

**Date and Time:** Monday 9 September 2024 17:03:00 CEST

**Job Number:** 233030160

**Documents (38)**

1. [*Genes associated with survival of female bovine blastocysts produced in vivo*](https://advance.lexis.com/api/document?id=urn:contentItem:693W-H811-F129-P0J6-00000-00&idtype=PID&context=1516831)

**Client/Matter:** -None-

**Search Terms:** statistics and data or statistics and eurostat or statistics and nutrients or statistics and collections or data and eurostat or data and nutrients or data and collections or eurostat and nutrients or eurostat and collections or nutrients and collections

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2. [*Perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), and perfluorononanoic acid (PFNA) increase triglyceride levels and decrease cholesterogenic gene expression in human HepaRG liver cells*](https://advance.lexis.com/api/document?id=urn:contentItem:693X-JCV1-F129-P0JS-00000-00&idtype=PID&context=1516831)

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3. [*NEWS BULLETIN NO. 11399*](https://advance.lexis.com/api/document?id=urn:contentItem:61PW-V3T1-JDKJ-13H6-00000-00&idtype=PID&context=1516831)

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4. [*The EU Commission's guide to CAP reform*](https://advance.lexis.com/api/document?id=urn:contentItem:61VP-DNK1-JC8V-433M-00000-00&idtype=PID&context=1516831)

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5. [*A scoping review of research funding for small-scale farmers in water scarce regions*](https://advance.lexis.com/api/document?id=urn:contentItem:671W-P2M1-JCWX-C2BG-00000-00&idtype=PID&context=1516831)

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6. [*Impact of overall diet quality on association between alcohol consumption and risk of hypertension: evidence from two national surveys with multiple ethnics*](https://advance.lexis.com/api/document?id=urn:contentItem:671W-P2C1-JCWX-C1NB-00000-00&idtype=PID&context=1516831)

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7. [*Committee on Regional Trade Agreements - Factual presentation - Comprehensive and Enhanced Partnership Agreement between the European Union and the Republic[...]es - Report by the Secretariat (Doc #:20-4428)*](https://advance.lexis.com/api/document?id=urn:contentItem:607V-TH91-JDG9-Y48H-00000-00&idtype=PID&context=1516831)

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8. [*In vitro antileishmanial potentialities of essential oils from Citrus limon and Pistacia lentiscus harvested in Tunisia*](https://advance.lexis.com/api/document?id=urn:contentItem:693W-H831-F129-P1DY-00000-00&idtype=PID&context=1516831)

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9. [*Federal Register: Prior Label Approval System: Expansion of Generic Label Approval Pages 56538 - 56548 [FR DOC #2020-17340]*](https://advance.lexis.com/api/document?id=urn:contentItem:60V8-SJN1-F0YC-N0GH-00000-00&idtype=PID&context=1516831)

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10. [*Market wrap: Warehouse REIT rises on Covid-19 driven demand*](https://advance.lexis.com/api/document?id=urn:contentItem:5YMJ-CRF1-DYX4-71XW-00000-00&idtype=PID&context=1516831)

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11. [*NEWS BULLETIN NO. 11284*](https://advance.lexis.com/api/document?id=urn:contentItem:60VG-23P1-F12K-R547-00000-00&idtype=PID&context=1516831)

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12. [*The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of synbiotics*](https://advance.lexis.com/api/document?id=urn:contentItem:671W-P291-JCWX-C2GC-00000-00&idtype=PID&context=1516831)

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13. [*Blood meal source and mixed blood-feeding influence gut bacterial community composition in Aedes aegypti*](https://advance.lexis.com/api/document?id=urn:contentItem:693W-H7S1-F129-P3B3-00000-00&idtype=PID&context=1516831)

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14. [*RETRACTED ARTICLE: Optimization of oncolytic effect of Newcastle disease virus Clone30 by selecting sensitive tumor host and constructing more oncolytic viruses*](https://advance.lexis.com/api/document?id=urn:contentItem:6CDF-MNC1-JDK8-006M-00000-00&idtype=PID&context=1516831)

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15. [*Identifying adaptive alleles in the human genome: from selection mapping to functional validation*](https://advance.lexis.com/api/document?id=urn:contentItem:693W-H831-F129-P3C9-00000-00&idtype=PID&context=1516831)

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16. [*NEWS BULLETIN NO. 11082*](https://advance.lexis.com/api/document?id=urn:contentItem:5Y9F-PK71-F12K-R380-00000-00&idtype=PID&context=1516831)

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17. [*NEWS BULLETIN NO. 11375*](https://advance.lexis.com/api/document?id=urn:contentItem:61HS-KFJ1-F12K-R0MT-00000-00&idtype=PID&context=1516831)

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18. [*Dietary condition and feeding practices of children aged 6–23 months in Ethiopia : analysis of 2005–2016 demographic and health survey*](https://advance.lexis.com/api/document?id=urn:contentItem:671W-P2C1-JCWX-C1TM-00000-00&idtype=PID&context=1516831)

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19. [*The Frontline: experts answer your questions on the impacts of the climate emergency - as it happened To mark the end of The Frontline series a panel of experts answer your questions about the climate crisis and how it is affecting Australia. Ask Prof Lesley Hughes, Greg Mullins, Prof Michael Mann and Assoc Prof Donna Green your questions, and see the answers on our live blog. Email frontline.live@theguardian.com or tweet #frontlinelive*](https://advance.lexis.com/api/document?id=urn:contentItem:5YBF-B911-F021-60YB-00000-00&idtype=PID&context=1516831)

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20. [*NEWS BULLETIN NO. 11405*](https://advance.lexis.com/api/document?id=urn:contentItem:61S5-PH21-F12K-R1J5-00000-00&idtype=PID&context=1516831)

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21. [*UK Intellectual Property Office grants trade mark "SPORTS DIRECT" to Sportsdirect.com Retail Limited*](https://advance.lexis.com/api/document?id=urn:contentItem:6157-1B21-JDG9-Y1GY-00000-00&idtype=PID&context=1516831)

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22. [*Synthesis and in vitro characterization of the genotoxic, mutagenic and cell-transforming potential of nitrosylated heme*](https://advance.lexis.com/api/document?id=urn:contentItem:693X-JCV1-F129-P0M4-00000-00&idtype=PID&context=1516831)

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23. [*NEWS BULLETIN NO. 11193*](https://advance.lexis.com/api/document?id=urn:contentItem:604Y-PD81-F12K-R2NG-00000-00&idtype=PID&context=1516831)

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24. [*Council of the European Union: COMMISSION STAFF WORKING DOCUMENT ON THE MOVEMENT OF CAPITAL AND THE FREEDOM OF PAYMENTS PDF document ST 6225 2020 REV 102-03-2020*](https://advance.lexis.com/api/document?id=urn:contentItem:5YBH-MMB1-F0YC-N556-00000-00&idtype=PID&context=1516831)

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25. [*Council of the European Union: COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS An EU-wide assessment of National Energy and Climate Plans Driving forward the green transition and promoting economic recovery through integrated energy and climate planning PDF document ST 10874 2020 INIT18-09-2020*](https://advance.lexis.com/api/document?id=urn:contentItem:60YG-W0J1-JDG9-Y1XD-00000-00&idtype=PID&context=1516831)

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26. [*Who will win the electric vehicle race? The role of place-based assets and policy*](https://advance.lexis.com/api/document?id=urn:contentItem:6BNK-C111-DY41-73R9-00000-00&idtype=PID&context=1516831)

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27. [*Soar Catchment Abstraction Management Strategy*](https://advance.lexis.com/api/document?id=urn:contentItem:60V3-GT31-F0YC-N23N-00000-00&idtype=PID&context=1516831)

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28. [*Federal Register: Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rules To List the Bi-State Distinct Population Segment of Greater Sage-Grouse With Section 4(d) Rule and To Designate Critical Habitat Pages 18054 - 18099 [FR DOC #2020-06384]*](https://advance.lexis.com/api/document?id=urn:contentItem:5YJN-WJK1-F0YC-N40G-00000-00&idtype=PID&context=1516831)

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29. [*NEWS BULLETIN NO. 11374*](https://advance.lexis.com/api/document?id=urn:contentItem:61HJ-MCV1-F12K-R2VR-00000-00&idtype=PID&context=1516831)

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30. [*NEWS BULLETIN NO. 11186*](https://advance.lexis.com/api/document?id=urn:contentItem:603F-WHY1-JDKJ-11R0-00000-00&idtype=PID&context=1516831)

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31. [*NEWS BULLETIN NO. 11354*](https://advance.lexis.com/api/document?id=urn:contentItem:61CD-5S91-JDKJ-11MV-00000-00&idtype=PID&context=1516831)

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32. [*The three Ps of making property work*](https://advance.lexis.com/api/document?id=urn:contentItem:5Y4X-DDK1-JCF2-H4FD-00000-00&idtype=PID&context=1516831)

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33. [*Potentials and pitfalls of transient in vitro reporter bioassays: interference by vector geometry and cytotoxicity in recombinant zebrafish cell lines*](https://advance.lexis.com/api/document?id=urn:contentItem:693X-JCV1-F129-P0HW-00000-00&idtype=PID&context=1516831)

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34. [*Don’t open the floodgates to a nuisance claim Simon Blackburn and Venetia Taylor look at where landowner responsibilities lie in relation to flood*](https://advance.lexis.com/api/document?id=urn:contentItem:5YY5-63X1-DYX4-702C-00000-00&idtype=PID&context=1516831)

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35. [*NEWS BULLETIN NO. 11376*](https://advance.lexis.com/api/document?id=urn:contentItem:61J0-KBY1-JDKJ-1504-00000-00&idtype=PID&context=1516831)

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36. [*ICIS Top 100 Chemical Distributors*](https://advance.lexis.com/api/document?id=urn:contentItem:5YYR-4RD1-JCF2-H000-00000-00&idtype=PID&context=1516831)

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# [***Genes associated with survival of female bovine blastocysts produced in vivo***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:693W-H811-F129-P0J6-00000-00&context=1516831)

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**Body**

Introduction

One of the characteristics of pregnancy is its propensity for failure. Death of the conceptus can occur at any point during pregnancy, with the greatest incidence in the early stages of development. In dairy cattle, for example, it has been estimated that about 23 to 30% of embryos alive at days 5 to 7 of gestation die before days 27 to 32, and about 12 to 13% of embryos alive at day 28 die by days 45 to 60 of gestation (Hansen ; Wiltbank et al. ). About 2 to 6% of fetuses die between day 40 and day 80, and about 4% die thereafter (Jousan et al. ; Wiltbank et al. ). A similar phenomenon has been described in the human (Boklage ; Ammon Avalos et al. ) and pig (Vonnahme et al. ; Langendijk et al. ).

The competence of the embryo to maintain pregnancy to term has been partly determined by the time it reaches the blastocyst stage; development of embryos to this stage depends on genetic inheritance (Ledoux et al. ), occurrence of chromosomal abnormalities (Griffin and Ogur ), and non-genetic characteristics of the oocyte (Hansen et al. ) and sperm (Trasler et al. ; Esakky et al. ) from which the embryo is derived. Identifying the expression of genes that are associated with embryonic competence for development after the blastocyst stage could lead to insights into genetic pathways important for embryonic development, identification of genetic loci important for genetic variation in fertility, and implementation of approaches to enhance embryonic survival in ***agricultural*** or clinical settings.

In the cow, the association between gene expression and competence of the blastocyst for sustained development has been examined in a model whereby one portion of a bisected blastocyst is transferred into a recipient female and the other half is used for transcriptome analysis. These experiments, initially using microarray analysis of gene expression, have resulted in identification of gene sets that differ in expression between embryos competent to develop after term as compared to those that are not for embryos produced in vitro (El-Sayed et al. ) and in vivo (Salilew-Wondim et al. ; Ghanem et al. ). More recently, the same model has been used in conjunction with high-throughput RNA sequencing to assess gene expression in female blastocysts produced in vitro (Zolini et al. ). In that study, there were a total of 617 and 470 genes that differed in expression between embryos that survived to day 30 or 60 of gestation, respectively, versus those that did not. Many differentially expressed genes (DEGs) identified in the in vitro–produced embryos that sustained pregnancies were related to cellular responses to stress.

The transcriptome profile of the blastocyst produced in vitro is different compared to that of the blastocyst produced in vivo (Smith et al. ; Corcoran et al. ; Smith et al. ; Driver et al. ). The objective of the current experiment was to identify differentially expressed genes for in vivo–produced, female blastocysts that survive after embryo transfer compared to those that fail to establish pregnancy. There are large differences in gene expression between male and female blastocysts (Bermejo-Alvarez et al. ). Accordingly, female embryos were used to reduce variation due to sex. Results revealed that the genes and gene pathways associated with survival of the blastocyst were largely distinct from those found earlier for the embryo produced in vitro (Zolini et al. ). In particular, competence of in vivo produced embryos to survive after transfer was associated with the upregulation of genes encoding transmembrane proteins and neural processes, and with downregulation of genes involved in oxidative phosphorylation.

Materials and methods

Animals

All animal procedures were approved by the University of Florida Institutional Animal Care and Use Committee. The experiment was conducted on a commercial farm located in Battle Creek MI, USA (42° 25″ N, 85° 14″ W). A total of 18 virgin Holstein heifers, 13 to 14 months of age, were used as embryo donors (n = 6) or recipients (n = 12). Donors and recipients were housed in free-stall barns with sand bedding and had ad libitum access to a total mixed ration formulated for Holstein heifers.

Production of embryos

Donor heifers were subjected to a protocol for induction of superovulation initiated at random stages of the estrous cycle. To synchronize the emergence of a new follicle wave, all visible follicles ≥ 5 mm in diameter were removed by transvaginal ultrasound-guided follicle ablation. Briefly, heifers were administered an epidural block consisting of 5 mL of 2% (w/v) lidocaine. Ovarian follicles were visualized using an ECM ExaPad ultrasound unit equipped with a 7.5-mHz microconvex probe (IMV Imaging, Rochester, MN, USA) enclosed in a plastic needle guide. Follicle ablation was performed using an 18-gauge, 5.5-cm needle (Watanabe Tecnologia Aplicada, Campinas, Brazil) attached to a metal rod. Immediately after follicle ablation, each heifer received a controlled internal drug-releasing device (CIDR - Eazi-BreedTM CIDR®, Zoetis, Kalamazoo, MI, USA) placed intravaginally. Follicle superstimulation was initiated 48 h after follicular ablation and CIDR insertion with 8 i.m. injections of decreasing amounts of follicle-stimulating hormone (FSH; Folltropin-V, Vetoquinol, Fort Worth, TX, USA), with 50, 40, 40, 30, 30, 20, 20, and 10 mg administered at 12-h intervals. To induce luteolysis, heifers received 25 mg of prostaglandin F2α (Lutalyse, Zoetis, Kalamazoo, MI, USA), i.m., in conjunction with each of the last two administrations of FSH. The CIDR was removed 12 h after the last injection of FSH and 100 μg of gonadorelin hydrochloride (GnRH, Factrel, Zoetis) was injected, i.m., 24 h after CIDR removal. All heifers were inseminated 12 and 24 h after GnRH with one straw of X-sexed sorted semen from a single Holstein bull (Modesty 507HO12600 - ST Genetics, Navasota, TX, USA).

Embryos were recovered by flushing the uterus 8 days after GnRH administration. Heifers were restrained and administered an epidural block consisting of 5 mL of 2% (w/v) lidocaine. A 16 Fr Foley catheter was inserted into one of the uterine horns with the cuff positioned at the base. Using gravity flow, commercial embryo recovery medium (Vigro Complete Flush, Vetoquinol, Fort Worth, TX, USA) was infused into the uterine horn and then expelled out of the uterine horn and ***collected*** into an embryo ***collection*** filter (Maxi filter, SPI™, Canton, TX, USA) attached via Y-tubing to the Foley catheter. The process was then repeated for the opposite uterine horn. Up to 500 mL of embryo recovery medium was used to flush each uterine horn. Blastocysts and expanded blastocysts were harvested and subjected to bisection.

Embryo bisection

Bisection of grade 1 blastocysts (Robertson and Nelson ) was performed as described elsewhere (Zolini et al. ) except that a scratch was made on the culture dish to facilitate positioning of the embryo. Briefly, a micro-blade fixed to a micromanipulator was gently pressed against the middle of the blastocyst so that trophectoderm (TE) and inner cell mass (ICM) cells were evenly distributed to both demi-embryos. The micro-blade was slowly moved forward and backward until the blastocyst was completely bisected and the zona pellucida was removed. One portion of the bisected blastocyst (the smaller or less intact portion if bisection was not uniform) was directly placed into a 0.2-mL tube and stored at − 80 °C until processing for RNA-seq analysis. The other demi-embryo was placed into a 25-μL drop of holding medium (ViGro™ Holding Plus Media, Vetoquinol) and then loaded into a 0.25-mL embryo transfer straw and transported for 30 min to the farm at room temperature.

Embryo transfer and pregnancy diagnosis

Recipient heifers were subjected to an ovulation synchronization protocol consisting of 100 μg GnRH (Factrel, Zoetis), i.m., and intravaginal insertion of a CIDR on day − 9 (day 0 = day of anticipated ovulation), 25 mg prostaglandin F2α (Lutalyse, Zoetis), i.m., and CIDR removal on day − 4, 25 mg prostaglandin F2α on day − 3, and 100 μg GnRH on day − 1. At day 7 after anticipated ovulation (8 days after the last GnRH injection), each recipient was subjected to examination of the ovaries by transrectal ultrasonography (ECM ExaPad, 7.5-MHz linear transducer) to confirm the presence of a corpus luteum. Animals received an epidural block consisting of 5 mL of 2% (w/v) lidocaine and then, randomly, a single demi-embryo was transferred into the ipsilateral uterine horn relative to the corpus luteum. Pregnancy diagnosis was carried out by transrectal ultrasonography on days 30 and 60 of gestation relative to the time of anticipated ovulation. There was no pregnancy loss between days 30 and 60. Based on pregnancy diagnosis, each embryo was classified as PP (survived to day 30 of pregnancy and continued to maintain pregnancy until at least day 60) or NP (not pregnant at day 30).

RNA extraction, cDNA library preparation, and transcriptome sequencing

Total RNA from each demi-embryo was isolated using the RNeasy Micro Kit (Qiagen, Germantown, MD, USA) according to the manufacturer’s protocol. Barcoded fragment libraries were constructed using the Bovine Custom AnyDeplete Ovation SoLo RNA-Seq System from NuGEN (San Carlos, CA, USA) following the manufacturer’s protocol. DNA integrity of the libraries was assessed using the High Sensitivity D1000 ScreenTape on the Agilent 4200 TapeStation (Santa Clara, CA, USA), and DNA concentration was measured using the KAPA qPCR kit (Boston, MA, USA) following the manufacturer’s protocol. Samples were then multiplexed and sequenced with 1 × 75-bp single-end reads on an Illumina NEXT-seq (Illumina, Inc., San Diego, CA, USA) according to the manufacturer’s protocol. Raw counts were obtained using CLC Genomics 1 × 75-bp kit Workbench software (Qiagen).

Bioinformatics

Analytic procedures were performed with the limma (Ritchie et al. ) and edgeR (Robinson et al. ) packages for R software. RNA-seq ***data*** was modified with the voom function of the limma package. Three samples were considered outliers based on distribution in a multidimensional scaling plot and because the samples had the greatest proportions of zero counts. ***Data*** from these samples were excluded from the analyses. Another sample was also excluded because it was determined to represent a male embryo based on the expression of the Y-linked genes DEAD-box helicase 3 Y-linked (DDX3Y), eukaryotic translation initiation factor 1A, Y-chromosomal (EIF1AY), sex determining region Y (SRY), and ubiquitously transcribed tetratricopeptide repeat containing Y-linked (UTY) (Chang et al. ). All of the retained samples expressed genes characteristically expressed in both TE (actin alpha 2, smooth muscle (ACTA2), caudal type homeobox 2 (CDX2), GATA-binding protein 2 (GATA2), and GATA-binding protein 3 (GATA3)) and ICM (DNA methyltransferase 3 alpha (DNMT3A), H2A.Z variant histone 1 (H2AFZ), and Nanog homeobox (NANOG)) (Negrón-Pérez et al. ). Genes with low expression counts (less than 1 count per million reads, n = 3536) were filtered out before normalization and a total of 21,080 transcripts were eligible for downstream analysis. For samples remaining in the analysis, embryos were classified as PP (n = 4) or NP (n = 3) and as derived from one of four donor cows (3742, 1 pregnant cow; 3844, 1 pregnant and 2 non-pregnant; 3891, 1 pregnant and 1 non-pregnant; 3901, 1 pregnant). Number of samples meets the requirement for minimum number for RNA-Seq experiments discussed by Conesa et al. ().

Gene expression ***data*** were normalized through the weighted trimmed mean of M-values method, implemented with the edgeR package. Normalization factors for all samples had a mean of 1, with a minimum of 0.72 and a maximum of 1.2. The voom function of the limma package was employed to transform the ***data*** for linear modeling. This function uses variances of the model residuals, and thus the model to be fitted was specified as a previous step, considering the effect of the group (PP and NP) and the donor cow. After ***data*** transformation, a linear model using weighted least squares for each gene was fit and a contrast between PP and NP groups was performed in order to calculate estimated coefficients and standard errors. Finally, moderated t- and F-***statistics*** and log-odds of differential expression were computed by empirical Bayes moderation of the standard errors towards a common value. P values were adjusted by the Benjamini and Hochberg method, which controls for the false discovery rate (FDR). The differentially expressed genes (DEGs) were defined in two ways: as those with a P value adjusted for FDR of < 0.05 and those with a FDR of < 0.10. The P values and the magnitude of fold change (log2FC) were visualized in a volcano plot, highlighting the up- and downregulated DEG.

Voom-transformed expression values from the DEG with FDR < 0.10 were subjected to hierarchical clustering of the genes and samples, and to construct a heatmap for expression levels. Genes and samples were clustered using the Euclidean distance as similarity metric and centroid linkage as the clustering method, with the Cluster 3.0 software (de Hoon et al. ). The clusters’ tree and heatmap were visualized with Java Treeview (Saldanha ).

Functional annotation and clustering of the DEGs were determined using DAVID Bioinformatics Resources 6.8 (Dennis Jr. et al. ). A total of 108 of the 155 DEG were annotated. ***Data*** were analyzed using the list of all expressed transcripts from the embryos as the background. Functional annotation clusters containing one or more terms with Benjamini-Hochberg adjusted P values < 0.05 are reported. Selected pathways showing DEG were visualized using Kyoto Encyclopedia of Genes and Genomes (KEGG) pathways (Kanehisa and Goto ) and the Pathview program (Luo et al. ). In addition, Ingenuity Pathway Analysis (IPA, Qiagen) was used to identify canonical pathways predicted to be activated (z > 2.0) or inhibited (z < 2.0); prediction of molecular, cellular, or physiological functions (exclusive of disease) predicted to be activated (z > 2.0) or inhibited (z < 2.0); and identification of putative upstream regulators predicted to be activated (z > 2.0) or inhibited (z < 2.0). The classes of upstream regulators considered from the analysis output were endogenous mammalian chemicals, cytokine, G protein coupled receptor, growth factor, ligand-dependent nuclear receptor, transcription regulator, translational regulator, and transmembrane receptor. A total of 91 of the 155 DEGs were annotated by IPA and subjected to analysis.

Results

Identification of genes differentially expressed between embryos that survived and maintained pregnancy versus those that did not

A total of 12 demi-embryos were transferred into synchronized recipients as described above. Of these, 5 demi-embryos survived and maintained gestation until day 60 (41.7%) and the remaining 7 demi-embryos did not survive until day 30 of gestation (61.3%). One demi-embryo was lost during processing. After excluding three other embryos that were considered outliers and one embryo that was male based on expression of Y-linked genes, transcript abundance was analyzed in 4 female demi-embryos that survived and maintained pregnancy to day 60 (PP) and 3 female demi-embryos that did not result in a pregnancy at day 30 (NP).

***Data*** on effects of pregnancy status on abundance of individual transcripts are presented in Supplementary File 1 Table . Using a FDR < 0.10, a total of 155 DEGs between PP and NP embryos were identified of which 73 genes were upregulated and 82 genes were downregulated in the PP group (Fig. ). When a more stringent cutoff was applied (FDR < 0.05), the total number of DEGs was reduced to 99 DEG, of which 37 genes were upregulated and 62 genes were downregulated in embryos that survived (Fig. ). Clustering of samples based on expression of DEG with FDR < 0.10 indicated a cluster of PP embryos in one group and NP embryo in the other group (Fig. ).

Volcano plot illustrating differentially expressed genes using a false discovery rate of 0.10 (light green and light red) and 0.05 (dark green and dark red). The x-axis represents the log2 fold change of expression for blastocysts that survived to days 30 and 60 compared to those that did not survive to day 30. Upregulated genes are shown in red and downregulated genes in green

Heat map showing the expression pattern of genes that were differentially expressed between blastocysts that survived to days 30 and 60 (PP) compared to blastocysts that did not survive to day 30 (NP). Shown are the transformed and normalized expression values for each differentially expressed gene (false discovery rate < 0.10) for each sample. The number following the PP and NP designation is the number of the donor from which the embryo was derived

Functional annotation of DEG

Functional annotation of upregulated and downregulated DEGs (FDR < 0.10 and FDR < 0.05) was performed using the DAVID bioinformatic tool.

Upregulated genes with FDR < 0.10 (58 annotated genes) were enriched in three functional clusters (Supplementary File 1, Table ). The first annotation cluster (enrichment score = 3.19), representing 28 genes (48% of the annotated genes), was enriched for terms related to transmembrane proteins including olfactory receptors, ion-channel proteins, and cell adhesion proteins. The list of genes in this annotation cluster is provided in Fig. . A total of 13 of the 28 genes in this cluster (46% of annotated genes) were olfactory receptor genes. Other genes, including ADGRV1, EPHA5, SCNA1A, SCNA2A, SORCS1, MFSD6, and UNC5C, are involved in neural development of function. Another annotation cluster was enriched for terms related to transmembrane proteins (enrichment score = 3.16) and the third term (enrichment score = 1.90) contained terms related to ion transport. There were no functional annotation terms with Benjamini-Hochberg scores with P < 0.05 when the set of upregulated genes for FDR < 0.05 (27 annotated genes) was analyzed. Nonetheless, the top two clusters were for terms related to transmembrane helix and receptors and signal transduction (Supplementary File 1 Table ).

Functional annotation cluster 1 for genes upregulated in blastocysts that survived to days 30 and 60 of pregnancy as determined by analysis using DAVID. The cluster was enriched for terms related to olfaction, receptors, and signal transduction. Genes located in a specific annotation are indicated by green. Note that 13 of the 28 genes in the cluster were olfactory receptors

The downregulated genes with FDR < 0.10 (50 annotated genes) were enriched in six functional clusters (Supplementary File 1, Table ). The first annotation cluster (enrichment score = 6.12) contained 26 genes (52% of the annotated genes) and was enriched for terms related to oxidative phosphorylation, mitochondrial function, and transmembrane proteins. The list of genes in this annotation cluster (Supplementary File 1 Table ) includes 7 genes for NADH dehydrogenase subunits, two subunits of ATP synthase F0, two cytochrome c subunits, and cytochrome B (Fig. ). The next greatest annotation cluster was enriched for terms related to ribosomal proteins (enrichment score = 2.0). When the DAVID tool was used to analyze the smaller set of downregulated genes, those with FDR < 0.05 (39 annotated genes), the functional annotation cluster related to oxidative phosphorylation and mitochondrial function had the greatest enrichment score (enrichment score = 6.76) and included 23 functional terms with Benjamini-Hochberg adjusted P values < 0.05 (Supplementary File 1 Table ).

Genes present in the oxidative phosphorylation pathway (KEGG bta:00190) that were downregulated in embryos that survived transfer. ***Data*** were visualized with Pathview and are reproduced with permission of Kyoto Encyclopedia of Genes and Genomes. Genes that were downregulated in embryos that survived are shown in green. There were no upregulated genes in the pathway

The functional annotations enriched in the set of DEG with FDR < 0.10 were also identified by IPA. A total of 91 of the 155 genes in this dataset were annotated (Supplementary File 1 Table ). Of these, 28 encoded for plasma membrane proteins (32% of annotated genes) including 8 classified as G protein–coupled receptors (7 olfactory receptors and ADGRV1), 4 transmembrane receptors (CLDN4, MFSD6, KLRC, and UNC5C), 5 ion channels, and 9 transporters. One of the other plasma membrane genes also encodes for a receptor (EPHA5). The other major type of protein encoded for by DEG was enzyme (19 genes; 21% of annotated DEG). There were five genes encoding for transcriptional regulators, with 4 upregulated in embryos that survived after transfer (DMRT2, MXI1, RFX3, and ZBTB37) and one that was downregulated (NPM1). There were two genes for cell signaling molecules that were both upregulated in embryos that survived, ANGPTL3 and TNFSF18.

Using IPA, the top molecular and cellular functions in which DEGs were overrepresented (based on Bonferonni-Hochberg adjusted P value) were cell-to-cell signaling and interaction (28 genes), cell death and survival (33 genes), cell morphology (12 genes), cellular assembly and organization (24 genes), and cellular compromise (12 genes). There were two canonical pathways whose activity was predicted to be changed (z > 2.0 or ≤ − 2.0) in embryos that survived and maintained pregnancy. Oxidative phosphorylation was predicted to be inhibited in embryos that survived to days 30 and 60 (z = − 3.32). There were 11 genes involved in oxidative phosphorylation that were downregulated in embryos that survived including two cytochrome C subunits (COX1 and COX3), six genes encoding for proteins in complex I (ND1, ND2, ND3, ND4, ND4L, and ND5), one gene in complex III (CYTB), two genes in complex IV (COX1 and COX3), and one gene in complex V (ATP6). The sirtuin pathway was predicted to be activated (z = 2.65; 9 genes) in embryos that survived to days 30 and 60 because of downregulation of expression of 9 genes that were largely part of the same set of genes associated with decreased oxidative phosphorylation (ATP6, CYTB, ND1, ND2, ND3, ND4, ND4L, ND5, and ND6). Exclusive of functions associated with diseases, it was predicted that DEG would lead to one change in cellular function—decreased activation of cells for embryos that survived after transfer (Fig. ).

Predicted inhibition of cell activation in blastocysts that survived to day 30 and day 60 based on changes in gene expression. Genes in red were upregulated and genes in green were downregulated in embryos that survived. Blue lines represent relationships that lead to inhibition of cell activation, the yellow line represents a relationship inconsistent with inhibition of cell activation, and gray lines represent situations where the effect is not predicted

DEG associated with ICM, TE, or hypoblast

The list of DEG was screened to identify genes associated with ICM, TE, or hypoblast as described elsewhere (Negrón-Pérez et al. ). This analysis was performed to evaluate whether embryos that survived to days 30 and 60 exhibit characteristics of gene expression consistent with a different ratio of ICM, TE, or hypoblast cells than embryos that did not survive to day 30. The only such gene that was differentially expressed was the TE gene KRT8 (FDR = 0.037), which was expressed 1.6-fold less for PP embryos. Other markers of ICM, TE, or hypoblast were not significantly different between embryo types. The fold-change difference between PP and NP embryos for genes considered epiblast markers was − 1.28 for HNF4A, − 1.25 for NANOG, and − 1.10 for POU5F1. The fold-change difference in expression between PP and NP for genes considered TE markers was − 3.92 for CDX2, 4.79 for ELF5, − 1.40 for GATA2, and − 1.44 for GATA3. Fold-change differences for hypoblast markers was 1.10 for GATA6, − 1.94 for FGFR2 1.88 for PDGFRA, and 3.20 for SOX17.

Comparison of DEG with other studies relating gene expression to embryo survival

Using the list of DEG with FDR < 0.10 from the present study, there were no genes that were regulated in the same direction as any of the 617 DEG identified for in vitro–produced embryos that established pregnancy at day 30 compared to those that did not (Zolini et al. ). The study of Zolini et al. () used broader inclusion criteria for DEG than the current study (P < 0.01 and a 2-fold or greater change in expression). If the same broad criteria were applied to the current experiment, there were only 2 genes expressed in the same direction as the 617 DEG identified by Zolini et al. (). In both experiments, expression of PGHD2 was upregulated in embryos that established pregnancy and the unannotated gene ENSBTAG00000043649 was downregulated.

The list of expressed genes in the current experiment was also compared to a list of 34 genes that were found to be differentially expressed among in vivo–derived embryos that survived to term after transfer vs those that did not (Salilew-Wondim et al. ). Only two genes were significantly associated with pregnancy outcome in the current experiment in the same direction as in the earlier experiment, namely EEFA1A and KRT8.

To assess the concordance between all experiments performed to assess the relationship between gene expression and embryo survival, we evaluated effects of pregnancy outcome in this experiment as well as others (El-Sayed et al. ; Salilew-Wondim et al. ; Ghanem et al. ; Zolini et al. ) on expression of 19 DEGs that were found to be in common by Ghanem et al. () when comparing their results to that of El-Sayed et al. (). Results are summarized in Fig. . Expression of EEF1A1 was downregulated in blastocysts that survived transfer in four of five experiments and expression of ND1 was downregulated in blastocysts that survived transfer in three of five experiments with blastocysts produced in vivo. There were 16 other genes in which there was a significant effect of pregnancy outcome in the same direction in two experiments, although the most common result for these genes was similarity between results of El-Sayed et al. () and Ghanem et al. (), who both used the same microarray platform to assess gene expression.

Concordance between differentially expressed genes related to embryo survival in the present experiment with two earlier experiments that related gene expression of the blastocyst to survival of transferred embryos to term. The color code indicates whether the gene was upregulated, downregulated, or not significantly associated with either calf delivery (El-Sayed et al. ; Ghanem et al. ), survival to day 30 (Zolini et al. ), or survival to day 30 and 60 (current study)

Colony-stimulating factor 2 (CSF2) can increase the competence of embryos produced in vitro to establish pregnancy after transfer (Loureiro et al. ; Denicol et al. ). Accordingly, the set of DEG in the present experiment (FDR < 0.10) was also compared with a list of 635 genes regulated by CSF2 (P < 0.01 and fold change > 2) in embryos produced in vitro (Zolini et al. ). There were three genes in common between the two datasets. In particular, two non-annotated genes, ENSBTAG00000039456 and ENSBTAG00000043565, as well as EPS8L1 were downregulated in PP embryos in the current study and were also downregulated by CSF2 in the earlier experiment. When the set of genes where PP differed from NP at P < 0.01 was evaluated, there was one additional gene that was also regulated by CSF2 in the same direction. Specifically, NKAPL was upregulated in PP embryos and by CSF2.

Upstream regulators of differentially expressed genes

Several categories of upstream regulators of DEG were evaluated by IPA. As summarized in Supplementary File 1, Table , a total of 7 transcriptional regulators (STAT3, PPARGC1B, MLXIPL, TFE3, PDX1, MYC, and the ligand-dependent nuclear receptor AHR) were predicted to be suppressed and one translational regulator (AGO2) was predicted to be activated in embryos that survived after transfer. There was a total of 5 hormones, cytokines, and growth factors predicted to be inhibited in embryos that survived after transfer, including angiotensinogen, leptin, leukemia inhibitory factor, estradiol, and testosterone.

Discussion

Like for recent observations with female embryos produced in vitro (Zolini et al. ), the transcriptomal profile of in vivo–derived, female blastocysts competent to survive after embryo transfer was found to be different from blastocysts that did not establish pregnancy after transfer. Importantly, however, the set of genes associated with embryonic survival, and the biological functions associated with those genes, is largely dissimilar for embryos produced in vivo versus those produced in vitro. For in vivo–derived embryos, as represented schematically in Fig. , most of the DEG associated with embryo survival were either upregulated genes associated with transmembrane proteins, notably olfactory receptors and proteins involved in neural function and development, or downregulated genes involved in oxidative phosphorylation. For embryos produced in vitro, in contrast, there was greater variety in the types and functions of DEG and many of the pathways associated with the DEG were related to cellular stress and DNA damage (Zolini et al. ). Thus, while the ability to survive the stress of cell culture is an important determinant of the subsequent fate of the embryo produced in vitro, other aspects of embryonic function and development are important for survival of the embryo that develops in vivo.

Summary of changes in gene expression in the blastocyst produced in vivo related to subsequent survival and maintenance of pregnancy to day 60. The number of upregulated (red) and downregulated (green) genes for embryos that survived after transfer is illustrated. The major functional categories represented by differentially expressed genes is indicated under the number of genes and possible functional implications of those changes in expression are listed in italics

In the current study, almost 50% of the genes upregulated in embryos that survived after transfer were genes encoding for transmembrane proteins, particularly olfactory receptors and proteins involved in neural development and function. Two explanations for why increased expression of these genes could facilitate successful development of the embryo are postulated. One possibility is that upregulation of specific receptor genes makes the embryo better able to participate in cell-cell interactions with the endometrium or itself or to respond to regulatory signals produced by the mother or embryo. One upregulated gene, CLDN4, is necessary for blastocyst formation in the mouse because of its role in tight junction formation (Moriwaki et al. ). Another upregulated gene was EPHA5. Ephrin ligands and receptors have been implicated in trophoblast attachment to the endometrium (Fujii et al. ). The largest cluster of upregulated DEG (13 genes) was for those involved in olfactory transduction. One receptor gene, OR52K1, probably recognizes n-aliphatic dicarboxylic acids (Lee et al. ) which can be detected in uterine fluid of the cow (Tríbulo et al. ). Olfactory receptors are not exclusively expressed in olfactory sensory neurons but are expressed in a variety of mammalian tissues where they have been implicated in the regulation of cell growth, differentiation, apoptosis, cell-cell recognition, migration, and secretion (Maßberg and Hatt ).

The second possibility is that the abundance of upregulated genes associated with neural development and function is indicative that differentiation of epiblast from ICM is an important determinant of embryo survival. Many of the genes encoding for transmembrane proteins upregulated in embryos that survived to days 30 and 60 are involved in neural function or development. Besides the olfactory receptor genes, these include ADGRV1 (Myers et al. ), EPHA5 (Das et al. ), SCNA1A and SCNA2A (Kwong and Carr ), MFSD6 (Bagchi et al. ), SORCS1 (Ribeiro et al. ), and UNC5C (Poliak et al. ). Upregulation of genes involved in neural processes is a characteristic of differentiation of the ICM to epiblast in cynomolgus monkey (Nakamura et al. ). In the cow, too, genes upregulated in the ICM include several associated with neural functions (Ozawa et al. ). It is possible that the upregulation of large numbers of genes associated with neural tissue for embryos that survive after transfer is a reflection that these embryos have more extensive differentiation of the ICM than embryos that did not survive transfer. Another observation consistent with this idea is the finding that embryos that survived to day 30 had reduced expression of NPM1. The protein encoded by this gene interacts with the pluripotency factors OCT4, SOX2, and NANOG and its downregulation in mouse embryonic stem cells can cause differentiation of mesoderm and ectoderm (Johansson and Simonsson ).

As found earlier for embryos produced in vitro (Zolini et al. ), the genes associated with embryonic survival did not include many genes considered markers of ICM, TE, and hypoblast lineages in the blastocyst. Thus, there was no evidence that allocation of cells into these first three lineages of the blastocyst is a major determinant of embryo competence for subsequent development.

Another characteristic of embryos that survived after transfer was downregulation of genes involved in energy metabolism. There were 11 downregulated genes involved in oxidative phosphorylation in embryos that survived including CYTC, six genes encoding for proteins in complex I (ND1, ND2, ND3, ND4, ND4L, and ND5), one gene in complex III (CYTB), two genes in complex IV (COX1 and COX3), and one gene in complex V (ATP6). These changes in gene expression, as well as decreased expression of genes such as the chaperone genes HSP90B1 and NPM1, the prostaglandin synthase gene PTGES, and the intermediate filament genes KRT8 and KRT18 resulted in the IPA prediction that cell activation was reduced in embryos that survived after transfer. Predicted changes in upstream regulators of gene expression, including upregulation of AGO2 involved in RNA interference (Herrera-Carrillo and Berkhout ) and downregulation of a variety of transcription factors and extracellular cell signaling ligands, are also consistent with reduced metabolism in embryos that survived after transfer.

Leese and colleagues have proposed the “quiet embryo” hypothesis that states that “thrifty” embryos that do not need to have high rates of metabolism are more likely to be successful in sustaining development than embryos that require a high rate of metabolism (Leese , ). Such embryos would enjoy lower oxygen consumption, diminished demand for energy and ***nutrients***, and reduced exposure to reactive oxygen species. There are ***data*** from embryo transfer experiments that are inconsistent with this hypothesis. For human embryos produced in vitro, those that established pregnancy after transfer exhibited higher consumption of glucose (Gardner et al. ) and oxygen in culture (Tejera et al. ). In the cow, there was a great deal of variation in oxygen consumption among blastocysts that developed in vivo but there was a non-significant tendency for pregnancy rate to be higher for blastocysts with higher oxygen consumption (Lopes et al. ). One difficulty in interpreting results of experiments measuring oxygen consumption is that embryo metabolism has never been measured in situ in the reproductive tract. Metabolism of mouse embryos changes within 3 h after removal from the reproductive tract and placement in culture (Lane and Gardner ).

One must be careful when interpreting results of gene expression because changes in transcript abundance may not reflect oxidative phosphorylation activity. With that caveat, results are consistent with the idea that low expression of oxidative phosphorylation genes by the blastocyst is beneficial for its subsequent long-term survival. Moreover, present results are similar to those of earlier studies examining the relationship between gene expression and embryo survival in cattle. The gene ND1, which encodes for one of the NADH dehydrogenase subunits of complex I in the electron transport chain, was less expressed for blastocysts that survived after transfer not only in the current experiment but also for earlier experiments with embryos produced in vitro (El-Sayed et al. ) and in vivo (Ghanem et al. ). In those two earlier studies, embryos that resulted in calf delivery also exhibited reduced expression of two mitochondrial transcripts that were not assessed in the current experiment.

Comparison of results between all of the experiments that identified genes whose expression in the blastocyst is related to embryo survival revealed only two that were consistently regulated differentially between blastocysts that survived as compared to those that did not. Such a result is not surprising considering the considerable variation between studies in the breed and sex of the blastocysts studied as well as in the platforms used to measure gene expression. Besides ND1, the other gene whose expression was consistently differentially regulated was EEF1A1, which was downregulated in blastocysts that survived transfer in four of the five studies. The repeatability in identification of ND1 and EEF1A1 among experiments is suggestive that these two genes are involved in processes important for embryo survival. As mentioned in the previous paragraph, ND1 may be one of the oxidative phosphorylation genes whose downregulation facilitates a metabolically quiet phenotype. The same may be true for EEF1A1, which encodes for the alpha subunit of the elongation factor-1 complex that plays diverse roles in cell including delivery of amino-acyl tRNA to the ribosome for protein synthesis, signal transduction, organization of the cytoskeleton, and export of nuclear proteins (Sasikumar et al. ).

It is possible that the biopsy procedure damaged some embryos to the extent that subsequent survival was compromised. In fact, it was observed that embryos produced in vivo were more difficult to bisect than embryos produced in vitro. Thus, some of the embryos classified as not surviving to day 30 may have been competent to survive after transfer except for damage associated with biopsy. As a result, the power of the experiment to detect genes whose expression was different for embryos that survived or not may have been reduced. Probably, there are more genes associated with embryonic survival than were detected here.

In conclusion, results reported here show that the survival of the in vivo–produced, female blastocyst to day 60 of pregnancy is associated with increased expression of genes encoding for transmembrane proteins, particularly those related to neural development, and decreased expression of genes involved in oxidative phosphorylation.

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[***Perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), and perfluorononanoic acid (PFNA) increase triglyceride levels and decrease cholesterogenic gene expression in human HepaRG liver cells***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:693X-JCV1-F129-P0JS-00000-00&context=1516831)

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**Body**

Introduction

Per- and polyfluoroalkyl substances (PFASs) are man-made chemicals that are extremely persistent and omnipresent in the environment (Wang et al. ). PFASs contain at least one fluoro-carbon chain of different lengths with varying chemical groups attached, and have unique chemical and physical characteristics, such as oil and water repellency, high temperature and chemical resistance, and emulsifying/surfactant properties. Because of these favorable properties, they are widely used in various industrial and consumer applications, e.g., firefighting foams, electronics, textiles, food contact materials, and cosmetics. According to OECD (), over 4700 PFASs have been identified. The production and use of the best-known and most-studied PFASs, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS), have been restricted globally due to concerns of risks to human health and the environment (ATSDR ; EFSA CONTAM Panel ). However, even though the use of PFOS and PFOA has been restricted, recent assessments of the European Food Safety Authority (EFSA CONTAM Panel , ) state that a considerable proportion of the European population is exposed to higher PFAS levels than the tolerably weekly intake (TWI) values.

EFSA CONTAM Panel () derived TWIs for PFOS and PFOA of, respectively, 13 and 6 ng/kw bw/week, based on the positive association between serum PFAS levels and serum cholesterol. This was observed in numerous epidemiological studies, including those by Steenland et al. (), Nelson et al. (), and Eriksen et al. (), studies that were used to derive BMDL5 serum levels of 21–25 ng/mL for PFOS and 9.2–9.4 ng/mL for PFOA. Corresponding daily intakes resulting in these serum levels at adult age were established using PBPK modeling, which were then used to derive the two TWIs. An increase in cholesterol levels was seen as adverse, since it is regarded to be a risk factor for cardiovascular disease. Besides an increase in serum cholesterol, exposure to PFOS and PFOA is also positively associated with an increase in serum triglyceride levels in a number of epidemiological studies (EFSA CONTAM Panel ). Interestingly, various rat studies, including those by NTP (, ), have shown that exposure to PFASs decreases rather than increases serum cholesterol and triglyceride levels. A similar observation was made in monkeys treated with PFOS (Seacat et al. ). Furthermore, ***data*** of a recent study on the kinetics and effects of PFOA in human cancer patients in a phase 1 dose-escalation trial also indicate that PFOA reduces serum cholesterol levels, whereas serum triglyceride levels were unaffected (Convertino et al. ). These human ***data*** are in line with ***data*** from a study using APOE\*3-Leiden.CETP mice, a model with a human-like lipoprotein metabolism, in which PFOA decreased plasma triglycerides, total cholesterol, and non-HDL-C, whereas HDL-C was increased (Pouwer et al. ). It should be noted that in these studies, the exposure and resulting serum levels are much higher than observed in epidemiological studies. Regarding the contradictory findings on the relation between PFAS exposure and cholesterol levels, Convertino et al. () suggested several confounding factors that may explain the observed associations. After the publication of the EFSA Opinion (EFSA Contam Panel ), another potential confounding mechanism related to the enterohepatic cycling of both bile acids and PFASs was brought up ([*https://www.efsa.europa.eu/sites/default/files/news/efsa-contam-3503.pdf*](https://www.efsa.europa.eu/sites/default/files/news/efsa-contam-3503.pdf)). More studies are needed to investigate the underlying mechanisms to support a causal relationship, as also recommended by EFSA in its recent risk assessment (EFSA CONTAM Panel ). It is noteworthy that in this new risk assessment, a group TWI of 8 ng/kg bw per week for the sum of four PFASs (PFOA, PFNA, PFHxS, and PFOS) was proposed, based on the effects on the immune system that were also associated with rather low serum levels of PFASs.

In light of the uncertainties around the relation between PFAS exposure and cholesterol and triglyceride levels, a better understanding of how PFASs may interfere with cholesterol and triglyceride metabolism is thus required. Inasmuch as the liver plays an important role in the regulation of cholesterol and triglyceride levels, mechanistic in vitro studies with human liver cells are important to gain insight into the effects of PFASs on these processes. In animals, PFASs have been shown to cause hypertrophy and hyperplasia of the liver, but also steatosis and possibly cholestasis (EFSA CONTAM Panel , ). To obtain more insight into the effects of PFASs on the human liver, the effects of PFOS and PFOA and the related PFAS perfluorononanoic acid (PFNA) in human HepaRG liver cells were determined in the present study. Effects on PFAS-induced changes in cellular cholesterol and triglyceride levels were assessed, followed by transcriptomics analysis to gain insight into possible underlying mechanisms.

Materials and methods

Chemicals

PFOA (purity 99%) and PFNA (purity 99%) were purchased from Sigma-Aldrich (Zwijndrecht, The Netherlands) and PFOS (purity 100%) was obtained from Synquest laboratories (Alachua FL). All stock solutions (dilution series) of the compounds were prepared in 100% dimethyl sulfoxide (DMSO HybriMax, Sigma-Aldrich). Chemical structures of the three PFASs are shown in Fig. .

Chemical structures of the PFASs tested in the present study

HepaRG cell culture

The human hepatic cell line HepaRG was obtained from Biopredic International (Rennes, France) and cultured in growth medium consisting of William’s Medium E+GlutaMAX™ (ThemoFisher Scientific, Landsmeer, The Netherlands) supplemented with 10% Good Forte filtrated bovine serum (FBS; PAN™ Biotech, Aidenbach, Germany), 1% PS (100 U/mL penicillin, 100 µg/mL streptomycin; Capricorn Scientific, Ebsdorfergrund, Germany), 50 µM hydrocortisone hemisuccinate (sodium salt) (Sigma-Aldrich), and 5 µg/mL human insulin (PAN™ Biotech). Seeding, trypsinization [using 0.05% Trypsin–EDTA (ThermoFisher Scientific)], and maintenance of the cells was performed according to the HepaRG instruction manual from Biopredic International. For cell viability studies, HepaRG cells were seeded in black-coated 96-well plates (Greiner Bio-One, Frickenhausen, Germany; 9000 cells per well in 100 µL). For gene expression studies and analysis of triglyceride and cholesterol levels, HepaRG cells were seeded in 24-well plates (Corning, Corning, NY; 55,000 cells per well in 500 µL). After 2 weeks on growth medium, cells were cultured for two days in growth medium supplemented with 0.85% DMSO to induce differentiation. Subsequently, cells were cultured for 12 days in growth medium supplemented with 1.7% DMSO (differentiation medium) for final differentiation. At this stage, cells were ready to be used for toxicity studies. Cells that were not immediately used were kept on differentiation medium for a maximum of 3 additional weeks. Cell cultures were maintained in an incubator (humidified atmosphere with 5% CO2 at 37 °C) and the medium was refreshed every 2–3 days during culturing. Prior to toxicity studies, differentiated HepaRG cells were incubated for 24 h in assay medium (growth medium-containing 2% FBS) supplemented with 0.5% DMSO.

Cell exposure

Test chemicals were diluted from 200-fold concentrated stock solutions in the assay medium, providing a final DMSO concentration of 0.5%. In each experiment, a solvent control (0.5% DMSO) was included. PFASs were tested in concentrations up to 400 µM. Different exposure durations and concentrations were used. After exposure, the effects of the PFASs on cell viability, triglyceride, and cholesterol levels, and gene expression were assessed.

Cell viability studies

The effect of the chemicals on cell viability was in the first instance determined on PFAS-exposed HepaRG cells cultured in 96-well plates, using the WST-1 assay. This assay determines the conversion of the tetrazolium salt WST-1 (4-[3-(4-iodophenyl)-2-(4-nitrophenyl)-2H-5-tetrazolio]-1,3-benzene disulfonate) to formazan by metabolically active cells. After exposure for 6, 24, or 72 h, the medium was removed and the cells were washed with Dulbecco’s Phosphate-Buffered Saline (DPBS; ThermoFisher Scientific). Next, WST-1 solution (Sigma-Aldrich) was added to the cell culture medium (1:10 dilution) and 100 µL was added to each well. After 1 h incubation in an incubator (humidified atmosphere with 5% CO2 at 37 °C), the plate was shaken at 1000 rpm for 1 min, and absorbance at 450 nm was measured (background absorbance at 630 nm was subtracted) using a microplate reader (Synergy™ HT BioTek, Winooski, VT, USA). Further experiments (cholesterol and triglyceride analyses and gene expression analyses) were performed in 24-well plates. Therefore, possible effects on cell viability were also examined in HepaRG cells in 24-well plates, by determining the total DNA quantity in each well. To that end, cells were lysed with RLT-lysis buffer (Qiagen, Venlo, The Netherlands) and the Quant-iT™ PicoGreen® dsDNA Assay Kit (Life Technologies) was used for DNA quantification. The samples were diluted two times in DPBS. Samples were also diluted another two times (in 1:1 RLT:DPBS). TE reagent was prepared according to the manufacturer’s protocol. A standard curve of dsDNA in TE reagent was prepared; a range of 1.25–0.002 µg/mL was used for quantification. In a black 96-well plate, 5 µL sample and 195 µL TE reagent were added, protected from light. DPBS:RLT (1:1) was taken along as a blanc. The plate was mixed in the dark for 4 min at 1100 rpm, and afterwards incubated for 5 min at room temperature. Fluorescence was measured using a microplate reader (Synergy™ HT BioTek) at excitation 485/20 nm, emission 528/20 nm, and a sensitivity of 40.

Triglyceride and cholesterol analysis

To determine the effect of PFAS exposure on triglyceride and cholesterol levels, a method based on gas chromatography with flame-ionization detection (GC-FID) was applied. To this end, differentiated HepaRG cells in 24-well culture plates were exposed for 24 h to PFOS, PFOA, or PFNA at concentrations ranging from 25 to 200 µM. After exposure, cells were washed three times with 0.5 mL DPBS/well. Cells were harvested in 150 µL RLT-lysis buffer and lysates of two wells were pooled in 1.5 mL Eppendorf Protein LoBind microcentrifuge tubes (Fisher Scientific, Hampton, USA). The samples were stored at − 80 °C until extraction. The extraction of triglycerides was performed under an N2 atmosphere according to a method described by Hutchins et al. () using isooctane:ethyl acetate (75:25). After thawing, the samples were transferred to 10 mL glass tubes. A mixture of isooctane and ethyl acetate (75:25, 5 mL) with 10 µL 0.5 mg/mL tritridecanoin (Nu-Chek Prep Inc., Elysian, USA) was added to the samples, followed by vortex-mixing (30 s), sonication (60 s), vortex-mixing (30 s), and incubation head over head (15 min). NaCl (1 mL, 0.9% w/v) was added and the samples were vortex-mixed for 60 s and centrifuged for 10 min at 1000×g to separate the two phases. A total of 4.2 mL of the organic (upper) phase were ***collected*** with a 1-mL glass Hamilton syringe. The polar phase was extracted again by adding 2 mL isooctane:ethyl acetate (75:25) followed by vortex-mixing, centrifugation, and ***collection*** of the organic phase. The two organic phases were combined, dried under N2 gas at 30–37 ℃, redissolved in 100 µL isooctane, and transferred to a GC vial. The samples were analyzed on a Trace GC Ultra GC-FID system (ThermoFisher Scientific, Waltham, USA). A sample volume of 2 µL was injected on a 5 m × 0.53 mm, 0.17 µm Sim Dist Ulti Metal column (CP7532, Agilent Technologies, Santa Clara, USA) and eluted at a N2 gas flow of 45.5 mL/min. The temperature program was as follows: 0.5 min 80 °C, 50 °C/min ramp to 190 °C, 6 °C/min ramp to 350 °C, and 5 min hold at 350 °C. The detector temperature was 370 °C. A triglyceride standard mixture (palm kernel triglycerides, BCR 632 A, Sigma-Aldrich, St. Louis, USA) was included in each sequence to calibrate the retention times of the triglycerides. Pure cholesterol (Sigma-Aldrich) was used to calibrate the retention time of cholesterol. Triglycerides (C44, C46, C48, C50, C52, and C54) and cholesterol were quantified by determining the AUC. The relative triglyceride and cholesterol levels were calculated by dividing the AUCs of triglycerides and cholesterol obtained upon treatment with the test compounds by the AUCs of triglycerides and cholesterol obtained with the solvent control sample. Statistical differences were assessed by performing a one-way ANOVA followed by Dunnett's test on the normalized ***data*** (fold-change compared to the solvent control) using Graphpad Prism 5, considering a p value < 0.05 as being statistically significant. The concentration–response ***data*** were also used for BMD analysis as described below.

Whole-genome gene expression analysis: microarray hybridisations and analysis

To obtain insight into the molecular and cellular effects of PFASs in the liver, differentiated HepaRG cells were exposed for 6, 24, or 72 h to 100 µM PFOA and for 24 h to 100 µM PFOS or 100 µM PFNA. After exposure, total RNA was isolated and purified using the RNeasy Minikit (Qiagen). RNA quality and integrity were assessed using the RNA 6000 Nano chips on the Agilent 2100 Bioanalyzer (Agilent Technologies, Amsterdam, The Netherlands). Purified RNA (100 ng) was labeled with the Ambion WT expression kit (Invitrogen) and hybridized to Affymetrix Human Gene 2.1 ST arrays (Affymetrix, Santa Clara, CA). Hybridization, washing, and scanning were carried out on an Affymetrix GeneTitan platform according to the instruction by the manufacturer. Quality control analysis, array normalization, and statistical analyses were carried out using MADMAX (Lin et al. ). For array normalization, the Robust Multiarray Average method (Bolstad et al. ; Irizarry et al. ) was applied. Probe sets were defined according to Dai et al. (). In this method, probes are assigned to Entrez IDs as a unique gene identifier. Subsequently, ***data*** were filtered with IQR 0.25 and three arrays with signal > 20. p values for the effect of the PFAS treatments were calculated using an Intensity-Based Moderated T-***statistic*** (IBMT) (Sartor et al. ). Significantly differentially expressed genes (DEGs) were selected using a p value of < 0.001 and fold-change of > 1.5 (treatment versus DMSO control) as cut-offs. Hierarchical clustering of DEGs was performed using the coolmap function (R/coolmap.R) in limma. The log-expression values were prepared by subtracting from each value the mean log2(FC) of the DMSO controls. Clustering of these control-corrected log2(FC) expression values was performed using complete linkage and Euclidean distance. Pathway analysis on DEGs was performed using ConsensusPathDB (CPDB). CPDB analysis was applied using the webtool [*https://cpdb.molgen.mpg.de*](https://cpdb.molgen.mpg.de), which combines and compares the results of multiple pathway databases (Kamburov et al. ; Herwig et al. ). For the analysis in the present study, four databases were selected, i.e., Reactome, KEGG, Wikipathways, and Biocarta. Pathways with a p value < 10−4 were considered to be affected significantly.

In a next step, MADMAX was used to perform a gene set enrichment analysis (GSEA) of the normalized and filtered ***data*** to identify enriched gene sets (Subramanian et al. ). Using this approach, genes are ranked based on the paired IBMT ***statistics*** and subsequently analyzed for over- or underrepresentation in predefined gene sets derived from Gene Ontology, KEGG, National Cancer Institute, PFAM, Biocarta, Reactome, and WikiPathways pathway databases. Only gene sets consisting of more than 15 and fewer than 500 genes were taken into account. Statistical significance of GSEA results was determined using 1000 permutations.

Real-time qPCR

For selected genes, concentration-dependent expression levels were determined in HepaRG cells. To that end, HepaRG cells were exposed to increasing concentrations of PFOA, PFOS, or PFNA for 24 h and total RNA was extracted from the HepaRG cells using the RNeasy Mini Kit (Qiagen, Venlo, The Netherlands). Subsequently, 500 ng RNA was used to synthesize cDNA using the iScript cDNA synthesis kit (Bio-Rad Laboratories, Veenendaal, The Netherlands). Changes in gene expression were determined by real-time PCR on a CFX384 real-time PCR detection system (Bio-Rad Laboratories) using SensiMix (Bioline; GC Biotech, Alphen aan den Rijn, The Netherlands). The PCR conditions consisted of an initial denaturation of 95 °C for 10 min, followed by 40 cycles of denaturation at 95 °C for 10 s and annealing extension at 60 °C for 15 s. The housekeeping gene RPL27 was used for normalization. RPL27 was chosen, since this has been reported to be one of the most stable genes based on a meta-analysis of 13,629 human gene array samples to identify the most stable expressed genes (de Jonge et al. ). The more commonly used beta-actin and/or GAPDH vary considerably under different experimental conditions (de Jonge et al. ). Primer sequences were taken from the Harvard PrimerBank and ordered from Eurogentec (Liège, Belgium). Sequences of the used primers are listed in Table . Statistical differences were assessed by performing a one-way ANOVA followed by Dunnett's test on the normalized ***data*** (fold-change compared to the solvent control) using Graphpad Prism 5, considering a p value < 0.05 as being statistically significant. The concentration–response ***data*** were also used for benchmark dose (BMD) analysis as described below.

Primer sequences used for qPCR

| **Gene name** | **Primer sequence** | |
| --- | --- | --- |
| **Forward** | **Reverse** |
| *RPL27* | ATCGCCAAGAGATCAAAGATAA | TCTGAAGACATCCTTATTGACG |
| *ANGPTL4* | CACAGCCTGCAGACACAACTC | GGAGGCCAAACTGGCTTTGC |
| *PDK4* | TGGAGCATTTCTCGCGCTAC | ACAGGCAATTCTTGTCGCAAA |
| *PLIN2* | ATGGCATCCGTTGCAGTTGAT | GATGGTCTTCACACCGTTCTC |
| *PLIN4* | GGCACCAAGAACACTGTCTG | TCGTACCCATGACCATAGACTT |
| *CPT1A* | TCCAGTTGGCTTATCGTGGTG | CTAACGAGGGGTCGATCTTGG |
| *ADH4* | AGTTCGCATTCAGATCATTGCT | CTGGCCCAATACTTTCCACAA |
| *LSS* | GCACTGGACGGGTGATTATGG | TCTCTTCTCTGTATCCGGCTG |
| *FDPS* | CTCCTCCCTCAGAATGAACG | CACCCTAACGATCTGGGAGA |
| *HMGCR* | TGATTGACCTTTCCAGAGCAAG | CTAAAATTGCCATTCCACGAGC |
| *EBP* | CTCAGCACCTAAGACTGGACA | ACGACTAAGACCCCTGTGACA |
| *IDI1* | TCCATTAAGCAATCCAGCCGA | CCCAGATACCATCAGACTGAGC |
| *ACAT2* | CCCAGCCAATGCTTCAGGAAT | AAGCCCACGTTTATCAGCTTC |

BMD analysis of qPCR and cellular triglyceride ***data***

To obtain more insight into possible differences in potencies of the three PFASs regarding their effects on triglyceride and cholesterol levels and on their effects on the expression of selected genes, concentration–response modeling and benchmark concentration analysis were performed using the PROAST webtool (PROASTweb version 65.2, RIVM, Bilthoven, The Netherlands, [*https://proastweb.rivm.nl*](https://proastweb.rivm.nl)), essentially as recommended by EFSA (EFSA Scientific Committee ). PROAST is particularly applied for modeling of in vivo (dose–response) ***data***, providing information on the benchmark dose (BMD). We used the PROAST software for the analysis of in vitro (concentration–response) ***data***, thereby providing information on the benchmark concentration (BMC). Tab-delimited text files containing ***data*** on concentration, mean effect (normalized effect to the solvent control), standard deviation, and sample size (number of biological replicates) were uploaded to the PROAST webtool and analyzed as continuous (summary) ***data***. In the tool, ***data*** are fitted to a number of mathematical models. The models showing the best (goodness of) fit, i.e., having the lowest Akaike Information Criterion (AIC) value, were used for calculation of the BMC and the corresponding two-sided 90% BMC confidence interval given by the BMCL (lower bound of the BMC confidence interval) and the BMCU (upper bound of the BMC confidence interval). The BMC, BMCL, and BMCU were determined for a benchmark response of 50% (BMR50) which corresponds to a 50% increase over the background response, resulting in a BMC50, BMCL50, and BMCU50. In PROAST, the used definitions are CES (critical effect size), CED (critical effect dose), CEDL (lower bound of the CED), CEDU (upper bound of the CED), which are identical to BMR, BMC, BMCL, and BMCU, respectively.

Results

Cell viability studies

In the first instance, the WST-1 assay was performed to get an impression on the PFAS concentrations that affect the viability of HepaRG cells. To that end, HepaRG cells in 96-well plates were exposed for 6, 24, and 72 h to increasing concentrations (up to 400 µM) of PFOA, PFOS, and PFNA. PFOA did not decrease cell viability upon 6 or 24 h exposure at any of the concentrations tested, but showed a clear drop in cell viability upon 72 h exposure at 400 µM (Fig. ). PFOS did not show a decrease in cell viability (not larger than 20%) in any of the treatments (6, 24, or 72 h; Fig. ). PFNA was the most cytotoxic PFAS, causing a more than 20% decrease in cell viability upon exposure for 6 h (400 µM), 24 h (200 and 400 µM) and 72 h (200 and 400 µM) (Fig. ). Cell viability upon a 24-h exposure was also determined in 24-well plates by quantifying the amount of DNA per well. These studies indicated that DNA quantity was unaffected up to 200 µM PFOA, 100 µM PFOA or 100 µM PFNA (***data*** not shown). Therefore, these concentrations were applied as maximum concentrations in the further studies.

Effects of 6, 24, and 72 h exposure to PFOA, PFOS, or PFNA on viability of HepaRG cells as determined with the WST-1 assay and expressed as % of the solvent control (0.5% DMSO). ***Data*** presented as mean ± SD of three independent experiments (using per independent experiment the mean of three technical replicates)

Triglyceride and cholesterol levels in cells

Concentration-dependent effects of PFASs on triglyceride and cholesterol levels were determined by performing an extraction of HepaRG cells that were exposed for 24 h to increasing (non-cytotoxic) PFAS concentrations, followed by detection using GC-FID. The outcome of these analyses is presented in Fig. . All PFASs caused a concentration-dependent increase in cellular triglyceride levels. Regarding the effects of the PFASs on cholesterol levels, limited effects were noticed. A slight decrease was observed at 100 µM PFOS and PFNA, but these effects were only statistically significant for PFOS. Dose–response modeling on the triglyceride ***data*** was performed using BMD analysis to obtain more insight into potency differences (Supplementary Fig. 1). BMC50 values (Table ) indicate that PFOS and PFNA are more potent than PFOA.

Cholesterol and triglyceride levels in HepaRG cells exposed for 24 h to increasing concentrations of PFOA, PFOS, and PFNA. Cholesterol and triglyceride levels were normalized to the levels as measured in the solvent control, which was set at 100%. Treatments with a statistically significant difference (p < 0.05) in triglyceride or cholesterol levels compared to the solvent control are indicated with \*. ***Data*** presented as mean ± SD of 4 (treatments) to 12 (controls) replicates obtained in two independent experiments

BMC50 values of PFAS-induced increase in triglycerides (sum of C44, C46, C48, C50, C52, and C54)

|  | **BMC50 (µM)** | |
| --- | --- | --- |
| **Expon model** | **Hill model** |
| PFOA | 184 (167?201) | 184 (167?201) |
| PFOS | 93 (86?101) | 93 (86?101) |
| PFNA | 93 (86?96) | 92 (86?96) |

BMC50 values are given in µM and BMCL–BMCU range is presented in brackets. ***Data*** are presented for the Exponential (Expon) model and the Hill model. Related concentration–response curves are presented in Supplementary Fig. 1

Microarray analysis: effects of 24 h exposure to 100 µM PFASs

Since none of the PFASs were cytotoxic at 100 µM, this concentration was used to study the effect of PFASs on whole-genome gene expression. HepaRG cells were exposed for 24 h to 100 µM PFOA, PFOS, or PFNA, and subjected to DNA microarray analysis. For PFOA, also a time-course experiment was executed in which HepaRG cells were treated with 100 µM PFOA for 6, 24, or 72 h followed by gene expression profiling. Figure  shows an overview of the results of the microarray ***data*** of HepaRG cells exposed for 24 h to 100 µM PFOA, PFOS, or PFNA. Upon normalization and filtering of the array ***data***, Volcano plots were generated, which show that PFNA had the largest effect on gene expression in HepaRG cells (Fig. a). Subsequently, differentially expressed genes (DEGs) were selected using a p value of < 0.001 (IBMT regularized paired t test) and fold-change of > 1.5 (treatment versus DMSO control) as cut-offs (for DEGs and corresponding p- and fold-change values, see Supplementary Table 1). Applying these cut-offs, PFOA significantly modulated the expression of 98 genes of which 56 genes were upregulated and 42 genes were downregulated. The expression of 153 genes was found to be significantly altered by PFOS treatment (47 genes upregulated and 106 genes downregulated). The most pronounced effect was observed for the PFNA treatment (1024 DEGs), resulting in 476 upregulated and 548 downregulated genes (Fig. b). Upon hierarchical clustering of the in total 1069 DEGs, PFNA treatment is clearly separated from the other treatments as indicated in the heatmap, as shown in Fig. c. Venn diagrams of the upregulated (left) and downregulated (right) genes (Fig. d) show that 24 genes are commonly upregulated by PFOA, PFOS, and PFNA, and that 31 genes are commonly downregulated by these three PFASs. The expression of these genes is presented in Supplementary Fig. 2.

Effects of PFOA, PFOS, and PFNA on whole-genome gene expression in HepaRG cells, exposed for 24 h to 100 µM PFOA, PFOS or PFNA. a Volcano plots showing relative changes in gene expression (expressed as signal log(2) ratio (SLR), x-axis) plotted against statistical significance (expressed as − log10 p value of IBMT regularized paired t test, y axis). Dotted line represents cut-off of p < 0.001. b The number of up- or downregulated genes based on a statistical significance cut-off of p < 0.001 (IBMT regularized paired t test) and a fold-change (FC) > 1.5. c Heatmap obtained upon a hierarchical clustering of DEGs. d Venn diagrams showing the number of genes up- and downregulated by the three PFASs. Material was obtained from three independent experiments

A concise pathway analysis was performed on these common DEGs using ConsensusPathDB (CPDB). For the 24 upregulated genes, the top 3 enriched pathway-based sets were “Amino acid synthesis and interconversion (transamination)” (Reactome), “Serine biosynthesis” (Reactome), and “PPAR signaling pathway (human)” (KEGG). For the downregulated genes, the three most significantly affected pathways were “Glycolysis/Gluconeogenesis (human)” (KEGG), “Urea cycle” (Reactome), and “Ethanol oxidation” (Reactome). More detailed results on the CPDB analysis of commonly modulated genes, as well as genes specifically regulated by one or two of the PFASs, are presented in Supplementary Table 2. Overall, the largest effects on gene expression changes were observed for PFNA, followed by PFOS and PFOA.

To obtain a better and more detailed insight into the biological pathways regulated by PFOA, PFOS, and PFNA in HepaRG cells, gene set enrichment analysis (GSEA) was performed. Figure  presents the top ten gene sets from these analyses for each PFAS, based on the obtained normalized enrichment scores (NERs) of significantly regulated gene sets (FDR q value < 0.05). Gene sets related to “PPAR signaling”, “lipid metabolism”, “fatty acid beta oxidation”, and “tRNA amino-acylation” featured prominently among the gene sets induced by PFOA (Fig. a). Gene sets induced by PFOS were related to “tRNA amino-acylation”, as well as to “RB (retinoblastoma protein) pathway in cancer”, and “cell cycle” (Fig. a). For PFNA, induction of genes related to “tRNA amino-acylation”, and “amino acid/oligopeptide transport” was observed (Fig. a). Only four gene sets were significantly repressed by PFOA, which are related to “cholesterol biosynthesis”, “arginine and proline metabolism”, and “glycolysis/gluconeogenesis” (Fig. b). “Cholesterol biosynthesis” and “glycolysis/gluconeogenesis” were also among the gene sets most prominently repressed by PFOS (Fig. b). PFNA repressed gene sets mainly related to “cholesterol biosynthesis” and “xenobiotics metabolism” (Fig. b).

The top ten most strongly induced (a) or repressed (b) gene sets in HepaRG cells in response to a 24-h exposure to PFOA, PFOS or PFNA, as determined on the basis of the normalized enrichment score (NES) and statistical significance (FDR q value < 0.05) obtained with the gene set enrichment analysis (GSEA). For PFOA, only four gene sets were found to be repressed. c Venn diagram showing the number of gene sets induced (positive NER) and repressed (negative NER) by PFOA, PFOS, and PFNA, describing gene sets commonly affected by the three PFASs. Only gene sets were included with an FDR q value < 0.05

The number of significantly affected gene sets by the three PFASs and the overlapping gene sets are visualized in the Venn diagram presented in Fig. c. When comparing all significantly regulated (q < 0.05) gene sets, it was found that PFOA, PFOS, and PFNA affect a number of common gene sets, including gene sets related to cholesterol biosynthesis (repressed), glycolysis/gluconeogenesis (repressed), tRNA amino-acylation (induced), amino acid transport across the cell membrane (induced), gene expression regulation by ATF4 (induced), and gene regulation by PERK (induced; large overlap with gene sets related to gene expression regulation by ATF4).

Figure  shows the expression of genes related to the gene sets that were commonly repressed (Fig. a, b) or induced (Fig. c–e) by the three PFASs. As shown in Fig. a, the majority of the genes belonging to the gene set cholesterol biosynthesis were downregulated, showing the largest effects for PFNA, followed by PFOS, and suggesting the lowest potency for PFOA. The GSEA also indicated that the gene set related to glycolysis/gluconeogenesis was repressed (Fig. b). Several genes involved in glycolysis, gluconeogenesis, or both, were downregulated, whereas PCK1 was upregulated by PFOA and PFOS, and PCK2 and HKDC1 by PFNA. This gene set (KEGG\_GLYCOLYSIS.GLUCONEOGENESIS) also contains several downregulated genes involved in ethanol metabolism, one of the commonly affected pathways identified with the CPDB analysis. As shown in Fig. c–e, the expression of genes related to ATF4-related gene expression, amino acid transport across the cell membrane, and aminoacyl-tRNA biosynthesis was upregulated, showing the largest effects for PFNA, while similar effects were observed for PFOS and PFOA.

PFAS-induced changes in expression of genes related to cholesterol biosynthesis (from Reactome; a), glycolysis/gluconeogenesis (from Kegg; b), PERK/ATF signaling (from Wikipathways; c), amino acid transport across the cell membrane (from Reactome; d), and aminoacyl-tRNA biosynthesis (from Kegg; e). Only genes are shown for which at least one of the PFASs induced a significant change in gene expression with at least a 1.5-fold change in expression. Genes were grouped according to the overlapping gene sets identified in the GSEA (Fig. c)

Comparison of PFAS-induced gene expression with gene expression ***data*** of a typical PPARα-agonist (GW7647), LXR-agonist (GW3965), and FXR-agonist (CDCA)

Peroxisome proliferator-activated receptor α (PPARα) is considered to be a relevant target of PFASs and was, indeed, one of the pathways identified upon CPDB analysis and for PFOA by the GSEA (see above). To assess whether the PFAS-induced expression profiles resemble the expression profile induced by a typical PPARα-agonist, we used the microarray ***data*** from the study of Wigger et al. (), who exposed HepaRG cells for 4 and 24 h to a series of nuclear receptor (NR) agonists [available on GEO (accession number: GSE124053)]. The ***data*** were analyzed using MADMAX as described above for the PFAS microarray ***data***, to obtain lists of DEGs related to a 24-h exposure to GW7647 (PPARα-agonist), but also GW3965 [liver X receptor (LXR)-agonist] and the bile acid CDCA [farnesoid X receptor (FXR)-agonist]. Comparing these DEGs with the DEGs related to PFAS exposure indicates that the PFASs, indeed, show a gene expression profile similar to the gene expression profile induced by the PPARα-agonist GW7647. Typical genes include PDK4, ANGPTL4, CPT1A, and CYP4A11. This applies in particular to PFOA and PFNA, but less for PFOS (Fig. ).

Gene expression changes induced by PPARα-agonist GW7647 (***data*** from Wigger et al. ) compared with gene expression changes induced by PFASs (***data*** from the present study) in HepaRG cells. GW7647-related DEGs for which at least one of the PFASs has a DEG are shown. Expressions of the solvent controls from the respective studies are shown left of the treatment ***data***

Gene expression profiles induced by the LXR-agonist GW3965 and FXR-agonist CDCA show a few similarities with the gene expression profiles induced by the PFASs (Supplementary Figs. 3, 4). Salient is that the gene most prominently downregulated by CDCA, CYP7A1, is also downregulated by all three PFASs, particularly by PFNA. This gene is known to be involved in the conversion of cholesterol to bile acids. CYP3A4 was upregulated by both the LXR-agonist GW3965 and FXR-agonist CDCA, as well as by the PFASs, and is involved in bile acid metabolism and xenobiotic metabolism.

We also assessed the effects of the three model NR agonists on the expression of genes within the gene sets commonly affected by the PFASs (Supplementary Fig. 5). These analyses indicate that the effects of model NR agonists on these genes are in general different from the effects of the PFASs.

Microarray analysis: effects of 6, 24, or 72 h exposure to PFOA

In addition to the analysis of a 24-h exposure to PFOA, PFOS, or PFNA, a time-course experiment was conducted in which HepaRG cells were exposed for 6, 24, or 72 h to 100 µM PFOA, followed by DNA microarray analysis. After 6 h exposure, the number of significantly regulated genes was relatively low compared to 24 h, especially for the downregulated genes (Supplementary Fig. 6). After 72 h of exposure, the number of significantly regulated genes was slightly higher than after 24 h, albeit differences were small (Supplementary Fig. 6). GSEA revealed that gene sets related to “PPARα signaling”, “regulation of lipid metabolism by PPARα”, “(mitochondrial) fatty acid beta oxidation”, and “fatty acid degradation” were significantly induced at all time points (Supplementary Fig. 7). Only one and four gene sets were significantly repressed upon 6 and 24 h exposure, respectively, and no gene set was repressed upon a 72 h exposure (Supplementary Fig. 7).

Gene expression analysis of selected genes related to PPAR signaling and cholesterol biosynthesis

To gain some insight into potency differences between PFOA, PFOS, and PFNA in the PFAS-induced PPAR activation and inhibition of cholesterol biosynthesis, concentration-dependent gene expression of five selected PPARα target genes (ANGPTL4, PDK4, PLIN2, PLIN4, and CPT1A), ADH4 [the gene most downregulated by the PPARα agonist GW7647, and also strongly downregulated by the PFASs (Fig. )] and six selected genes related to cholesterol biosynthesis (FDPS, LSS, HMGCR, EBP, IDI1, and ACAT2) was determined using qPCR analysis. Concentration-dependent increases in the expression of PLIN2, PLIN4, and PDK4 were observed for the three tested PFASs, whereas ANGPTL4 expression only significantly increased upon PFOA and PFNA exposure. Effects on CPT1A were limited: only a small increase was noticed upon PFOA exposure. ADH4 was downregulated by the three PFASs, already at relatively low concentrations, showing the highest potency for PFNA and a similar potency for PFOA and PFOS (Fig. ). Concentration-dependent decreases in the expression of FDPS, LSS, HMGCR, EBP, IDI1, and ACAT2 were observed for all three PFASs, although not statistically significant for IDI1 and ACAT2 upon PFOA exposure (Fig. ). Concentration–response modeling using BMD analysis was performed on the normalized expression ***data*** to calculate BMC50 values (Supplementary Fig. 8). Obtained BMC50 values (Table ) suggest that PFOA is the most potent in activating the PPARα response genes followed by PFNA, although potency differences between the PFASs appeared to be gene-specific. Interestingly, PLIN2 expression was most induced by PFOS, although the BMC50 concentration was lower for PFOA. Regarding effects on the expression of cholesterogenic genes, PFNA and PFOS showed to be more potent inhibitors than PFOA (Table ).

Concentration-dependent effects on gene expression of the PPAR-responsive genes (ANGPTL4, PDK4, PLIN2, PLIN4, and CPT1A), ADH4, and genes related to cholesterol biosynthesis (LSS, FDPS, HMGCR, EBP, IDI1, and ACAT2) by PFOS, PFOA, and PFNA. Gene expression was normalized to the housekeeping gene RPL27 and the gene expression of the solvent control was set at 1. Treatments with statistically significant difference (p < 0.05) in gene expression compared to the solvent control are indicated with \* (one-way ANOVA followed by Dunnett’s multiple comparison test (Graphpad Prism 5). ***Data*** presented as mean ± SD of three independent experiments

BMC50 values of PFAS-induced changes in gene expression of PPAR-responsive genes (ANGPTL4, PDK4, PLIN2, PLIN4, and CPT1A), ADH4, and genes related to cholesterol biosynthesis (LSS, FDPS, HMGCR, EBP, IDI1, and ACAT2)

|  | **BMC50 (µM)** | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***ANGPTL4*** | ***PDK4*** | ***PLIN2*** | ***PLIN4*** | ***CPT1A*** | ***ADH4*** | ***LSS*** | ***FDPS*** | ***HMGCR*** | ***EBP*** | ***IDI1*** | ***ACAT2*** |
| PFOA |  |  |  |  |  |  |  |  |  |  |  |  |
| Expon model | 19 (6.7?43) | 20 (13?29) | 11 (7.1?14) | 77 (19?173) | 174 (28?5190) | 56 (38?74) | 130 (30?621) | 131 (54?215) | 118 (53?198) | 181 (96?357) | 198 (135?306) | > 200 |
| Hill model | 18 (7.3?41) | 19 (13?89) | 11 (7.0?18) | 77 (19?173) | 173 (28?5100) | 50 (30?75) | 131 (29?626) | 131 (54?215) | 118 (53?199) | 181 (97?355) | 198 (135?307) | > 200 |
| PFOS |  |  |  |  |  |  |  |  |  |  |  |  |
| Expon model | NA | 72 (51?91) | 32 (24?35) | 92 (67?108) | > 100 | 58 (33?78) | 40 (8.9?310) | 79 (33?99) | 85 (55?101) | 89 (54?122) | 81 (65?94) | 88 (71?103) |
| Hill model | NA | 72 (51?91) | 28 (24?32) | 92 (67?108) | > 100 | 58 (33?78) | 40 (8.7?315) | 79 (33?99) | 85 (55?101) | 89 (54?123) | 81 (65?94) | 88 (71?103) |
| PFNA |  |  |  |  |  |  |  |  |  |  |  |  |
| Expon model | 44 (14?89) | 34 (28?41) | 42 (21?67) | 55 (37?74) | > 100 | 33 (24?42) | 43 (21?69) | 28 (14?49) | 52 (29?74) | 68 (52?81) | 63 (49?75) | 71 (57?84) |
| Hill model | 44 (14?89) | 33 (27?39) | 42 (21?67) | 47 (33?65) | > 100 | 33 (24?42) | 43 (211?69) | 28 (14?49) | 53 (29?74) | 68 (52?81) | 63 (49?75) | 71 (57?84) |

BMC50 values are given in µM and BMCL–BMCU range is presented in brackets. ***Data*** are presented for the Exponential (Expon) model and the Hill model. Related concentration–response curves are presented in Supplementary Fig. 8

NA not applicable: no dose–response and thus BMC50 obtained

Discussion

The present study assessed the effects of PFOA, PFOS, and PFNA on human HepaRG liver cells, with a particular interest in the effects of these compounds on cholesterol and triglyceride metabolism. All three PFASs downregulated cholesterogenic genes, with PFNA being the most potent and PFOA the least potent. Despite these changes, none of the PFASs significantly changed cellular cholesterol levels. All three PFASs caused an increase in cellular triglyceride levels, with PFOS and PFNA having similar potency and PFOA having a somewhat lower potency. Other cellular processes affected by the PFASs, as indicated by the gene expression analyses, point to effects on PERK/ATF4 signaling, tRNA amino-acylation, amino acid transport, and glycolysis/gluconeogenesis, and support the activation of PPARα.

The expression of cholesterogenic genes decreased upon treatment with all three PFASs. At 100 µM, the strongest effects were observed for PFNA and PFOS (Fig. ). The relatively low potency of PFOA was confirmed by concentration–response analysis of qPCR ***data*** of six selected genes of the cholesterol biosynthesis pathway, i.e., LSS, FDPS, HMGCR, EBP, IDI1, and ACAT2. This qPCR analysis also suggested PFNA to be slightly more potent than PFOS in inhibiting cholesterogenic gene expression. A decrease in expression of genes related to cholesterol synthesis was also shown by Behr et al. () for PFOA and PFOS in HepaRG cells. Cellular cholesterol biosynthesis is regulated by intracellular cholesterol levels, which is mediated by sterol regulatory element-binding proteins (SREBPs) 1 and 2 (Shimano ; Horton et al. ; Adams et al. ; DeBose-Boyd and Ye ). SREBPs are synthesized as inactive precursors and held in a tripartite complex with SREBP cleavage-activating protein (SCAP) and INSIG-1 in the endoplasmic reticulum (ER) membrane. In response to low cholesterol levels, INSIG-1 dissociates and the SCAP–SREBP complex is translocated to the Golgi apparatus for proteolytic activation. The resulting active N‐terminal SREBP enters the nucleus, where it binds to sterol regulatory elements in the promoter regions of target genes, including genes involved in cholesterol synthesis. In the presence of sufficient cholesterol, cholesterol accumulates in the ER membrane, causing a conformational change in SCAP resulting in binding of SCAP to INSIG-1, release of COPII, and trapping of SCAP in the ER membranes. As a result, SREBP is not transported to the Golgi and will not be activated. Besides cholesterol, unsaturated fatty acids have been reported to prevent SREBP transport from the ER to the Golgi, thereby inhibiting SREBP signaling, which may result in a decrease in cholesterol synthesis. Unsaturated fatty acids may stabilize INSIG-1 in the ER membrane, causing SCAP (and SREBP) to remain in the ER (DeBose-Boyd and Ye ). Interestingly, gene sets related to the regulation of cholesterol biosynthesis by SREBP (e.g., Wikipathway 1982) were downregulated, especially by PFNA and PFOS (Fig. b; Supplementary Fig. 9), suggesting that the PFASs inhibit SREBP-mediated gene expression in HepaRG cells. Accordingly, it can be hypothesized that PFASs may mimic the suppressive effect of unsaturated fatty acids on SREBP signaling.

Various NRs have been reported to play a role in the control of cholesterol homeostasis, such as PPARs, LXRs, and FXRs (Ory ; Li and Glass ; Li and Chiang ). Several studies have assessed whether PFASs bind and activate (or inhibit) gene expression regulated by different NRs (from different species), e.g., using reporter gene systems. From these studies, it is evident that various PFASs induce PPARα-mediated gene expression, and that activation of other NRs, including the ERα, ERβ, AR, CAR, FXR, LXRα, LXRβ, PPARβ, PPARγ, RARα, and RXRα, seems to be limited (Vanden Heuvel et al. ; Wolf et al. ; Behr et al. , ). Comparison of the gene expression ***data*** obtained upon HepaRG exposure to PFASs from the present study with those obtained after HepaRG exposure to a PPARα-agonist (GW7647), an LXR-agonist (GW3965) and an FXR-agonist (CDCA) reported by Wigger et al. (), indicate that the PFASs act as PPARα-agonists, but not as FXR nor as LXR agonists, corroborating the ***data*** obtained in the reporter gene systems. It can, therefore, be concluded that the tested PFASs in our study, indeed, activate PPARα-mediated gene expression, especially PFOA and PFNA, and, to a lesser extent, PFOS (Fig. ). The relatively low activity of PFOS compared to PFOA and PFNA has also been shown by Wolf et al. () using a reporter gene assay with human PPARα.

Various endogenous ligands have been reported for PPARα, including fatty acids, various eicosanoids, oxidized phospholipids, and oleoylethanolamide (Grygiel-Gorniak ; Schupp and Lazar ). Activation of PPARα is well known to promote fatty acid oxidation (Dreyer et al. ), which is expected to lead to a reduction in intracellular triglyceride levels. Consistent with this notion, PPARα deficiency in mice leads to a fatty liver (Costet et al. ; Kersten et al. ). By contrast, in the present study, all PFASs induced a concentration-dependent increase in triglyceride levels, suggesting that the triglyceride-raising effect is independent of PPARα. Increased liver triglyceride levels have also been observed in laboratory animals treated with PFASs, including PPARα knockout mice (Das et al. ). However, rather than only promoting fatty acid catabolism, PPARα also induces the expression of numerous genes involved in triglyceride synthesis and storage, including several lipid droplet-associated proteins of the PLIN family. Indeed, PFASs induced the expression of the PPARα target genes PLIN2 and PLIN4, with strong induction by all three PFASs (Fig. , Table ). Accordingly, it is conceivable that the induction of PLIN2 and/or PLIN4 mediates the observed increase in cellular triglycerides by PFASs. The notion that different PPARα agonists may have different potencies towards different target genes is called the SPPARM (selective PPAR modulator) concept (Fruchart and Santos ) and may explain why certain PPARα target genes are most strongly induced by one PFAS, whereas others are most strongly induced by another.

Treatment with PPARα agonists is known to lower plasma triglyceride levels. Because of this property, a number of PPARα agonists are in clinical use for the treatment of hypertriglyceridemia and atherogenic dyslipidemia. Given that PFASs and in particular PFOA and PFNA are potent PPARα activators, this group of compounds may also impact on plasma triglyceride levels. Indeed, PFASs were previously shown to markedly reduce plasma triglycerides in mice by stimulating lipoprotein lipase-mediated triglyceride clearance and by inhibiting the secretion of triglycerides and ApoB by the liver (Bijland et al. ). Intriguingly, some epidemiological studies suggest that exposure to PFASs is associated with increased rather than decreased plasma triglyceride levels (e.g., Steenland et al. ; Zeng et al. ). Whether these ***data*** reflect a causal relationship between PFASs and triglycerides remains unclear.

Epidemiological ***data*** have also revealed a positive association between plasma levels of PFASs and serum cholesterol levels (Steenland et al. ; Nelson et al. ; Eriksen et al. ). Currently, it is unclear whether this association reflects a causal effect of PFASs on plasma cholesterol or whether it is due to confounding. The downregulation of genes involved in cholesterol biosynthesis, also observed by Behr et al. (), seems to contradict the positive association between serum cholesterol and PFASs. Nevertheless, it is interesting to speculate on potential causal mechanisms. Intracellular cholesterol levels are tightly regulated (Luo et al. ). Therefore, if cholesterol levels in hepatocytes would increase, these are expected to be excreted into bile (via ABCG5/8) and/or into the circulation (via VLDL particles). Hypothetically, this may result in increased serum cholesterol levels. We did not measure cholesterol levels in the medium of the cell cultures, so we cannot exclude such an effect. Behr et al. () recently measured cholesterol levels in PFOS- or PFOA-exposed HepaRG cells and the cell culture medium, using the fluorescence-based AmplexRed Cholesterol Assay. They did not find changes in cellular cholesterol levels, but reported a small increase of cholesterol in the medium upon a 24-h exposure to 100 µM PFOS, but not at lower concentrations, nor by PFOA. Another hypothesis on a possible mechanism underlying increased serum cholesterol levels can be based on the ***data*** presented here, in which we find a marked repression of the SREBP pathway by PFOS and PFNA (Supplementary Fig. 9), including downregulation of the LDL receptor gene (LDLR). It can be hypothesized that PFASs may be able to raise plasma cholesterol by suppressing SREBP-dependent transcription of LDLR, thus decreasing the hepatocellular uptake of cholesterol-rich LDL, which may result in an increase in serum cholesterol levels. Future studies should be directed towards further investigating the effect of PFASs on LDL receptor protein levels in human hepatocytes.

Although the three PFASs showed, in general, a different gene expression profile than the bile acid CDCA, similarities were also observed (Supplementary Fig. 4). CYP7A1, which codes for the key regulatory enzyme in the synthesis of bile acids from cholesterol, was found to be the gene most downregulated by CDCA in HepaRG cells (Wigger et al. ). CYP7A1 was also downregulated by the three PFASs in our study as well as by PFOA and PFOS in the HepaRG study of Behr et al. (). It is of interest to note that Behr et al. () also observed changes in cellular and extracellular bile acid composition, and that, dependent on the concentration and the chemical (PFOA or PFOS), cholic acid (CA) levels increased (GCA and TCA), whereas chenodeoxycholic acid (CDCA) levels decreased (GCDCA and TCDCA). At the gene expression level, our study shows a decrease in the expression of CYP8B1 and CYP27A1 upon PFNA treatment (Supplementary Table 1), playing a role in CA and CDCA formation, respectively. Bile acids can regulate their synthesis via a feedback mechanism by activating FXR, which results in increased expression of the gene NR0B2 encoding small heterodimer partner (SHP), leading to a decrease in CYP7A1 expression (Chiang ). However, in our study, NR0B2 expression was downregulated by PFOS and PFNA (Supplementary Table 1), as also reported by Behr et al. () for PFOA and PFOS and the CYP7A1 downregulation is, therefore, not expected to be mediated via FXR/SHP. Behr et al. () suggested CYP7A1 downregulation to be mediated via downregulation of HNF4A (based on Abrahamsson et al. ()), but HNF4A was only significantly downregulated in our study by PFNA, not fully supporting this mechanism. In agreement with the ***data*** of Behr et al. (), we found, besides the downregulation of CYP7A1, also an upregulation of CYP3A4, which both have been described as key events in the AOP for cholestasis, and, thus, may contribute to the development of cholestasis (Vinken et al. ).

Gene sets related to glycolysis/gluconeogenesis were downregulated by all three PFASs, as indicated by the GSEA (Fig. b). However, PCK1, which codes for a key enzyme in gluconeogenesis (catalyzing the formation of P-enolpyruvate from oxaloacetate), was upregulated by PFOA and PFOS. PFNA induced an upregulation of PCK2, which is a mitochondrial variant of PCK1. PKLR, involved in the glycolysis (conversion of P-enolpyruvate to pyruvate), and G6PC, covering the last step in gluconeogenesis (conversion of glucose-6P to glucose), were downregulated by all 3 PFASs. In addition, the expression of PDK4 was strongly upregulated, which may result in decreased activity of pyruvate dehydrogenase linking glycolysis with the citric acid cycle. When considering the changes in expression of these genes, the resulting cellular effects may point to the process of glyceroneogenesis (Hanson and Reshef ; Reshef et al. ; Nye et al. ). The upregulation of PCK1 (and possibly also PCK2) and downregulation of PKLR may result in increased P-enolpyruvate levels, suggesting the process to be directed to gluconeogenesis. However, given the downregulation of the aldolases (ALDOB and ALDOC), glyceraldehyde 3-P conceivably is not directed towards fructose-1,6-diphosphate but towards dihydroxyacetone-P, which can be used for triglyceride synthesis. Glyceroneogenesis was first described in white adipose tissue, but has also been reported to take place in the liver (Reshef et al. ) and is supported by the increased levels of cellular triglyceride levels in the present study.

The gene expression ***data*** from our study also point to disturbance of the endoplasmic reticulum (ER) membrane by the three PFASs, reflected by the activation of PERK/ATF4 signaling (Fig. c) (Liu et al. ; Rozpedek et al. ). ER stress induces Unfolded Protein Response (UPR) pathways via activation of protein kinase RNA-like endoplasmic reticulum kinase (PERK) and subsequent phosphorylation of Eukaryotic Initiation Factor 2 alpha (eIF2α). This activation of eIF2α results in attenuation of global protein translation and triggers preferential translation of selected genes such as Activating Transcription Factor 4 (ATF4). ATF4 upregulates genes that play a role in cell recovery, adaptation to stress conditions, and restoration of cell homeostasis (Rozpedek et al. ), including genes that are involved in cell metabolism and ***nutrient*** transport. Interestingly, it has been demonstrated that during ER stress, e.g., caused by amino acid starvation, ATF4 induced the expression of aminoacyl-tRNA synthetase (ARS) genes and genes coding for amino acid transporters (Adams ; Shan et al. ; Krokowski et al. ; Han et al. ). These genes were found to be upregulated by the PFASs in the present study (Fig. d, e). Upon continued stress conditions, PERK/ATF4 may also activate downstream CHOP (= DDIT3; Fig. c), which promotes apoptosis (Rozpedek et al. ). CHOP/DDIT3 expression was highly induced by PFNA (Fig. c). Activation of these pathways has also been reported to be induced by saturated fatty acids in human liver cells, possibly playing a role in the induction of non-alcoholic fatty liver disease (NAFLD) (Cao et al. ). Previously, it has been demonstrated that PFOA induces ER stress and UPR in HepG2 liver cells (Yan et al. ) and ER-stress-related autophagy in A549 lung cells (Xin et al. ).

It is of interest to note that the concentrations applied in the present study (µM range) are relatively high compared to the serum concentrations that have been reported to relate to an increase in serum cholesterol in the epidemiological studies (nM range), especially considering differences in the free fraction of the PFASs in vitro (relatively high free fraction) versus in vivo (relatively low free fraction). Therefore, although the present study provides insight into mechanisms underlying PFAS toxicity, the effects as determined in the present study do not necessarily take place in humans at relevant exposure levels. Therefore, it would be of interest to test in the future the effects upon chronic exposure to PFASs at lower concentrations, as this may better resemble relevant human exposure. Interestingly, reported internal concentrations of PFOA in human cancer patients in a phase 1 dose-escalation trial were in the µM to mM range (Convertino et al. ), being in the range of concentrations tested in the present study. The reported decrease in serum cholesterol levels in these patients with increasing PFOA concentrations (Convertino et al. ), may relate to the decrease in cholesterogenic gene expression as identified in the present study.

In conclusion, the results of the present study point to an increase in cellular triglycerides upon PFAS exposure in HepaRG cells and a decrease in cholesterogenic gene expression. The latter is unlikely to be the indirect consequence of increased cholesterol levels, since our GC-FID analyses showed no effects of PFASs on cellular cholesterol levels. Rather, the effect may be due to PFAS-induced inhibition of SREBP signaling, as has been reported before for unsaturated fatty acids (Cao et al. ). Furthermore, although PFOA, PFNA, and, to a lesser extent, PFOS activated PPARα signaling, an increase rather than a decrease in cellular triglyceride levels was observed in PFAS-exposed HepaRG cells. The mechanisms underlying this PFAS-induced increase in triglyceride levels remain to be unravelled, but may be related to induction of specific lipid droplet-associated proteins or to a possible induction of glyceroneogenesis. Interestingly, the PFASs also induced expression of genes related to ER disturbance, activating PERK-eIF2α-ATF4 signaling, which may explain the upregulation of aminoacyl-tRNA biosynthesis and amino acid transporters. Altogether, the present study provides more insight into the molecular effects of PFASs on triglyceride levels and cholesterogenic gene expression in human liver cells, but can neither confirm nor contradict a possible causality between PFAS exposure and increased serum cholesterol as identified in human epidemiological studies.

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HINA Digest

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**Body**

Zagreb,Hrvatska08 January 2021 (Hina) - PM: Coalition strongly supports all gov't post-quake activities ZAGREB, 8 January (Hina) - Prime Minister Andrej Plenkovic said on Friday the parliamentary majority strongly supported all the activities the government had undertaken after last week's earthquakes and that it was willing to create a legislative framework to enable the reconstruction of the areas affected. Speaking to the press after a virtual coalition meeting, he said the majority also supported "the commendations ofthe work of the police, the civil protection, the army, firefighters, the HGSS (Croatian Mountain Rescue Service), the Red Cross, activities at local level, the support from the healthcare system, from all those who have contributed, and the thanks to all the citizens who have directly helped those affected in recentdays." Plenkovic said the majority was willing to create and modify the legislative framework that would also facilitate the coordination of all the services in the field, notably after the formation of a task force to deal with the aftermath of the earthquakes. "There is a strong desire to use this situation, which has first and foremost distressed many of our fellow citizens in (Sisak-Moslavina) county, as well as inKarlovac and Zagreb counties, for development and solving all the problems which exist in that county." Plenkovic said he expected the coalition to discuss this topic next week as well as during the next parliament session.

Medved: Structural engineers havechecked nearly 12,000 damaged properties ZAGREB, 8 January (Hina) - Deputy Prime Minister Tomo Medved, who heads the task force dealing with the aftermath of the 29December earthquake, said on Friday that the authorities had to date received 29,206 requests for examination of damaged buildings, and structural engineers had examined 11,800 of them. On Thursday alone, they examined 1,902 buildings damaged by the earthquake, Medved told Croatian Radio. According to official ***data***, 2,231 people cannot stay in their homes because they are either heavily damaged or have been destroyed in the disaster. Medvedmentioned a series of aftershocks that were still intermittently felt in Sisak-Moslavina County, which makes the job of structural engineers more difficult. The minister said that many villagers in remote rural settlements were reluctant to leave their homes. Citizens safe from possible floods, says deputy PM ZAGREB, 8 January (Hina) - The head of the earthquake task force, Tomo Medved, on Friday visited the embankment in Galdovo near Sisak and said that the Hrvatske Vode water management company had started building the second line of defence which would be done soon and that citizens were safe from possible floods. Cracks occured on the embankment in Galdovo near Sisak due to last week's earthquake so there is fear that due to the high water level the Sava river could flood the area Due to the state of the embankment, there is no point in repairing it, and the Hrvatske Vode company has started building the second line of defence in the shape of a ring, said Deputy Prime Minister and War Veterans' Minister Tomo Medved, as carried by the Croatian Radio-Television (HRT). He explained that the second line of defence was being built so that, in case of a high water level, the water would end up in a lake and not cause additional damage. Medved said that in a couple of days that new line of defence should be completed and that the citizens were safe from possible floods. "This is proof of our quality and timely decisions and our professional services," Medved said. Minister says quake damagedarmy property in Petrinja ZAGREB, 8 January(Hina) - Defence Minister Mario Banozic said on Thursday evening that some damage had been established onparts of army property in Petrinja where civilians were temporarily staying after the devastating 29 December earthquake. Banozic told the N1 commercial broadcaster that the damaged property would have to be repaired, and said that the defence ministry would cooperate with civilian authorities in efforts to seek solutions for the accommodation of 400 civilians whofoundtemporary shelter in the army barracks. He called forstabilisingthe situation and for providing assistance to people in need and after that, he said, reconstruction can start. Immediately after the quake, it was necessary to clear debris, make roads usable, transfer patients to a safe place, Banozic recalled. Apart from that, the army staff was also included in checking river embankments in the quake-hitregion. "The army has done a lot of work, and it is my wish that we start reconstructing the area as soon as possible," he said, adding that army service people would still be engaged on the ground to deliver humanitarian aid,clear rubble as well as to transport container homes to villages in the area. 338 earthquake victims moved to safety fromarmy barracks ZAGREB, 8 January (Hina) - The relocation of 338 earthquake victims from the army barracks in Petrinja, which served as a reception centre for locals and care home residents, was completed on Friday morning, a spokesman for the task force dealing with the aftermath of the 29 December earthquake told Hina. "There were a total of 338 people in that facility, including 116 care home residents and 222 local inhabitants," spokesman Mladen Pavic said, noting that they had all been moved to safe locations. The care home residents were moved to care homes in Lika-Senj County andZagreb as well as to the Topusko spa. However, the 222 local residents were not moved out of Petrinja, but were relocated from one building to another within the same army barracks. Pavic said that the civilians were relocated because of possible structural damage done to the building they were staying in. "The building they were staying in did not suffer visible damage, but because of possible structural damage, structural engineers recommended their relocation because a large number of people were staying in the same building," the spokesman said. 350 families accommodated in container homes ZAGREB, 8 January(Hina) - Civil Protection director Damir Trut said on Friday 350 families had been accommodated in container homes in earthquake-hit areas, adding that there wasdemand for 1,000 to 1,500 such homes and it would likely increase. Speaking to the press in Petrinja, he said structural engineers had inspected only a third of the buildings reported to have been damaged in Sisak-Moslavina County in last week's tremors. He estimated that it would be necessary to accommodate more people whose homes were permanently or temporarily unsafe. Container home database Trut said a container home database was being compiled in cooperation with local authorities and that it was updated on a daily basis. Initially, he added,the database contained 500 requests for the accommodation of families who had nowhere to stay. Trut said he still did not have information on how many family homes were designated asunsafe or how long it would take to accommodate everyone, saying itdepended on the pace of setting up container and mobile homes, their production as well as donations. To date, between 25 and 30 container homes have been set up perday, he said. Container homes likely solution for many people According to Trut, container homes will likely be the solution for the accommodation of many until housesare built, notably in rural areas. "They will stay in those homes unless they opt for some other accommodation." He said the task force dealing with the aftermath of the 29 December earthquake was doing a very good job. He announced that 70 container homes would arrive this weekend from Turkey and that ten had arrived from Austria today. Hotels donate 125 mobile homes, additional purchases discussed ZAGREB, 8 January (Hina) - Hotels have so far donated 125 mobile homes for earthquake-hit Sisak-Moslavina County, and representatives of hoteliers and tourist associations discussed the purchase of additional mobile homes at a meeting with the government on Friday. After the meeting, Prime Minister Andrej Plenkovic thanked the hotels for donating the 125 mobile homes that had already been delivered to Sisak-Moslavina County and said that providing additional mobile homes had been discussed today. The state would procure them through the Ministry of Tourism, Ministry of Economy and Commodity Reserves and transfer them to Sisak-Moslavina County as soon as possible in order to provide temporary accommodation for earthquake victims, Plenkovic said. Talks on the use of mobile homes available along the Croatian coast will be held by the Tourism and Sports Ministry and the Economy Ministry, said Plenkovic, hoping that many of those will be delivered to Sisak-Moslavina County as soon as possible. The 125 mobile homes that have been donated so far are between 24 and 32 metres square, they are equipped with a bathroom and kitchen, and most of them came with bed linen, towels and cutlery, said the director of the Croatian Tourism Association (HUT), Veljko Ostojic. He announced that today and tomorrow a thorough examination of everything available would be carried out, and during the weekend a precise list of everything deemed appropriate and suitable for assistance would be provided. The meeting was also attended by Finance Ministar Zdravko Maric, Economy and Sustainable Development Minister Tomislav Coric, Physical Planning, Construction and State Assets Minister Darko Horvat and representatives of several tourism companies. 755 buildings in Karlovac sufferHRK 99mquake damage ZAGREB, 8 January (Hina) - Following two strong earthquakes, HRK 99 million worth of damage has been reported for 755 buildings in Karlovac so Mayor Damir Mandic told a press conference on Friday that even before the deadline for reporting damage it could be said the conditions for declaring a natural disaster had been met. Due to danger and damage to their house, one family was moved to a city-owned flat after the first earthquake (28 December)andafter the second earthquake (6 January) six more families wereprovided with replacement accommodation.Deputy Mayor Ivica Mrzljak said that 17 buildings were unsafe, two of which were empty, while 11 families had to move out of six of them. They were offered hotel accommodation or another possibility with the costsbeing covered by the city budget. Mrzljak told everyone who had removed the damage by themselves due to urgency to save the invoices because they would be the basis for receiving compensation. Deputy Mayor Andreja Navijalic said that all schools were safe even though nearly all of them had sustained damage, and as many as 26 dangerous chimneys had to removed from Dragojla JarnevicPrimary School in agreement with conservators as they are only used fordecorative purposes. According to Navijalic, next week employers will undergo evacuation training and it will be checked whether all instructions are clear so that, if necessary, everyone knows exactly what to do for a quick and safe evacuation. Of the 755 damaged buildings, 111 are owned by the state, and of the HRK 99 million damage,HRK 76.3 million damage has been sustained by state-owned buildings and HRK 22.7 million by private buildings, Mrzljak said, underscoring that ministries are still checking their buildings in Karlovac and that damage can be reported by 14 January. Seven teams of civil engineers are helping owners assess the damage, and only today they have to visit 50 locations. Since the first earthquake, firefighters have intervened in 12 locations, mostly removing chimneys and rubble in high placeswhich was dangerous for residents and passers-by, and damage removal is still ongoing. Hungary, MOL donate 50 containers to quake-hit Croatia ZAGREB, 8 January(Hina) - Hungary's Foreign Minister Peter Szijjatro, who on Friday visited the quake-hit area of Croatia, attended the ceremony of the delivery of the first two out of 50 containers which Hungary decided to donate to Croatians whose homes were damaged by the 29 December devastating earthquake. The first two containerswere delivered in the town of Petrinja. The remaining 48 can be expected next week. The visiting minister said that the donation of 50 containers had been ensured by Hungary's MOL company, as the biggest investor in the Croatian economy.Hungary's oil and gas group holds 49.1% in Croatia's INA company.As Croatia's largest investor, Mol feels a responsibility for everyone affected by the earthquake, particularly those in the Sisak, according to the minister. Apart from this donation, a Hungarian company is going to deliver 5,000 lamps, and the Hungarian government pledged to participate in the reconstruction of one church and one school destroyed in the disaster. Szijjarto said that he wished strength and endurance to the Croats in the quake-wrecked areas. Croatia's Foreign and European Affairs Minister Grodan Grlic Radman and Minister Tomo Medved, who is at the helm of the task force to deal with the aftermath of the quake, thanked Hungaryfor the assistance and donations. Medved said that the need to help people after the quake made the Croatians as well as all the neighbouring countries and partners united. The headof the Civil Protection Authority, Damir Trut, said that Turkey had sent 70 containers that would arrive in Croatia on Saturday. Also on Friday, ten more containers were delivered to Sisakfrom Austria. Between 300-350 families that were left without their homes in the quake, have to date been provided with container homes, Trut said. Italy, Bulgaria send aid to Croatia after earthquake ZAGREB, 8 January (Hina) - Italy is sending a group of experts to Croatia to help save the cultural heritage of earthquake-hit Petrinja, while Bulgaria has provided €100,000 for the reconstruction of a secondary school and the Croatian Academy of Sciences and Arts in Zagreb, the two countries' embassies said on Friday. A magnitude 6.2 earthquake struck central Croatia on 29 December, causing extensive property damage in Petrinja, Sisak and surrounding communities. The tremor was felt in neighbouring countries as well, and aid is coming in from around the world. Italy was among the first countries to come to Croatia's aid, sending 100 military tents after the earthquake. This Sunday it is sending a group of Blue Helmets for Culture to help protect the artistic heritage of Petrinja and the surrounding area, the Italian Embassy said in a statement. Blue Helmets for Culture is a task force established by UNESCO in 2015 in response to the destruction and looting of cultural heritage in Mesopotamia, the cradle of civilisation, by the terrorist group ISIS. The first task force was formed in 2016 under an agreement between UNESCO and the Italian government. The first mission of Blue Helmets for Culture in Croatia will last a week and will be followed by a second contingent of Italian Blue Helmets. The Italian Embassy building in Zagreb has been closed because of damage caused by the earthquake. The Embassy has launched a fundraiser to help Croatian institutions with the reconstruction of damaged areas. "We sympathise because we are close not just historically but also thanks to many joint projects in the Adriatic and because Italy has fresh memories of seismic disasters. We want to share our experience with our Croatian friends," Italian AmbassadorPierfrancesco Sacco said. In the last 50 years, Italy has been hit by dozens of earthquakes, some with devastating consequences, such as those that struck Friuli in 1976 and Irpinia in 1980 as well as those that occurred more recently, in L'Aquila in 2009 and Amatrice in 2016, the Italian Embassy said. Bulgaria sent an aid delivery worth €83,660 via the EU Civil Protection Mechanism on 1 January, including 100 radiators,500 camping beds and 300 mattresses, the Bulgarian Embassy said. Three Bulgarian trucks delivered mineral and spring water, and the Bulgarian government provided €100,000 for the reconstruction of the Gornjogradska Gimnazija school building and the Croatian Academy of Sciences and Arts in Zagreb (€50,000 for each building). The Embassy said that thetwo institutions had played an important role in the past in bringing Bulgarians and Croats closer together. At the end of December, the Bulgarian Embassy donated food to the Croatian Red Cross for earthquake victims. German firefighters bring humanitarian aid to earthquake-hit Croatian county ZAGREB, 8 January (Hina) - A 23-truck convoy organised by firefighters from the German state of Baden-Wurttemberg arrived in Sisak-Moslavina County on Friday morning, bringing humanitarian aid to earthquake victims. Fifty German firefighters brought 230 tonnes of aid, including firefighting equipment, clothing, hygiene products and construction material. The area was struck by a 6.2-magnitude earthquake on 29 December, leaving seven people killed and extensive property damage. "We started ***collecting*** aid already on 31 December and we have already brought the first convoy of aid. The second convoy set out at 4pm on Thursday with 23 vehicles and 50 firefighters. Since we don't want to be a burden to anyone, we just came to deliver the equipment. We will help with the unloading and will head back to Germany on Saturday morning," the convoy's leader Gerhard Lai said. County fire marshal Mijo Brlecic thanked the German firefighters for the donation, citing their years-long cooperation. He said that the construction material was particularly valuable because it was in short supply. The first convoy of 11 firefighting vehicles and three Red Cross vehicles from Baden-Wurttemberg arrived a week ago, bringing 110 tonnes of aid, mostly medical supplies, food and hygiene products and firefighting equipment. Plastic manufacturers donate construction foil,bags to quake-hit areas ZAGREB, 8 January(Hina) - Three Croatian manufacturers ofvarious foils and confectionery packaging -- Muraplast, Brkovic and Optiplast -- have decided to donate necessary products to the quake-hit areas, and the donation includes 30 tonnes of construction foil, worthHRK 250,000, for damaged roofs. The donation, provided by these three private companies,consists also of tensof thousand of plastic bags for the deliver of meals and food. Banija Is Our House initiative helping quake victims ZAGREB, 8 January (Hina) - The Banija Is Our House humanitarian initiative, which has raised over HRK 500,000 and €27,000 for earthquake victims, held its inaugural meeting in Petrinja on Friday, bringing together representatives of the Serbian Orthodox Church, the Serb National Council (SNV) and other Serb organisations in Croatia. Banija Is Our House is an SNV initiative. The meeting was also attended by the Solidarna foundation and the Red Cross. Aid for the victims is arriving also from Serbia and Bosnia and Herzegovina, the SNV said, adding that trucks with construction material and 72 container homes were being delivered in cooperation with the Red Cross and the relevant services. A donation of container homes from Belgrade was delivered yesterday with the help of the Croatian army. The initiative has opened an account for donations at Zagrebacka Banka, primarily to help the people in rural Banija. Aladrovic expects no problem in pension payments in quake-hit areas ZAGREB, 8 January(Hina) - Labour and Pension System Minister Josip Aladrovic saidon Thursday that he expected no problem in the payment of pension and other allowances to beneficiaries in the quake-hit Sisak-Moslavina County. Aladrovic told the NOVA TV broadcaster that the ministry was in permanent contact with the Croatian Post (HP) and commercial banks, adding thatthe disbursement of the allowanceswould start on Friday. Postmen will be engaged in delivering the allowances, whichcan also be collectedin HP officesin the area. The minister said that some additional measures were on the table to help mitigate the consequences of the quake. Thus, businesses in the quake-hit area will be covered by the job-retention grants of 4,000 kuna per employee per month.An estimated 20,000 workersare likely to be encompassed by this measure, and thus HRK 160 millionshould be set aside for this purpose in the first two months of 2021. Asked by the press what would happen after volunteer cooks and chefs, who arepreparing meals for people in the quake hit areas, left therenext week, Aladrovic said that the labour ministry would define criteria onwho could be eligible for free meals which would be distributed by the Red Cross, the Civil Protection Authority and the army. 30,000 workers encompassed by shortened working hours scheme The minister recalled that when it came toanti-epidemicrestrictionsdue to the COVID-19 pandemic, a wage subsidy scheme to encourage employers to cut workers’ hours was in place and now covered 30,000 workers. The minister said that currently50% of the work hours was subsidised and thata new proposal would be to raise this to 90% for the worst-hit businesses. "The state thus finances 9 out of 10 working hours," Aladrovic said, adding that the European Union has provided HRK 2.2 billion to fund this scheme, and the disbursement would suffice for the first threeor four months of 2021, depending on the epidemiological situation. Job-keeping benefits extended to businesses in quake-affected areas ZAGREB, 8 January (Hina) - The Croatian Employment Service (HZZ) has extended benefits for shorter working hours until the end of the year, while job-keeping benefits of HRK 4,000 a month per employee, designed for businesses affected by the coronavirus crisis, will be extended to businesses in earthquake-hit areas in January and February. The decision was made by the HZZ governing council at its meeting on Friday. The council amended the decision on the conditions and methods of using funds for the implementation of active employment policy measures in 2021. The decision aims to help enterprises in the earthquake-affected Sisak-Moslavina, Zagreb and Karlovac counties to maintain their business activities, the HZZ said. Labour and Pension System Minister Josip Aladrovic said on Thursday that all employers and employees in the affected areas would be covered by the job-keeping measure. He said that about HRK 160 million would be disbursed in January and February of this year to help 20,000 workers in the affected areas. Hiring of foreign workers - labour market test no longer needed for about 40 occupations Given that the amended Foreign Nationals Act entered into force on 1 January, the HZZ governing council decided on occupations for which employers are not required to request a labour market test. The decision applies to about 40 occupations, including bricklayer, carpenter, stonemason, house painter, plumber, locksmith, car mechanic, butcher, baker, pastry cook, computer programmer andsystem administrator. Every farmer affected by quake will be reached, says minister ZAGREB, 8 January(Hina) - About 2,700 family farmsin earthquake-hit Sisak-Moslavia County have suffered damage and 2,100 have been visited to date, ***Agriculture*** Minister Marija Vuckovic said on Friday, adding that every farmer would be reached. Fortyadvisors and staff of the Croatian Agency for ***Agriculture*** and Food are visiting the affected farmsand they will visit those in Karlovac and Zagreb counties too, Vuckovic said while visiting the quake-hit areas. She said the ministry had undertaken many activities so that help to the farmers there was systematic, including subsidy payments and helping them to selltheir products. The minister thanked "our big ***agricultural*** systems (for) purchasing small quantities of ***agricultural*** products from small producers at fair prices." She said ***agriculture*** would undergo a comprehensive overhaul without too much red tape. Cooperation has been established with lumber producers and Croatian Forests, and donations have been ensured for every stage of reconstruction in the affected areas, she said. Vuckovic also visited a Red Cross warehouse in Sisak wherethe charity'srepresentatives thanked food companies, including Belje, and other donors who are theirregularsuppliers. There have been many private donors to date,but now supplies arebeing organised, Red Cross representatives said, adding that its staff and volunteers were ready to be engaged in quake-hit areas for months. Everything that can will be saved, culture minister says ZAGREB, 8 January (Hina) - The Minister of Culture and Media, Nina Obuljen Korzinek, on Friday attended the evacuation of archival material from Petrinja, saying that everything that could be reached would be evacuated from the earthquake-hit area by the end of next week. Following the evacuation of artworks from the Krsto Hegedusic Gallery in Petrinja on Thursday, Obuljen Korzinek and her aides on Friday attended the start of the evacuation of the storage facility of the State Archives in Petrinja. The minister said that the evacuation would continue in the coming days, adding that Italian experts in the extraction of artworks from under the rubble were coming on Sunday to assess what could be evacuated. "Weput safety and human lives before everything else. Of course, we will try to save what can be saved. I believe we will evacuate everything that can be reached by the end of next week," Obuljen Korzinek said. Speaking of the damage to the historical heritage of Petrinja, the minister said that the reconstruction would focus on preserving the visual identity of historical buildings while modernising them in terms of energy efficiency and protection against earthquakes. "The historical heart of the town has been heavily damaged. At this point we are thinking of a project similar to the reconstruction of war-torn Vukovar, to rebuild the centre of Petrinja by preserving its identity," Obuljen Korzinek said. ***Data*** ***collection*** tools developed for quake-hit area ZAGREB, 8 January(Hina) -The acting director of the fund for post-quake reconstruction, Damir Vandjelic, said on Thursday that a decision on the reconstruction of Sisak-Moslavina County according to the existing law on the post-quake reconstruction of Zagrebhad not yet been made. However, he told the NOVA TV broadcaster that he hadgot an insight into the situation in the Sisak Countyand that they had developed the necessary information tools. "We follow the activities of volunteers and the extent and kind of the damage, we have set up a call centre where citizens can submit requests for the inspection of their buildings by structural engineers. Another application is for the assessment of structural engineers and the status on the ground. Every property is geo-located," Vandjelic said. About 27,800 requests have been submitted via the call centre, and in 46% of the those cases, aninspection has been conducted, while54% remain to be inspected. Asked how much money could be expected from abroad for the reconstruction of Sisak-Moslavina County, Vandjelic said it could be above €300 million. Interactive map helps detect extent of quake damage, saysdaily ZAGREB, 8 January (Hina) - The ***data*** ***collected*** by satellite and drone monitoring, which were used to develop an interactive map of the Croatian crisis management association, show that 681 buildings have beendamaged in Petrinja, 891 in Sisak and as many as 1,171 in Glina, Vecernji List daily reported on Friday. The interactive map includes three categories of buildings: red label for destroyed buildings, orange for damaged buildings and yellow forprobably damaged buildings, the daily said. The head of theCroatian crisis management association, Igor Magdalenic, was quoted as saying that this interactive map was used as support to the operations of the Civil Protection. Magdalenic underscored that the map could not replace competent experts on the ground. It is possible, for instance, that some buildings are damaged but the damage is not visible from outside, and structural engineers must inspect the interior of buildings, he added. Croatiacoronavirus update: 1,098 new cases, 38 deaths, 1,538 recoveries ZAGREB, 8 January(Hina) - Of 6,742 tests performed in the last 24 hours, 1,098 have returned positive (16.2%), and there have been another 38 related deaths bringing the death toll to 4,304, Croatia's national COVID-19 response team said on Friday. There are 2,251COVID patients in hospitals, including 194 on ventilators. The number of active cases in Croatia stands at 5,794, and there are 18,277 people in self-isolation. To date, 1.06 million people have been tested. Since the start of the epidemic in Croatia, a total 217,946 people have contracted the novel coronavirus and 207,848 have recovered, including 1,538 in the last 24 hours. Adherence to anti-epidemic measures producing results, epidemiologist says ZAGREB, 8 January (Hina) - Coronavirus tests indicate thatnew infection numbers havedropped to 15% and that the number of deaths is also falling, but the figures are still high and people are advised to adhere to restrictionsbecause they have produced results, epidemiologist Iva Pem Novosel said on Friday. She recalledthat before tighter restrictions were imposed, the share of positive tests had been 30% and in some high-risk areas as much as 50%. Pem Novosel told the HTV public television serviceCroatia was among the best countries in Europe in terms of the vaccination rate thanks to its network of public health institutions through which the vaccine was distributed. She said that vaccination was going according to plan and that all vaccine deliverieshad been made as agreed. "Over 20,000 people have been vaccinated by yesterday and we are very pleased with that," she added. Pem Novosel stressed the importance of adhering to the present epidemiological measures, which expire on 10 January, adding that in her opinion it was still not the right time to ease the restrictions. "It's worth sacrificing ourselves a bit longer because the measures in place are producing results." Anti-epidemic measures extended until end of January ZAGREB, 8 January(Hina) - The current restrictions to curb the COVID-19 epidemic, which expire on 10 January, have been extended until 31 January, which meansthatrestaurants and cafes in Croatia will remain closed for the next three weeks, the national coronavirus crisis management team said on Friday. Some of the restrictionsrefer to shortened work hours,restrictions for passengers in public transportation, no more than 25 people are allowed to gather for public events, and so on. Shops and shopping centres are required to ensure 10 to 20 square metres of space per customer, depending on the size of the net sales area. Interior Minister Davor Bozinovic said that despite the downward trend in new coronavirus numbers, the number of hospitalisations was still high and that cold winter conditions were conducive to the spread of the novel virus. The authorities still expect the impact of the Christmas and New Year holidays as well as of the recent earthquakes on the total tally of coronavirus cases. The crisis management team is worried by thecurrent trends in Europe, where some countries with more stringent restrictions are faced with a resurgence. Health Minister Vili Beros said that there were now fewer hospitalised COVID patients and fewerfatalities, but that there was no room for relaxation. He recalled that the largest number of hospitalised COVID patients, 2,956, was registered on 21 December, and their number fell to 2,251 on Friday. The largest number of patients on ventilators, 306, was registered on 19 December, and today it stands at 194. On 12 December, there was a record high number of new patients admitted to hospitals in a day, 306, while on Friday, 215 new patients were hospitalised for COVID treatment. The head of the Croatian Institute of Public Health, Krunoslav Capak, said that Croatia's incidence rate per 100,000 inhabitants over a period of 14 days stoodat 351.8 today, which put it in the middle of the EU ranking. On 27 December, Croatia fared much worse, with a 14-dayincidence rate of 974 new cases per 100,000 people. Croatia's COVID-19 related death rate per million at 1.032 Capak said that currentlyCroatia's COVID-19 related death rate per million inhabitants was 1.032, and in these termsCroatia ranks 20th in the European Union. To date,Croatia has vaccinated 24,985 persons, including 3,000 in the quake-hit Sisak-Moslavina County, Capak said. Entrepreneurs disappointed restrictions not being eased ZAGREB, 8 January (Hina) - The Voice of Entrepreneurs association said on Friday it was disappointed that restaurants and bars were still not allowed to reopen, warning that a billion kuna in revenues that would have been generated by them in December mostly ended up in foreign-owned retail chains. The national coronavirus response team announced on Friday that the existing restrictions on public gatherings, the work of restaurants and bars, and shortened working hours, imposed to curb the spread of the coronavirus, would remain in force until the end of January. The Voice of Entrepreneurs complained that again they did not know how long the measures would remain in place and that there was no mention of any compensation to businesses that had been forced to shut down or limit their operations. The association cited ***data*** from the National Employment Service showing that the number of unemployed people had risen to 160,000. The association's executive director Drazen Orescanin said that entrepreneurs had expected that the national coronavirus response team would allow restaurants, bars and fitness centres to reopen today, after they were closed on 28 November. "Restaurant and bar owners can volunteerin Petrinja, Glina and other areas that have been hit by the earthquake, cooking and handing out over 10,000 meals a day for the last ten days, but when they return home they cannot open their own businesses and work in controlled conditions complying with the epidemiological measures. This is a disgrace and we want this decision changed immediately," Orescanin said. The association noted that job-keeping aid was late andmost businesses did not have access to credit lines, while the government refused to provide aid to all the businesses which it had forced to shut down or limit their operations. It stressed that living on a minimum wage of HRK 4,000 a month was impossible. "We call on the government to give this minimum wage to county prefects, chiefs of agencies, heads of various government departments, members of Parliament andgovernment ministers, and to allow entrepreneurs and workers to work," the association said, appealing to the government to say clearly when the restrictions would be eased. Croatian Academy of Sciences and Arts supports national vaccination plan ZAGREB, 8 January(Hina) - TheDepartment of Medical Sciences of the Croatian Academy of Sciences and Arts (HAZU) on Friday expressed support to the national plan for immunisation of the population against COVID-19, and called on medical professionals to get vaccinated. "Based on the available and sufficient scientific evidence we can claim that the existing vaccines that have been approved or will soon be approved in Croatia are highly effectiveand safe for mass vaccination against the coronavirus disease," HAZU says. We support the national plan for vaccination against the coronavirus disease, and the authorities have started rolling out vaccines to medical professionals and citizens at high risk of developing serious symptoms of COVID-19, says the HAZU. The academy recalls that when 70% to 80% of the population gets inoculated, this will create much-desired conditions for the end of the epidemic and for going back to a normal life. TheHAZUDepartment of Medical Sciences has joineda national campaign for raising awareness of the importance of vaccination of healthcare workers against COVID-19. The campaign has been launched by the Croatian Chamber of Nurses. Number of HZMO insured personsdown 0.6% in Dec2020 ZAGREB, 8 January (Hina) - The number of insured persons registered with the Croatian Pension Insurance Institute (HZMO) fell to 1,536,300 in December 2020, decreasing by 0.6% both month on month and year on year, while the number of insured persons in 2020 was 1.2% lower than in 2019. The downward trend began in April 2020 as a result of the crisis caused by the coronavirus pandemic, and it was the first time since March 2015 that the number of insurance policy holders had fallen on an annual level,Raiffeisen Bank(RBA) said in an analysis of the HZMO ***data***. The largest annual decrease was observed in the accommodation provision and food service sector, where the downward trend continued for the tenth month in a row. The number of insured persons in this sector declined by 10.5% or 9,796 people in December 2020 compared with December 2019. The retail trade sector and the manufacturing industry, which account for the largest number of insured persons, registered declines of 1.7% and 1.4% respectively. The largest annual increase,of 5.6% or 6,520 insured persons, was recorded in the construction sector, whichhas seen an upward trend since October 2015, RBA said. Pension fund assets exceed HRK 125bn ZAGREB, 8 January(Hina) - The net asset value of Croatia's mandatory and voluntary pension funds exceeded HRK 125 billion at the end of 2020, up by 4.5 billion from the end of February 2020whencoronavirus started spreading, the Croatian Financial Services Supervisory Agency said on Friday. At the end of last year, citizens held HRK 119 billion worth of assets inmandatory pension funds and HRK 6.7 billion in voluntary funds. Since mandatory funds were launched in 2002, the average yieldhas been 6.91%in category A, 5.41% in category B and 5.13% in category C. Last year the COVID-19 crisis affected monthly yields differently, but mandatory pension funds ended it with a positive annual Mirex for all three fund categories. The bulk of pension fund assets remainsinvested in sovereign bonds -68.2% in mandatory and 58.9% in voluntary funds. Shares account for 18.5% of assets in mandatory and 24% in voluntary funds. Also, 8.3% of assets in mandatory and 10% in voluntary pension funds are invested in investment funds. Last year saw a mild decrease of investment in bonds, by 3.24% on average, and a mild increase of investment in risky assets (shares and investment funds), by 1.54% on average. Unemployment in Croatia in Nov 2020 same as EU average ZAGREB, 8 January (Hina) - Unemployment in the European Union and the euro area slightly dropped in November, and it also dropped in Croatia, becoming equal to the EU average, a report from the European statistical office showed on Friday. In November 2020, the unemployment rate in the 27-member EU, as measured by the International Labour Organisation (ILO) methodology, was 7.5%, down by 0.1 percentage points compared to October, ***Eurostat*** said. The same decline was registered in the euro area, where unemployment dropped to 8.3%. In November 2019, unemployment was 6.6% in the EU and 7.4% in the euro area. There were 15.933 million unemployed persons in the EU in November 2020, including 13.609 million in the euro area. Their number declined compared to October by 222,000 in the EU and by 172,000 in the euro area. Compared to November 2019, the number of unemployed rose by 1.795 million in the EU and by 1.425 million in the euro area. Spain records highest unemployment rate The highest unemployment rates in November 2020 were recorded in Spain (16.4%) and Lithuania (10.4%). In Croatia, the unemployment rate, as measured by ILO methodology, was 7.5% in November, compared to the revised 7.8% in October. There were 135,000 unemployed persons in Croatia in November, 5,000 fewer than in October, according to revised ***data***. The lowest unemploymentrates in November were recorded in Czechia (2.9%) and Poland (3.3%), the report shows. The European statistical ***data*** did not have the ***data*** for Estonia, Greece and Hungary. Youth unemployment rate on the rise In November 2020, 3.171 million young persons (under 25) were unemployed in the EU, including 2.629 million in the euro area. Compared to October, their number increased by 51,000 in the EU and by 64,000 in the euro area. Compared to the same month of 2019, it rose by 456,000 in the EU and by 398,000 in the euro area. The youth unemployment rate in the EU went up to 17.7% in November 2020, from 17.5% in October 2020. In the euro area it grew from 17.5% to 18.0%. Croatia's exports drop by 2.3%, imports by 9.2% in Jan-Nov 2020 ZAGREB, 8 January (Hina) - Croatia exported HRK 101.6 billion worth of commodities in the first eleven months of 2020, a decrease of 2.3% compared with the same period of 2019, while imports fell by 9.2% to HRK 156.2 billion, according to initial ***data*** from the National Bureau of ***Statistics*** (DZS) released on Friday. In January-November 2020, compared with the same period of 2019, the foreign trade deficit was reduced by 19.7% to HRK 54.6 billion. Coverage of imports by exports was 65.1%. Exports to EU member states decreased by 0.2% to HRK 70.95 billion, while exports to non-EU countries dropped by 6.8% to HRK 30.65 billion. EU imports fell by 8.9% to HRK 125.67 billon and non-EU imports declined by 10.2% to HRK 30.5 billion. Expressed in euro, exports totalled €13.5 billion, down 3.8%, while imports amounted to €20.75 billion, a decrease of 10.6%. The foreign trade deficit was €7.25 billion. EU exports fell by 1.6% to €9.4 billion and non-EU exports dropped by 8.3% to €4.1 billion. EU imports decreased by 10.3% to €16.7 billion and non-EU imports declined by 11.6% to €4.1 billion. Hungary House opened in Rijeka ZAGREB, 8 January (Hina) - The Hungary House, housing the office of the Hungarian honorary consul to Croatia, was formally opened in the Pecine district of the northern Adriatic city of Rijeka on Friday in the presence of Hungarian Foreign Minister Peter Szijjarto. Zoran Vukic said he was honoured to have been appointed Hungary's honorary consul to Primorje-Gorski Kotar, Istria and Lika-Senj counties, and that he would be working on strengthening the ties between the two countries. Szijjarto spoke of the centuries-old common history of the two countries. Croatia and Hungary have many common interests and areas for further cooperation. Croatia is among the most popular destinations for Hungarian tourists, and the two countries also share economic interests, primarily those concerning the port of Rijeka and the recently launched LNG terminal at Omisalj on the northern Adriatic island of Krk, the Hungarian foreign minister said. Frano Matusic, State Secretary at the Croatian Ministry of Foreign and European Affairs, said that Croatia and Hungary were friendly countries whose relationship could serve as an example of excellent cooperation. He noted that this was also thanks to the Hungarian minority in Croatia and the Croatian minority in Hungary acting as a good bridge for cooperation. Robert Jankovics, who represents the Hungarian minority in the Croatian Parliament, said that about 500 ethnic Hungarians live in the Rijeka area. Croatian Foreign Ministry congratulates Biden, Harris on win certification ZAGREB, 8 January(Hina) - AfterCongress certified U.S. President-elect Joe Biden and Vice President-elect Kamala Harris' victory early on Thursday, Croatia's Foreign and European Affairs Ministry congratulated them on the certification of the victory. The Croatian tweetedthat it was sending"congratulations to President-ElectJoe Bidenand Vice President-Elect Kamala Harrison finalizing the electoral victory in the Congress." "Croatia looks forward to future close cooperation with our strategic partner and NATO Ally." The U.S. Congress on Thursday officially certified Biden's victory and the transition of power is scheduled for 20January. The certification of Biden and Harris's victory ensued early on Thursday, followinga long day and night marked by chaos and violence in WashingtonD.C., after extremists emboldened by President Donald Trump had sought to thwart the peaceful transfer of power that has been a hallmark of modern American history by staging a violent insurrection inside the U.S. Capitol. Biden and Harris finished with 306 electoral votes, while Trump and Mike Pence won 232. It takes 270 electoral votes to win the presidency. Estimated 10% of Montenegrin population may have had coronavirus ZAGREB, 8 January (Hina) - If the current rate of about 500 daily coronavirus casesin Montenegro continues, the country could have about 10% of thepopulation positive forthe novel virus to date by the end of January. Since the start of the pandemic, Montenegro has registered 51,160 infections with coronavirus, and currently there are10,000active cases. In terms of the number ofactive cases per 100,000 inhabitants, Montenegro ranks first in the region with 1,497 per 100,000.Slovenia follows with the ratio of 1,082 per 100,000 and Bosnia and Herzegovina with 852 per 100,000, the Montenegrin MINA news agency stated on Thursday when Podgorica reported 463 new daily cases. On Thursday, there were seven COVID-related deaths, bringing the death toll to 712 in the country with apopulation of about 600,000. Slovenia logs 2,045 new coronavirus cases, 25 deaths ZAGREB, 8 January(Hina) - There have been2,045 new positive COVID cases out of 14,718 PCR and rapid antigene tests conducted in Slovenia in the last 24 hours, the country's government stated on Friday. In the last 24 hours, 25 patients died of the COVID-related complications. Currently there are 22,718 active cases, including 1,169 hospitalised patients of whom 189 are in intensive care wards. Slovenia has so far administered COVID-19 vaccines to 12,265 persons. The country's seven-day incidence rate per 100,000 inhabitants stands now at 1,797, the health ministry said. Slovenian Press Agency still without money for normal work ZAGREB, 8 January (Hina) - The Slovenian Press Agency (STA) said on Friday the government had still not paid it for the performance of public service in 2020 nor began the signing of a new contract for this year. STA management and journalists said in a press release that payments for the performance of public service were overdue for 43 days now. They said they were continuing to work despite the suspended financing, but added that the consequences could result in the national press agency suspending its operation. The press release said that would cause a major disruption in informing the domestic and foreign public about events in Slovenia and the world as well as deal a blow to the image of democratic Slovenia. Half the agency's revenue comes from the state budget and the rest from commercial sources. Journalists' associations accused the conservative Janez Jansa cabinet of wanting to tighten control of the agency. In other news: Conflict of Interest Commission fines MP, president's advisor ZAGREB, 8 January(Hina) - The Conflict of Interest Commission on Friday fined HRK 3,000 each MP Milorad Pupovac for receiving a fee for a second public duty to which he was not entitled and the president's advisor Orsat Miljenic for an incorrect declaration of assets. The Commission found that Pupovac was not entitled to a fee rangingfrom HRK 1,800 to 2,300 annually which he received for his work in the Serb National Council (SNV) from 2014 to May 2019. Commission member Toncica Bozic said work in the SNV was a second public duty as ethnic Serbs were elected to it. Under the Conflict of Interest Act, an official who receives a salary for a public duty, which in Pupovac's case is his salary as an MP, is not allowed to receive a second salary nor a fee for discharging a second public duty. Miljenic was fined for failing tostate in his declaration of assets that he was receiving a HRK 3,000fee from 2018 to February 2019 as a member of the State Judicial Council andthat he has shares in Atlantic Group as well asfor incorrectly stating the size of his flat. Vigilare guilty of discriminating against LGBTIQ persons pending appeal ZAGREB, 8 January (Hina) - The Vigilare assocation was on Friday found guilty pending appeal of discrimination, incitement to discrimination and harassment of LGBTIQ persons and their families, said the association called Dugine Obitelji (Rainbow Families) which had sued Vigilare. According to the verdict, delivered by the Zagreb County Court, Vigilare has to remove all discriminatory and disturbing content from their website within eight days, and they are prohibited from further posting and using content that in any way discriminates against, incites discrimination and harasses LGBTIQ persons, their families and children. The Rainbow Families had filed a lawsuit against Vigilare for launching a petition called "Stop state television's homo-propaganda. Let's stop fake rainbows, let's protect children and the family!" The petition was published on the association's website, calling on citizens to stop the screening of a documentary film for children called "Jana's Rainbow Family", which was broadcast last year by Croatian Radio and Television (HRT). According to the ruling, Vigilare has to publish the verdict at its own expense in the Jutarnji and Vecernji List dailies and reimburse the Rainbow Families association for litigation expenses. The County Court also said that through its action the Vigilare association had directly violated the constitutionally guaranteed right of every person to respect and legal protection of their private and family life, and that the texts on the petition's website could not be considered free expression of thought and speech as they were not in accordance with the constitutionally guaranteed freedoms -- primarily the protection of personal and family life. Croatia's Filip Zubcic finishes second in Adelboden giant slalom ZAGREB, 8 January (Hina) - Croatia's best skier, Filip Zubcic, took the second place in the World Cup giant slalom race in Adelboden, Switzerland on Friday, lagging 1.04 seconds behind the winner, Alexis Pinturault of France, while Swiss Marc Odermatt finished third, trailing 0.07 behind Zubcic. Zubcic thus repeated his last year's placement in Adelboden when he also finished second, behind Slovenian Zan Kranjec. After coming in third in the first run, 0.97 seconds behind Pinturault and only 0.01 secondbehind Odermatt, in the excellent second run Zubcic was only 0.07 seconds behind Pinturault and 0.04 seconds behind Austria's Roland Leitinger, so he managed to clinch the second place in the World Cup giant slalom for the third time in his career. In addition to finishing second twice in Adelboden, he also came in second in Hinterstoder last year. This is Zubcic's sixth career podium result. He has two victories, in Yuzawa Naebi last yearand in Santa Caterina a month ago, where he also finished third two days later. In the giant slalom standings, Zubcic remains third with 288 points, Odermatt is first with 350 points and Pinturault second with 340. In the World Cup overall standings, Zubcic is ranked fourth with 375 points, behind Pinturault with 575, Norwegian Alexander Aamodt Kilde with 515 and Odermatt with 451 points. ZSE indices continue upward trend ZAGREB, 8 January (Hina) - The main Zagreb Stock Exchange (ZSE) indices rose for the fourth consecutive trading day on Friday. The Crobex increased by 1.14% to 1,806.24 points, reaching its highest level since 6 March 2020 when it closed at 1,819 points. The Crobex10 went up by 1.06% to 1,129.21 points, its highest level since the end of February last year. Turnover at the close of the trading session was HRK 10.3 million, about 1.1 million higher than on Thursday. Forty-six stocks traded today, with 28 of them recording share price increases, eight registering price decreases and 10 remaining stable in price. Five of the stocks passed the turnover mark of one million kuna. The largest turnover, of HRK 2.2 million, was generated by the preferred stock of the Adris insurance and tourism group. Its price rose by 2.93% to HRK 422 per share. Shares of Koncar Electrical Industry turned over HRK 1.9 million, closing at HRK 625, down by 2.46%. Shares of the Valamar Riviera hotel company ended at HRK 31.40, up 1.29%, turning over HRK 1.8 million. Shares of the Podravka food company generated a turnover of HRK 1.4 million, closing up 0.82% at HRK 494 per share. Shares of the SZAIF closed-end alternative investment fund ended the day at HRK 22.60 per share, up 3.67%, turning over HRK 1.1 million. (€1 = HRK 7.554535) THIS BULLETIN INCLUDES ITEMS RELEASED BY 2100 HRS ON FRIDAY (Hina) ha Masthead Brief News Bulletin is published by the Croatian News Agency HINA Marulićev trg 1610 000 ZagrebCroatia web:[*www.hina.hr*](http://www.hina.hr) mail: [*hina@hina.hr*](mailto:hina@hina.hr) phone: (+385 1) 48 08 660; fax (+385 1) 48 08 822 Publisher: Branka Gabriela Valentić, DirectorEditor in Chief: Serđo Obratov Bulletin Editor: Marija Šestan

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**Body**

\* **What is the state of play of the CAP reform?**

>> At the end of October, both the European Parliament and the Council agreed on their respective negotiating positions on the CAP reform, enabling the beginning of the trilogues. The first meeting between the three institutions (including the commission) took place on November 10, establishing each institution's position and an indicative timeline for the next meetings.

The next trilogues were scheduled for November 19 (Strategic Plans regulation), December 2 (Common Market Organisation regulation), and December 4 (Financing, management and monitoring regulation).

The commission first presented its proposals in June 2018, introducing a more flexible, performance and results-based approach that takes into account local conditions and needs, while increasing EU level ambitions in terms of sustainability. Higher environmental and climate ambitions are reflected by a new green architecture, which includes an enhanced conditionality, and the new eco-schemes system. The commission published a report in May 2020, highlighting the compatibility of its proposals with the Green Deal, subject to a number of conditions. The commission is determined to play its full role in the CAP trilogue negotiations, not only as an honest broker between the co-legislators, but as a driving force for greater sustainability.

\* **What are the commission's priorities in the CAP reform negotiations?**

>> The commission wants to ensure rules on conditionality, combining the current rules on cross-compliance and "greening", match the level of ambition of its 2018 proposals. Conditionality is a crucial aspect of the new green architecture, as the mandatory baseline in terms of environmental and climate action for CAP beneficiaries. Conditionality is key for mitigating climate change, preserving biodiversity and protecting wetlands and peatlands, but it also plays an important role in animal welfare and food safety. It is essential for the commission that the new eco-schemes are effective in nudging farmers towards adopting sustainable farming practices. To do this, a substantial share of available funding should be dedicated to eco-schemes, in combination with significant rural development funds allocated to environmental and climate actions. It is important that there are no loopholes.

The CAP has to contribute at least 40% to climate expenditure. To uphold the commitment of the parliament and of the council, this figure has to become an obligation rather than an expectation. It is also crucial the accounting system towards this figure is credible and transparent. Currently, at least 80% of CAP goes to less than 20% of beneficiaries. The commission will work with the parliament and council to ensure more equity in distribution of support, as EU support is a very significant part of the income of many small and medium-sized farmers.

The rural development pillar of CAP has to make a substantial contribution to support actions beneficial to climate and environment. This has to go well beyond what it delivers today.

The CAP has to help farmers become more resilient, by making ***agriculture*** and food systems more sustainable. To that end, the CAP must make a substantial contribution to the Farm to Fork and Biodiversity Strategies.

Finally, the commission believes the right system needs to be in place to track and monitor implementation of the new CAP and the progress made towards the Green Deal objectives.

\* **What are the key elements of the CAP reform that should lead to further sustainability in *agriculture*?**

>> While ring-fenced ecoschemes and agri-environment commitments have been accepted by parliament and council as key features of the CAP, the commission aims to ensure that these are ambitious, building upon and going beyond a high level of conditionality.

The commission will work during the trilogues to ensure conditions and financial rules for eco-schemes do not undermine their effectiveness. The commission will also need to ensure any unused funds from ecoschemes are re-allocated to "specific environmental and climate-related objectives".

Conditionality, the basic requirements to be able to receive CAP support, is another area of concern. While the positions of the parliament and council go beyond the status quo, we are of the view that higher ambition is necessary and achievable.

For example, it is essential to ensure only non-productive high-biodiversity "landscape features" [hedges, field margins, dry-stone walls, isolated trees, etc] are accepted under conditionality. Conditionality is also key in making the CAP compatible with the expectations of society, through improving consistency of the policy with the environment, public health, animal health, plant health and animal welfare objectives. Restrictions to the scope of standards, and exemptions from, or postponement, of implementation of standards should be kept to a minimum.

\* **How will the commission treat the CAP strategic plans, which implement the CAP in each member state?**

>> Two key elements of the Commission proposal have already been accepted by the Council and the European Parliament: the "no backsliding" principle, and the legal link between CAP plans and environment and climate legislation. The proposed "green architecture" requires member states to demonstrate their CAP strategic plans have a higher environmental and climate ambition, and contribute to the transition to sustainable food systems. Second, member states must show how, in pursuing CAP objectives, they will also make a specific contribution to achievement of the objectives of existing EU environmental, climate, sustainability and energy legislation set out in the draft CAP Strategic Plan Regulation.

The commission will also assess links to the Farm to Fork and Biodiversity Strategies and their targets. To that end, member states should put forward national values to contribute to these targets.

\* **Will additional requirements on farmers be sufficient to really improve the sustainability of our food systems?**

>> The European Green Deal is a growth strategy. In addition to the substantial support available through the CAP, market demand will drive further growth of a sustainable agri-food sector. That is why initiatives to promote sustainable production. and helping consumers make healthy, naturefriendly and climate-friendly choices. are crucial. For example, by introducing EU wide labelling for sustainable food, and promoting consumption of products that match these sustainability standards.

Innovation is key to achieve sustainability and meet our food production needs. The new Horizon Europe programme will see substantial investment in research and innovation for food, environment and farming, The CAP will support farmers in the adoption of innovative techniques and technologies, to benefit the environment and help face the consequences of climate change.

The CAP will encourage and support farmers in adoption of sustainable production methods, through voluntary and mandatory measures. It will also support farmers in taking advantage of new opportunities, including the bio-economy and circular economy.

\* **How can the commission ensure that the conditions for receiving support (conditionality) are ambitious enough?**

>> The future system of conditionality will be the bedrock of the new CAP, concerning the environment, climate and sustainable food production. It should therefore be more ambitious than the current systems of cross-compliance and "greening" that have allowed regular farming practices to count towards greening targets. Some changes proposed by the European Parliament and Council in their negotiating positions seem to undermine that ambition.

The proposed good farming practice, on setting aside ***agricultural*** land as non-productive, should strongly benefit biodiversity.

The minimum percentage of that land should apply to all ***agricultural*** land and be ambitious enough to go beyond the existing CAP. This means, for example, catch and cover crops cannot be included. The proposed good farming practice on protecting wetlands and peatlands must ensure a real protection of such lands. This measure should be introduced as soon as possible to end damage to these carbon-rich soils and continued release of greenhouse gases. In fact, this practice commithighlights how ***agriculture*** can play a key role in storing carbon, also bringing new opportunities for farmers.

\* **How will the commission ensure eco-schemes are effective?**

>> Proposed eco-schemes will be an important innovation of the new CAP, dedicating substantial funding from the CAP's direct payment framework to sustainable farming practices, including minimum requirements for use of fertilisers, plant protection products, and animal welfare.

In co-operation with agrienvironmental commitments from the rural development framework, they will power the green transition in ***agriculture***.

The commission believes the flexibility sought by the council in implementing the minimum level of spending should be foreseen only if unspent funds are transferred to other climate and environmental objectives.

The commission will support member states in making the best possible use of eco-schemes, including in relation to agro-ecology, precision farming, agro-forestry, and carbon farming.

\* **Is the rural development budget for environmental and climate actions sufficient?**

>> The Commission is pleased to see a broad agreement on its key elements. However, the Commission strongly believes the proposed 30% minimum spending on environmental and climate actions cannot include support for areas facing natural constraints (ANCs). This would be misleading, as support for farming in ANCs is not linked to environment or climate requirements beyond conditionality.

\* **How will CAP strategic plan recommendations prepared by the commission ensure higher environmental ambition?**

>> The commission has put in place structured dialogue with member states for preparation of CAP strategic plans. As part of this dialogue, it will provide recommendations to each member state in respect of their CAP strategic plans. Recommendations, based on analysis of each national situation, will be particularly important in setting out how the commission expects strategic plans to contribute to the Green Deal and in particular to targets in the Farm to Fork and Biodiversity strategies. The recommendations will cover economic, environment, climate, and societal aspects of ***agriculture*** and rural areas.

Sustainability is equally important under all these general objectives. The commission will consult member states before finalising recommendations. Once adopted, the recommendations will be made public.

\* **How will stakeholders be involved in the preparation of CAP strategic plans?**

>> Consulting stakeholders in the designing and implementing process of the new CAP is crucial for the commission, which has made it an obligation in its proposals. In particular, involvement of environmental authorities is key, to ensure CAP strategic plans take into account local environmental conditions so that the CAP contributes effectively. The CAP has an impact beyond farming and has to be a genuine Green Deal policy.

Targets in the Green Deal are ambitious, and we all have to contribute to meet them, including farmers, foresters, and the rural population. It is self-evident that while implementing the new CAP, all stakeholders concerned must have a say.

The commission consulted a diversity of stakeholders throughout the design of the new CAP, and will remain open to dialogue with concerned stakeholders, representing all interests. Comprehensive impact assessments have preceded proposals. Future proposals linked to the Farm to Fork strategy will also be based on impact assessments.

Commitment to transparency and to good governance should not end with adoption of the CAP legislation. That is why we insist on a comprehensive monitoring framework, including all relevant indicators and on a yearly reporting.

\* **How will the commission ensure at least 40% of the CAP budget will contribute to climate action?**

>> To uphold the commitment of the European Parliament and of the Council, this figure has to become an obligation, rather than an expectation. In parallel, climate action and expenditure has to be meaningful and transparent. To reach this, each action is categorised according to how significantly it contributes to the fight against climate change, and this contribution will be tracked annually.

Tracking spending in CAP plans related to climate change objectives is proposed to operate on the basis of awarding weightings (co-efficients) of 0%, 40% or 100% to categories of spending, according to the relevance to climate change.

If the level of climate actions in conditionality is reduced, in line with the positions of co-legislators, this level may need to be reassessed

The allocation of weightings put forward by the Commission is justified by various elements of the Commission's CAP reform proposal:

\* Under the system of "conditionality", all beneficiaries of CAP area-related and animal-related payments will have to respect a range of obligations, which relate to climate change (for example, maintaining permanent grassland and protecting wetlands and peatlands, all of which are important sinks and storage of carbon).

Strengthened conditionality in line with the Commission proposal would justify a higher weighing of the basic and complementary income support for sustainability, compared to the current period.

\* In addition, member states will offer eco-schemes to farmers, funded from the direct payments budget. Examples of eco-schemes that are fully beneficial to climate mitigation are carbon farming or agro-forestry.

Such schemes get a 100% climate marker.

\* The minimum spending requirement of 30% of rural development funds per member state for climate and environmental actions can be met through land-based payments (for example, agrienvironmental management commitments) but also through support for green investments such as planting woodland or installing facilities for producing renewable energy.

It contains only actions that are fully contributing to the EU climate targets and therefore a 100% climate marker is allocated.

\* Areas with natural constraints are excluded from the 30% minimum spending under rural development. They do not fully contribute to climate change targets and therefore receive a 40% climate marker. Including such areas under this ringfencing as proposed by legislators would seriously weaken the climate ambition of the CAP.

\* **Will the new CAP address unfair distribution of direct payments, namely that 20% of farmers receive 80% of payments?**

>> This unequal distribution of public support to farming raises concerns of economic efficiency and social equity.

At the same time, the distribution of support reflects the concentration of land, as the support is largely areabased. Direct payments are as concentrated as land: 20% of the largest farms in the EU concentrate 80% of ***agricultural*** land.

These 20% largest farms also account for 80% of total ***agricultural*** production, based on standard output.

Policy is necessary to address this inequality and more generally to ensure a fairer, more effective and efficient distribution of support. Therefore, the commission aims to ensure that income support is distributed in a fairer and more balanced way.

The allocation of direct payments must be better targeted towards genuine farmers whose livelihoods depend on farming. The commission proposed to reduce direct support as of (EURO)60,000 per farm and full capping as of (EURO)100,000 per farm per year. This is supported by the European Parliament, while the European Council only supports capping that is voluntary for member states. The commission believes that the fairer distribution objective remains a very important one and is thus keen to ensure an agreement that contributes to better targeting and fairer distribution of support.

The commission also proposed a mandatory redistributive payment, which would allow increasing of support for small and medium- sized farms by allocating higher levels of income support to those farms.

The option to grant an attractive round-sum to small farmers to further redistribute support was also proposed.

Finally, several member states still base support on so-called entitlements, which are linked to levels of production in a (distant) past.

The commission calls on the remaining member states using such a system to move away from it, in favour of a distribution of support that is more linked to the specific agronomic or economic needs of the ***agricultural*** sector.

\* **What are other actions under the Farm to Fork Strategy?**

>> The Farm to Fork Strategy aims to achieve a fair, healthy and environmentally friendly food system.

A comprehensive action plan addressing all parts of the food system, from farm to fork, is being rolled out.

This action plan includes:

\* Horizontal actions such as the development of legislative framework proposal for sustainable food systems (2023) and the development of a contingency plan for ensuring food supply and food security (2021);

\* Actions to ensure sustainable food production, such as the revision of the Sustainable Use of Pesticides Directive and legislation on the placing on the market of plant protection products, including ***statistics*** (2021-2023), revision of the seed legislation and forest reproductive material, with several initiatives in the area of plant health (import checks, surveillance and traceability), revision of the animal welfare legislation (2023), the revision of the Farm Accountancy ***Data*** Network Regulation to create a Farm Sustainability ***Data*** Network (2022), clarification of the scope of competition rules with regards to sustainability in ***collective*** actions (2022), legislative initiatives to enhance co-operation and non-legislative initiatives on transparency (2021-2022); as well as an EU carbon farming initiative 2021;

\* Actions to stimulate sustainable food processing, wholesale, retail, hospitality and food service' practices, such as initiatives to facilitate integration of sustainability in corporate strategies (2021), development of an EU code on responsible business and marketing conduct (2021), initiatives to stimulate reformulation of processed food (2021), revision of ***nutrient*** profiles (2022), revision of food contact material legislation (2022), enhanced co-ordination on food fraud (2021- 2022), revision of the legislation on marketing standards for ***agricultural***, fishery and aquaculture products (2021-2022).

\* Actions to promote sustainable food consumption, facilitating the shift towards healthy, sustainable diets, such as harmonised mandatory front-of-pack nutrition labelling (2022), proposal on origin labelling for certain products (2022), determine modalities for setting up minimum criteria on sustainable food procurement (2021), proposal on sustainable food labelling (2024), review of the EU promotion policy (2020-2021), review of the EU school scheme (2023), proposals for EU targets on food waste reduction (2023), and revision of EU rules on date marketing ("use by" and "best before") (2022).

\* **This questions and answers guide supplied by the European Commission spells put how it will work with parliament and council to make the CAP reform fit for the European Green Deal**

**Graphic**

Picture, **Controversially, the EU Commission insists that 30% minimum spending on environmental and climate actions from the rural development budget is over and above support for areas facing natural constraints (ANCs). The Commission says support for farming in ANCs is not linked to environment or climate requirements beyond conditionality**.

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[***A scoping review of research funding for small-scale farmers in water scarce regions***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:671W-P2M1-JCWX-C2BG-00000-00&context=1516831)

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**Body**

Main

The 2015 Sustainable Development Goals (SDGs) have motivated the development community to focus on improving the livelihoods and climate resilience of small-scale farms. To focus research, programmatic efforts and donor funding towards supporting small-scale farmers, SDG 2.3 aims to "double the ***agricultural*** productivity and incomes of small-scale food producers [by 2030]". Critical to achieving SDG 2.3 is to sustain farmers’ production and incomes through climate shocks and stressors. As climate projections indicate that drier regions will become drier and that droughts are likely to increase, small-scale farmers in already water scarce regions will require additional support.

Tackling water scarcity in small-scale farming systems remains a top priority for development organizations, researchers and donors,. As precipitation patterns change with climate change, the livelihoods of small-scale farmers who lack access to water and technologies will become even more marginalized,. Small-scale farmers represent >80% of the world’s farms and are major contributors to the food system–; farms of <5 ha produce nearly 50% of the global food supply. Finding options for this large and diverse set of farmers to adapt to increasing water scarcity is a growing central tenet to alleviate poverty and to ensure a resilient food system,.

A key question for donors is which interventions have proven impacts. For instance, improved water access and water-use efficiency have been shown to increase yields and farmer incomes but interventions that are successful in one region do not necessarily work elsewhere. Many interventions (such as water harvesting, soil improvement strategies, drought-resistant crops and livestock breed selection) are heterogeneous and their impacts can vary across physical, social and political dimensions. This creates a challenge for donors seeking to focus their investments around the goals of increasing food production, improving livelihoods and reducing climate vulnerability for small-scale farmers. Despite the large volume of evidence produced every year in peer-reviewed journals, grey literature and monitoring and evaluation reports, it is difficult to track which interventions have adequate research support. For instance, in water scarce regions it remains unknown if general research trends have kept up to date with policy trends that have shifted from the focus of the Green Revolution era on improving yields to modern development initiatives (for example, SDGs) that include livelihoods, commitment to reducing environmental impacts and gender. To date, the evidence base addressing interventions to improve the livelihoods of small-scale farmers in water scarce regions is limited. Structured evidence syntheses such as systematic reviews and meta-analyses do exist–, as do more traditional literature reviews,, but all tend to focus on subtopics such as conservation ***agriculture***, irrigation or policy frameworks.

This scoping review collates many different types of interventions aimed at small-scale farmers in water scarce regions across low- and middle-income countries (LMICs) to understand the breadth of evidence for available on-farm interventions. Our effort seeks to help donors identify future research funding, to focus the efforts of researchers towards filling knowledge gaps and to build a repository of studies on a broad swath of interventions that may improve the yields and incomes of small-scale farmers.

We focus our evidence synthesis on water scarce, small-scale farms across LMICs to assess whether research effort is being conducted in the locations that need it most. Our research identifies countries that have limited research for adaptation solutions, yet high numbers of small-scale farmers in water scarce regions. On the basis of the available evidence, we systematically map research effort onto intervention types to identify which interventions lack research (Box ). We also assess whether studies examined environmental trade-offs or gender effects to ensure that there is evidence for integrated solutions that reflect the relationship between SDG 2.3 and other development goals. Our scoping review provides a rapid way to identify the breadth of evidence represented in the literature to assist the adaptation of small-scale farmers to water scarcity.

Box 1 Method summary

Spatial analysis

To calculate how many small-scale farmers live in water scarce regions, we overlaid spatial datasets of farm size and water scarcity. We then estimated the disparity that small-scale farmers face in accessing irrigation, a critical on-farm resource in water scarce regions. While this was a coarse method that relied on spatial overlays, it enabled us to take a high-level view on where water scarce areas and small-scale farmers are colocated and estimate the number of these farms that probably have access to irrigation.

Evidence synthesis

To identify research trends and gaps, we synthesized academic and grey literature from 26 databases. We focused on studies that tested the effects of on-farm interventions on small-scale farmers’ incomes or yields in water scarce regions across LMICs. We used a ‘systematic mapping’ method assisted by machine learning to quantify the number of studies per type of intervention and to identify countries that had few studies.

The inclusion criteria for our scoping review were that:

studies explicitly addressed small-scale farmers

studies examined on-farm production management techniques or technologies that explicitly addressed water scarcity, drought adaptation or water efficiency adaptation

studies examined the effect on yield or incomes of an on-farm intervention

study assessments needed to include either a control case for comparison (temporal or spatial) for identifying the outcomes in the absence of the intervention (this can be from a randomized control trial, pre–post design, post–post design and so on) or a comparison between alternative interventions

Full description available in . Evidence synthesis protocol available in the .

Results

Research needs versus research effort

We found that 76.7% of small-scale farms and 72.4% of small-scale farm area across all LMICs were probably located in water scarce regions. We also found that existing technological penetration of basic irrigation infrastructure for these farms was low. For example, we estimated that fewer than 37.2% of small-scale farms in water scarce regions across all LMICs were irrigated, compared to 43.2% of non-small-scale farms (Fig. and Supplementary Fig. ). The largest disparities in irrigation coverage between non-small-scale farms and small-scale farms were in Latin America and the Caribbean, South Asia and Sub-Saharan Africa. Yet, in East Asia and the Pacific and in the Middle East and North Africa regions, small-scale farms had greater irrigation coverage than non-small-scale farms.

Irrigation coverage for small-scale farms in water scarce regions.

The percentage of small-scale and non-small-scale farms under irrigation (as opposed to rainfed) by region and across all LMICs. The left plot shows the relationships in water scarce regions, while the right plot shows the relationships in non-water scarce regions.

We also found a large variation across countries of the number of studies of interventions for farmers living in water scarce regions (Fig. ). When comparing where research on interventions was conducted with where high numbers of water scarce, small-scale farms were located, we observed considerable gaps for countries where few studies met our criteria, such as Nigeria, Mali, Uganda, Chad and Ivory Coast (Fig. shows that these countries had 12, 10, 7, 1 and 0 studies, respectively). There were also hotspots of water scarce, small-scale farms with more moderate research effort, which included India, Ethiopia, Kenya, Tanzania and Ghana (Fig. shows that these countries had 74, 54, 48, 33 and 28 studies, respectively). These differences in the amount of studies are quite large when considering that the included studies ranged from 1962 to 2019.

Number of studies per country included in literature synthesis.

A map showing the number of studies that measured the impact of an intervention on the incomes and/or yields of small-scale farmers in water scarce regions. Countries in grey indicate that no studies met our inclusion criteria. High-income countries were only included if they tested an intervention relevant to small-scale farmers in water scarce regions of LMICs.

Number of small-scale farms in water scarce regions compared to research coverage.

Each point represents the number of small-scale farms in a country that are in water scarce regions. The size of the points corresponds to the number of studies that measured the impact of an intervention on the incomes and/or yields of small-scale farmers in water scarce regions. The colours indicate the economic grouping of the countries as low, lower-middle or upper-middle income.

A promising finding was that 55% of studies tested interventions in controlled field trials and 18% were modelling studies both of which focus on the causal relationships between the interventions and yield and/or incomes. In addition, 28% of studies were from household surveys to determine if interventions designed for water scarce, small-scale farms worked in farmers’ local contexts according to farmers’ responses on yield and livelihood outcomes. Studies in high-income countries were excluded unless they were relevant to LMICs (for example, studies that used experiments and modelling to mimic water scarce conditions) and those accounted for 2% of the studies we analysed. We found eight meta-analyses and six systematic reviews in our literature search. Five of the meta-analyses found that seed priming, soil management and water management contributed to increased yields in water scarce contexts; the three meta-analyses that examined conservation ***agriculture*** showed mixed results in its effects on yield for water scarce contexts (Table ).

Results from the eight meta-analyses included in our evidence synthesis

| **Refs.** | **Intervention** | **Outcome** | **Effect** | **Number of studies** | **Quality score (out of 4)** | **Regions** |
| --- | --- | --- | --- | --- | --- | --- |
| Ref. | Water harvesting | Yields | Increase | 29 | 2.13 | Semi-arid Africa and Asia |
| Ref. | On-farm seed priming | Yields | Increase | 44 | 2.31 | Global |
| Ref. | ***Agricultural*** water management technology | Yields | Increase | 1,430 | 2.25 | Southern Africa |
| Ref. | Combined cattle manure and inorganic fertilizer | Yields | Increase | 46 | 2.19 | Global |
| Ref. | ***Nutrient*** management | Yields | Increase | 29 | 2.25 | Africa |
| Ref. | Conservation ***agriculture*** | Yields | Decreasea | 610 | 1.88 | Global |
| Ref. | Conservation ***agriculture*** | Yields | Decrease | 41 | 2.00 | Sub-Saharan Africa |
| Ref. | Conservation ***agriculture*** | Yields | Increase | 27 | 1.94 | Southern Africa |

Results are from the eight meta-analyses our scoping review identified to synthesize interventions for small-scale farmers to adapt to water scarcity. Each meta-analysis synthesized the effect of the intervention on small-scale farms’ yields. The ‘number of studies’ refers to the number of studies the meta-analysis included in their synthesis. The ‘quality score’ was the average score we rated each meta-analysis by using CEESAT. aIncrease occurred only in certain conditions.

Research focus on yields versus livelihoods

We found that most articles assessed outcomes associated with yield (91% of articles) as compared to livelihoods (21% of articles examined incomes and/or expenditures) (Fig. ). Despite shifts from Green Revolution rhetoric in the 1950s–1970s to language used in the Millennium Development Goals that launched in 2000 and the subsequent 2015 SDGs, research continues to focus on yields compared to livelihoods (Supplementary Fig. ).

Number of studies per outcome by intervention.

The number of studies classified by intervention type, outcome and methodology. The left plot classifies studies that examined the effects of interventions on farmer incomes or expenditures, while the right plot classifies studies examining the effects of interventions on yields. Different colours correspond with different methodological approaches (for example, experimental plots, observational household or plot surveys, statistical modelling, meta-analysis or systematic review). Interventions are grouped into eight broad classes (see Supplementary Table for full definitions). Water refers to direct water interventions (for example, irrigation or water harvesting). Soil includes direct soil-based interventions (for example, fertilizer or liming). Crop and pest include crop species and crop variety-based interventions and pest management as these can consist of overlapping interventions. Tillage includes all variants of tillage. Cropping system includes crop rotation, intercropping, fallow, monocropping and so on. Livestock refers to any intervention directly related to livestock (for example, species feed or vaccinations). Natural resource protection includes protection of farm natural resources (for example, via erosion control or buffer strips). Digital technology refers to any digital intervention (for example, weather advisories or precision ***agriculture***).

We checked this research bias towards yields compared to livelihoods by assessing meta-analyses that synthesized the literature on interventions for small-scale farmers in water scarce regions. We found that all eight meta-analyses focused on yield (Table ). This shows that not only is the focus on yield prevalent in the primary literature but it is also the sole focus of existing research syntheses that quantifies the relationships between interventions and outcome for small-scale farmers in water scarce regions to date.

In addition to outcomes, the coverage and evidence for different kinds of interventions is also diverse. Farm-level interventions represent a toolbox of actions that farmers can take to tackle water scarcity directly, which include drip irrigation, soil improvement strategies, integrated pest management, crop rotation and so on (Fig. ). While we found higher coverage for interventions around irrigation, tillage, soil amendments, cropping systems, crop varieties and pest management (145–210 articles), we found little work on key interventions of interest, including livestock interventions (43 articles), solutions that protect natural resources at the farm scale, such as buffer strips and contouring (15 articles) and digital technology interventions (three articles) (see Supplementary Table for full definitions of interventions). Changes in the number of studies increased for all interventions over time but the relative share of studies per intervention remained stagnant since the early 1990s (Supplementary Fig. ).

Research on environmental impacts and effects on gender

We found relatively high coverage of research that examined environmental impacts of the intervention assessed (68.9% of interventions and 50.4% of articles; Fig. ). Most of these studies assessed win–wins between farmers and the environment in the context of water scarcity, such as improving water efficiency, increasing water availability (for example, through rainwater harvesting) and managing soil for greater water retention. A smaller share of research (7% of interventions and 6.3% of articles; Fig. ) addressed the negative environmental effects of interventions, such as greenhouse gas emissions, biodiversity loss and land conversion/degradation.

Number of studies per cross-cutting theme over time.

The upper plot shows the cumulative number of studies that included analysis on environmental impacts and/or gender dimensions of the interventions assessed. The lower plot disaggregates the environmental impacts into eight subcategories.

We found few studies that considered gender aspects of the effects of interventions on yields and incomes. Only 9.6% of interventions (and 9.6% of articles; Fig. ) either assessed gender differences in the outcomes measured or framed their research with a gender lens, with most of these studies examining if the intervention could reduce the time burden many female farmers face. This limited number of studies was uncovered even though we used broad inclusion criteria to include studies not only if they directly addressed gender outcomes but also if they were framed in terms of gender issues.

Discussion

This scoping review quantified the global irrigation gap of small-scale farms and found that water scarce regions needed equitable irrigation infrastructure the most. While our results generally found that small-scale farmers face unequal access to one critical resource in adapting to water scarcity across LMICs, local political, economic and environmental realities may determine irrigation access. These realities may explain the variation in irrigation coverage between small-scale and non-small-scale farmers across regions. Hence, donors and researchers should focus on water scarce regions with the largest disparities in access to critical resources (for example, irrigation or other) and the lowest amount of evidence for the efficacy of on-farm interventions on yields and livelihoods. A limitation to these findings is that our research highlights only one type of disparity that small-scale farmers face (irrigation coverage) but future studies can build on our methods to examine other types of marginalization (for example, poor soil quality, distance to markets, climate exposure, land use, land tenure/governance and so on) to help prioritize research funding towards evidence-backed interventions for disadvantaged small-scale farmers.

We found that the shift in funding priorities for small-scale farmers from improving yields during the Green Revolution to including livelihoods, environmental trade-offs and gender impacts in the SDGs was not always reflected in the research. Yields have remained the main focus in this research literature since the 1960s (Supplementary Fig. ). Yet, yields only provide a partial farm productivity measure based on output per unit of land cultivated. They cannot proxy for productivity measures that incorporate more production factors (for example, total factor productivity), for economic measures (for example, farm profitability or farm household welfare measures based on income, consumption or asset holdings) or for dynamic measures that address the probability that the welfare of a farm household falls below some threshold in a given year (for example, vulnerability or resilience). All of these outcomes can be difficult to measure and even yields, which are relatively straightforward to measure, are subject to bias when self-reported. One cannot conclude whether an intervention has been successful for small-scale farmers without incorporating economic measures that properly account for self-provisioned inputs such as family labour and capture aspects of farmers’ livelihoods.

Critical environmental trade-offs of interventions need to be tested to ensure that funded projects do not have deleterious effects on local natural resources and, in turn, on small-scale farmers’ future livelihoods. While clear environmental and productivity win–wins were prevalent in the literature, such as water-use efficiency–, it was concerning that so few studies jointly addressed cost-cutting solutions to both environmental degradation and productivity, which include, sustainable intensification, minimizing biodiversity loss and solutions across the food–energy–water nexus–. Future research should help identify where and when win–win interventions exist or when environmental trade-offs are inevitable.

Similarly, there was a large research gap on gender dimensions of interventions. Donors should focus funding research that assesses interventions specifically designed to improve women’s outcomes, for example by addressing their large time burden. In addition, existing interventions need to be tested to ensure avoidance of unintended consequences on women. We were concerned to find that gender themes were so rarely addressed, even though women comprise 43% of the ***agricultural*** labour force, account for two-thirds of livestock keepers in LMICs and are often responsible for very large shares of ***agricultural*** tasks (for example, 90% of hand weeding across Sub-Saharan Africa), while consistently farming plots that are smaller than male farmers’ plots. Studies examining the gender effects of on-farm interventions in water scarce regions should focus on gender-specific interventions, such as reducing unpaid labour requirements of women, to free up women’s time towards the most productive activities. Improving the gender balance of female extension agents or ***agricultural*** researchers—for instance, only 24% of African ***agricultural*** researchers are female—may help to better align research priorities towards the needs of female small-scale farmers.

Given the importance of livestock for adaptation in water scarce conditions, climate solutions that protect farm-level natural resources, and the benefits of climate services and digital technology for in-season recommendations and responses, the lack of evidence we found suggests a need for more research addressing these three types of interventions. While the dearth of research in digital technology is probably due to its relatively recent emergence, the low interest in livestock and interventions that protect natural resources have been persistently low throughout the last several decades (Supplementary Fig. ). The lack of research on livestock interventions to improve productivity or incomes in water scarce regions was particularly concerning considering an estimated 23% of farmers own cattle. Our findings compliment the notion that pastoral systems in LMICs have tended to receive less investment from the international research community and other institutions, compared to livestock systems in high-income countries and cropping systems more broadly. While interest in livestock systems has, however, been growing in recent years, driven by increasing concerns about food security, land competition, the vulnerability of remote communities and the environment as well as by a raising awareness regarding the contribution of livestock systems to all these aspects,, we did not see relative increases in the number of studies examining these systems over time (Supplementary Fig. ). Climate resilience strategies for livestock keepers require increased institutional support through policies that address the issues of land tenure, fragmentation and degradation. The evidence gap we found pertaining to natural resource protection may reflect the focus of this particular literature on different outcome metrics, such as contouring to prevent soil erosion or using buffer strips to improve biodiversity instead of the focused outcomes of improving yields and livelihoods of the SDG 2.3. However, as ecosystem services are an important dimension of a farm’s resilience to climate stressors and shocks, natural resource protecting interventions require more evidence for their effects on farmer livelihoods in water scarce regions.

Digital solutions for water scarce, small-scale farms is an emerging field but funders should prioritize research grants to test the livelihood impacts of these solutions. There are more applications for small-scale farmers generally but there is limited evidence to apply these interventions even outside of water scarce regions. For example, a meta-analysis carried out in 2019 only found five studies with nine observations that examined digital solutions that improved small-scale farmers’ yields (researchers found a 0–8% increase) and the odds of adopting a recommended ***agricultural*** input (researchers found a 13–31% increase). While the goal of our systematic map was not to identify studies suitable for a meta-analysis, we found seven studies that examined digital solutions for farmers in water scarce regions. These studies focused on providing farmers with tools to improve the water-use efficiency of their irrigation systems, climate information to farmers and to aid decisions in ***nutrient***, water and weed management to reduce production risks. Despite the promise of digital solutions in water scarce environments, we suggest that there needs to be better proof of digital technologies that are tested in low-bandwidth settings since many small-scale farmers live outside of 3G and higher mobile coverage areas. Research in these geographies, metrics and outcomes will bring us closer to meeting the needs of water scarce, small-scale farms on the ground.

To achieve the SDG 2.3 goal of bolstering small-scale farmers’ yield and livelihoods, a greater research focus is needed in water scarce regions of LMICS. Future research needs to test the effects of on-farm interventions not only on yields but also on more outcomes that are relevant for farmer livelihoods, such as farm profitability, farmer income and resilience. Trade-offs between interventions and the environment need to continue to become part of research designs and donor requirements to ensure that unintended environmental impacts can be avoided, especially in regions with limited water resources and for populations that are systematically disadvantaged from accessing critical on-farm infrastructure. Similarly, gender dimensions of interventions require a tremendous amount of support in research funding since these remain under-researched despite being an SDG cross-cutting theme. We suggest that funders incorporate these outcomes into their impact assessment frameworks for research grants. For specific policy recommendations see Box .

Box 2 Recommendations

These recommendations address research funding priorities to bolster outcomes for small-scale farmers in water scarce regions.

Geographic focus. Donors should increase their focus on water scarce regions, especially in countries with many small-scale farmers and little research available, when evaluating the impacts of on-farm interventions to improve outcomes for small-scale farmers.

Sustainability focus. By requiring funded research to measure key environmental outcomes associated with interventions in water scarce regions, donors can reduce the gap in evidence that quantifies trade-offs between on-farm interventions and deleterious environmental effects, whether they are experienced off-farm, thus harming other farmers, or on-farm, thus harming future livelihoods opportunities.

Gender focus. Donors should address the dearth of evidence seeking to improve outcomes for women in water scarce regions by requiring funded research to explicitly address gender themes.

Intervention focus. Donors can earmark research funds for addressing digital solutions and livestock interventions, two intervention types that have been neglected by researchers focusing on on-farm interventions to assist small-scale farmers in water scarce regions. Digital solutions comprise an emerging field that holds promise for improving farm management in water scarce regions. Interventions to enhance livestock productivity in mixed farming systems also offer an important opportunity to enhance the productivity of small-scale farmers in water scarce regions.

Methods

Spatial analysis

To contextualize the disparity small-scale farmers face in accessing critical resources, we quantified the number of small-scale farms with irrigation in water scarce regions in LMICs. We created a spatial layer of small-scale farms and overlaid it with available water scarcity and irrigation spatial layers. Our analysis provided estimates aggregated to the country level. While this was a coarse method that relied on spatial overlays, it enabled us to take a high-level view on where water scarce small-scale farmers live and how many of these farms have access to irrigation.

To create the small-scale farms layer, we implemented the SDG 2.3 definition of small-scale farms through spatial proxies at 10 km2 resolution. SDG 2.3 defines small-scale farms as the smallest 40% of farms in a country and farms with the lowest 40% of ***agricultural*** revenue in a country. We used an available farm size map at 10 km2 resolution with a global spatial extent. It was created by using a crowd-sourced field size map to downscale the national farm size distributions of the World Census of ***Agriculture***. Each grid cell contains the most common farm size using World Census of ***Agriculture*** categories: 0–1 ha, 1–2 ha, 2–5 ha, 5–10, ha, 10–20 ha, 20-50 ha, 50–100 ha, 100–200 ha, 200–500 ha, 500–1,000 ha and farms >1,000 ha. We computed the smallest 40% of farms in a country on the basis of this map. Since there are no comparable spatial ***data*** on ***agricultural*** revenue, we used a proxy for ***agricultural*** revenue. We used a downscaled gross domestic product (GDP) per capita dataset available at 110 km2 resolution, which we subsetted to cropland area. We computed the lowest 40% of GDP per capita per country using this ***data***. We aggregated the farm size map to the same spatial resolution as the GDP per capita map and overlaid these two layers to find pixels that were both the smallest 40% of farms in each country and in ***agricultural*** areas with the lowest 40% of GDP per capita in each country. We estimated the number of farms in each pixel by dividing the ***agricultural*** area by the predominant farm size of that pixel. This approach allowed us to identify the poorest ***agricultural*** areas with the smallest farms in each country.

We created the water scarcity layer by combining two different measures of water scarcity at 10 km2 resolution. Each grid cell needed to be either green (rainwater stored in the soil) or blue (fresh surface water and groundwater) water scarce. We defined green water scarcity according to the IPCC definitions of a semi-arid region, which is an area with <250 mm of rainfall in a year. We used the Global Precipitation Climatology Centre rainfall dataset (full v.2018) to calculate the median rainfall per grid cell from 1996 to 2005. We relied on Mekonnen and Hoekstra’s blue water scarcity dataset to identify grid cells that had on average at least one month of blue water scarcity a year from 1996 to 2005. Through using subnational and intra-annual green and blue water scarcity ***data***, we implemented a more detailed view on water scarcity than commonly reported country-level water scarcity metrics reported at annual intervals.

To determine the irrigation area for small-scale farms compared to non-small-scale farms, we used the global rainfed and irrigated croplands (GRIPC) layer, which is a global irrigation map at 500 m2 resolution. The irrigation map was created through remote sensing and calibrated to nationally reported irrigation coverage ***statistics*** to represent circa 2005 values. This irrigation map provided the percentage of ***agricultural*** area in a grid cell covered by irrigated cultivation, rice paddy or rainfed cultivation. For our analysis, we only used the irrigated and rainfed categories. We excluded paddy cropland (and the corresponding farming populations) from our analysis because GRIPC does not further classify paddy fields as irrigated or rainfed in their pixel level dataset but they do offer that irrigated paddy accounts for 66 Mha of global cropland and non-irrigated paddy accounts for 63 Mha of global cropland in their manuscript; put another way, this near 50/50 split should not have a major effect on our estimates of the share of water scarce areas that are irrigated but future studies would benefit from better spatial ***data*** that splits irrigated and non-irrigated paddy. To provide the full range of values, our scoping review did not include paddy and found that 37.22% of crop area farmed by small-scale farmers in water scarce regions is irrigated (versus 43.19% farmed by not small-scale farmers). If we assume all paddy fields are rainfed, then 26.48% of crop area farmed by small-scale farmers in water scarce regions is irrigated (versus 37.24% farmed by not small-scale farmers). If we assume all paddy fields are irrigated, then 55.07% of crop area farmed by small-scale farmers in water scarce regions is irrigated (versus 52.82% farmed by not small-scale farmers).

We overlaid the small-scale farm layer, the water scarcity layer and the irrigation layer to calculate the number of farms with and without irrigation. We repeated this analysis for non-small-scale farms and non-water scarce regions. Results were aggregated to the country level and summed across all LMICs and per world region.

Evidence synthesis

We used a ‘systematic map’ assisted by machine learning and natural language processing (NLP) to perform our evidence review. Systematic maps (also referred to as ‘evidence maps’ and ‘gap maps’) are an emerging type of systematic review that attempt to identify patterns of research, to identify gaps in a field and future priorities for research. A systematic map is not like traditional expert-based or narrative reviews in that it attempts to capture all of the research on a given topic and reduce the authors’ biases. Systematic maps can capture the full-breadth of interventions relevant to a population, such as our scoping review that asks: What is the spectrum of farm-level interventions that have been tested to increase small-scale farmers’ incomes, yields and productivity in water scarce regions?

Our systematic map method had six steps: (1) forming the research question; (2) querying academic and grey literature databases for relevant studies; (3) screening titles and abstracts to determine if a study should be included in our synthesis; (4) screening the full text of studies that passed step 3 to determine if a study should be included in our synthesis; (5) extracting relevant ***data*** from each included study; and (6) summarizing and reporting the results. The protocol for this scoping review was registered on the Open Science Framework ([*https://osf.io/c6n4k/*](https://osf.io/c6n4k/)) before study selection, which can also be accessed in our .

The guiding question for this systematic map was: ‘What spectrum of farm-level interventions to alleviate water scarcity has been tested to increase small-scale farmers’ incomes, yields and productivity?’

An exhaustive search strategy was developed and applied to 26 academic and grey literature databases to identify all available research pertaining to on-farm interventions that have been tested to increase small-scale farmers’ incomes and yields in water scarce regions in low- and middle-income countries. Search terms included variations of the key concepts in the research question: small-scale farmers, water scarcity, and income, yield and productivity. Searches were performed in the following bibliographic databases: CAB Abstracts and Global Health (access via CAB Direct), Web of Science Core ***Collection*** (access via Web of Science), Scopus (access via Elsevier), Agricola (access via EBSCOhost), EconLit (access via EBSCOhost) and ProQuest Dissertations & Theses Global (access via ProQuest). A search of grey literature sources (20 specialist organizations and online databases) was also conducted. Full search strategies for each database, including grey literature, can be accessed in their entirety in our protocol available in our or at [*https://osf.io/c6n4k/*](https://osf.io/c6n4k/). Search results were de-duplicated to remove redundant citations identified from multiple sources, resulting in 18,365 unique publication records.

We screened the 18,365 titles and abstracts to include or exclude from our scoping review. Two independent reviewers assessed each title and abstract. If there was disagreement between reviewers on whether the study was to be included, a third independent reviewer decided. Articles needed to meet the following eligibility criteria for inclusion in our systematic map. (1) Studies needed to address small-scale farms explicitly. For inclusion in the evidence synthesis, we defined a small-scale farm to meet two of four dimensions: land size, labour input (especially of family members), market orientation and economic size. (2) Studies examining on-farm production management techniques or technologies explicitly addressing water scarcity, drought adaptation or water efficiency adaptation. For the systematic map, we erred on the side of inclusivity and used a general definition of water scarcity to include a broad range of studies and interventions across a spectrum of ***agricultural*** regions as well as the concept of water stress. We considered water scarcity as when there is not enough water to be used by a farmer for ***agricultural*** purposes, which includes blue and green water. We considered water stress to be an additional subset of water scarcity where certain farmers are economically disadvantaged due to poor access to water resources. (3) Studies examining the effect of an on-farm intervention on yields or incomes. While interventions that improve small-scale farmers welfare can range across plot-level technologies, farm-level management, ***collective*** action, government infrastructure projects and bi/multilateral trade agreements, we only focused on-farm-level interventions to represent a toolbox of actions that farmers can take to tackle water scarcity directly. (4) Studies including either a control case for comparison (temporal or spatial) for identifying counterfactual outcomes in the intervention’s absence (for example, by using randomized control trials, pre–post designs, random block designs, modelling and so on) or studies comparing alternative interventions. We included reviews if they were systematic reviews or meta-analyses. The most common reason an article was excluded was because it characterized a farming practice, rather than measuring the effects of the farming practice on yields or livelihoods. Other common reasons that studies were excluded were because the interventions were not explicitly linked to water scarcity, water savings or improving adaptation to drought. Several studies were not in English, which was a limitation of our research.

To assist the time-consuming task of sorting the 18,365 titles and abstracts that we identified in the academic and grey literature databases, we used a machine learning approach. Using NLP and machine learning for this stage of systematic reviews is an emerging method. While studies have used Naive Bayes and Support Vector Machines (SVM) models, the Google Development Team released the Bidirectional Encoder Representations from Transformers (BERT) model on Tensorhub in 2019 and it has outperformed other NLP models in a variety of tasks. BERT is a deep learning language representation model that is context aware, in which the word in context of the sentence and the sentence in the context of the paragraph are embedded in the structure of the model. The BERT comes pretrained, which speeds up processing time since the end user only needs to fine-tune the model. Our scoping review tests the BERT model against other classification models to assist a systematic review.

Our team manually classified 1,500 titles and abstracts to include or exclude from our scoping review. We split the manually classified titles and abstracts into training and test ***data*** to build and validate several machine learning classifiers. We tested the accuracy of Naive Bayes and SVM, where we used a bag-of-words model with term-frequency times inverse document-frequency (TFIDF) to construct the features of the model. We conducted cross-validated grid searches to identify optimal sets of hyperparameters, which included removing stop words (common words in the English language) and stemming (converting the word to the root word); all hyperparameters assessed can be found in the supplemental code provided. We compared these scores to a BERT model that we fine-tuned to minimize binary cross entropy loss in a classification layer. We used the multilanguage base version of BERT (12-layer, 768-hidden, 12-heads, 110 M parameters), which was trained on the top 102 languages with the largest Wikipedias. Our supplemental code details all parameterization ([*https://github.com/vinnyricciardi/Ricciardi\_etal\_2020\_ceres*](https://github.com/vinnyricciardi/Ricciardi_etal_2020_ceres)). For all models, we calculated accuracy, precision, recall and F1 scores through k-fold cross validation (k = 10) (Supplementary Table ). The goal was for the model to perform better than the level of agreement our team achieved during the manual classification of titles and abstracts. During the manual classification, two random reviewers (out of a team of ten reviewers) classified each title and abstract. If there was disagreement, a third reviewer broke the tie. Reviewers agreed on the classification 82% of the time. Each of the NLP models performed better than 82%. BERT was the best-performing model with an 88% accuracy (Supplementary Table ). We applied this final model to the 18,365 titles and abstracts to classify each study to be included or excluded from our scoping review. The model included 1,423 studies in our scoping review for full-text review, of which we were able to find and download 1,355 texts.

In the next phase of our assessment, we downloaded the 1,355 full-texts and manually checked if they were to be included or excluded from our scoping review. In the fourth stage of our assessment, for each of the 560 articles included, we manually extracted the location each study was conducted, the type of method, the type of farming system (crop, livestock or mixed), the intervention assessed (see Supplementary Table for full list), the outcome assessed (yield or income) and whether the study measured a cross-cutting theme (gender effects or environmental impacts). This final stage consisted of one reviewer extracting the information from each text, with communication between reviewers to ensure consistency. Supplementary Fig. shows the number of publications included and excluded at each stage. Our final analysis consisted of cross-tabulations and descriptive ***statistics***.

Through our evidence synthesis, we identified eight meta-analyses. We extracted the intervention and outcome assessed, the location(s) that the meta-analysis included, also the number of studies the meta-analysis included. We recorded the main finding of the meta-analysis to understand the impact of the intervention on the outcome (for example, did water harvesting increase, decrease or have no effects on yields of water scarce, small-scale farms). To assess the quality of each meta-analysis, we relied on Collaboration for Environmental Evidence Synthesis Assessment Tool (CEESAT), which provides a score sheet of 16 questions to appraise the rigour, transparency and limitations of the systematic review or meta-analysis. For each question, the meta-analysis can receive a red score for the lowest score, an amber score, a green score or a gold score for the highest rating. We converted these scores from one to four, averaged the scores and presented them in Table . Our provides our scoring for the CEESAT score sheet.

Reporting Summary

Further information on research design is available in the linked to this article.

**Acknowledgements**

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**Notes**

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[***Impact of overall diet quality on association between alcohol consumption and risk of hypertension: evidence from two national surveys with multiple ethnics***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:671W-P2C1-JCWX-C1NB-00000-00&context=1516831)

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**Body**

Introduction

Alcohol consumption is one of the biggest public health challenges facing modern society []. However, protective health effects of low levels of alcohol consumption have been documented in some researches [–], thus the net balance of health risks and harms from alcohol consumption remains controversial []. Alcohol is commonly consumed around mealtimes [], and different habits of alcohol consumption were frequently associated with varied diet quality []. Previous studies have reported that increasing alcohol consumption was likely significantly associated with increased risk of cirrhosis only in subjects with a high saturated fat diet [], and moderate red wine consumption was probably associated with decreased risk of cardiovascular disease only in high flavonols diet []. These observations indicated that alcohol might have different health effects depending on other dietary factors. However, it is still not well understood whether and how overall diet quality modifies the health effects of alcohol, although establishing this modification may add necessary knowledge for public policy of alcohol use.

To examine this question, the association between alcohol consumption and hypertension was selected in this study. Hypertension was chosen as the outcome because it is highly prevalent worldwide with estimating 1.39 billion persons and representing 31% of all adults, which is also a major risk factor for cardiovascular diseases []. Considerable evidence supports the role of ethanol in the etiologic process of hypertension. However, potential benefits or risks attributable to light-to-moderate alcohol intake on the risk of hypertension remain uncertain. Inconsistent results have reported linear, J-shape, or threshold relationship of alcohol consumption with the risk of hypertension. Based on the evidence above, this study hypothesized that overall diet quality might partially explain the discrepancy, which means the linear, J-shape, or threshold relationship depending on overall diet quality.

Therefore, using three population-based ***data*** from National Health and Nutrition Examination Survey (NHANES), China Health and Nutrition Survey (CHNS), and Harbin Cohort Study on Diet, Nutrition, and Chronic Noncommunicable Disease (HDNNCDS), this study aims to examine whether and how overall diet quality influence association between alcohol consumption and risk of hypertension based on cross-sectional and prospective ***data*** in multiple ethnics.

Methods

Study population

The National Health and Nutrition Examination Survey (NHANES)

The NHANES is a stratified multistage probability cluster survey conducted in the non-institutionalized U.S. population []. This study included 23,609 nonpregnant and non-former drinking adults aged 18–80 years [N = 4221 in NHANES (2003–2004); N = 4258 in NHANES (2005–2006); N = 5119 in NHANES (2007–2008); N = 5269 in NHANES (2009–2010); N = 4739 in NHANES (2011–2012)]. And those with hypertension at baseline were excluded. Written informed consent was obtained from all participants and was approved by the National Center for Health ***Statistics*** Institutional Review Board.

The China Health and Nutrition Survey (CHNS)

The CHNS is a nationwide survey aiming to investigate health and nutritional status in Chinese populations []. The CHNS cohort initially mirrored national age–sex–education profiles, and by 2011 the provinces in the CHNS sample constituted 47% of the Chinese population. The present analysis limited eligibility to adult men and nonpregnant women aged over 18 years who participated in 1997 surveys (N = 10,601). A subgroup includes 6984 subjects who consecutively participated in 1997 and 2000 surveys and participated in at least once a follow-up survey during 2004 and 2011. And those with hypertension at baseline were excluded. The survey protocols, instruments, and the process for obtaining the informed consent were approved by the Institutional Review Committees of the University of North Carolina at Chapel Hill, NC, USA, and the China National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention, Beijing, China. All participants provided written informed consents before the surveys.

The Harbin Cohort Study on Diet, Nutrition, and Chronic Noncommunicable Disease (HDNNCDS)

The HDNNCDS was launched in 2010 by the national key discipline, Department of Nutrition and Food Hygiene at Harbin Medical University []. A total of 9704 subjects aged 18–74 years old and free of hypertension were included in this study. The protocol was approved by the Ethics Committee of Harbin Medical University, and written informed consent was provided by all subjects.

Dietary assessment

In the NHANES, 24-h dietary recalls using the U.S. Department of ***Agriculture***’s (USDA’s) Automated Multiple-Pass Method were conducted by trained interviewers. Detailed descriptions of the dietary interview methods are provided in the NHANES Dietary Interviewer’s Training Manual. The MyPyramid Equivalents Database, 2.0 for USDA Survey Food Codes 2003–2004 was used to transformed food codes into 32 food groups. In the CHNS, dietary assessment is based on a combination of three consecutive 24 h recall. Thirty-five food groups were generated based on similar ***nutrient*** profiles or culinary uses, which are identical to the food items used in the 2002 Chinese national nutrition survey. In the HDNNCDS, a dietary assessment was evaluated by the validated food frequency questionnaire (FFQ) containing ***data*** regarding the usual dietary intake over the past 12 months, including 103 food items.

Diet quality indexes calculation

Two diet-quality scores were calculated using food components and scoring criteria that have been described previously [, ]. Briefly, the Alternate Healthy Eating Index including nine food components, each scored from 0 (unhealthy) to 10 (healthiest) and selected based on evidence of an association with the risk of chronic disease was used to assess the overall diet quality in the NHANES. Total scores ranged from 0 to 90, with higher scores indicating a healthier diet. The Chinese dietary balance index-07 (DBI-07) including six food components was used to assess the overall diet quality in the CHNS and HDNNCDS, which was calculated based on the ‘Chinese Dietary Guideline’ and the ‘Chinese Food Pagoda’. Since our research aimed to study the relationship between alcohol consumption and risk of hypertension in the context of different dietary quality, so alcohol consumption was not included in both diet-quality scores calculation above. And then, the sum of the absolute values of both positive and negative scores was calculated to assess the overall quality of food intake. Total scores ranged from 0 to 72, with lower scores indicating a healthier diet. Further information is provided in Supplementary Table and Supplementary Table .

Outcome measures

Hypertension was identified by self-reports of a history of hypertension diagnosis, and/or systolic pressure ≥140 mm/Hg, and/or diastolic pressure ≥90 mm/Hg, and/or receiving treatment for hypertension.

Statistical analysis

The flow chart of this study was presented in Supplementary Fig. . CHNS and HDNNCDS were merged into one sample ***data*** because they both included Chinese. ***Data*** were analyzed and presented by ethnics (Caucasians, Africans, Hispanics, and Chinese). Baseline AHEI and DBI were categorized from the Highest (quartile 1) to the lowest (quartile 4), and changes in DBI between 1997 and 2000 in CHNS was categorized into quartiles from the largest decrease (quartile 1) to the largest increase (quartile 4). Continuous and frequency variables were expressed as the mean ± standard deviation (SD) and percentage, and their differences across ethnics were examined by the general linear models with adjustment for age and sex. Logistic regression and Cox’s proportional-hazards regression were performed to investigate the association of diet quality indexes, alcohol consumption, and risk of hypertension in cross-sectional and prospective ***data***, respectively. Restricted-cubic-spline regressions to flexibly model the association between alcohol consumption and risk of hypertension was conducted by diet quality indexes and tested statistical interactions between diet quality indexes and alcohol consumption using continuous cross-product terms by the likelihood ratio test in models.

A sensitivity analysis was performed in HDNNCDS (N = 9704), an independent population-based study that measured dietary information through FFQ to examine whether different methods for measurement of food intake could influence the results. All statistical analyses were performed using R 3.2.5 ([*http://www.r-project.org/*](http://www.r-project.org/)). A two-sided P < 0.05 was considered statistically significant.

Results

Characteristics of study variables by ethnics

Table summarizes the mean levels of study variables across different ethnicities. Caucasians have the greatest dietary fat intake. Africans have the lowest fiber intake and the highest prevalence of hypertension. Hispanics have the lowest smoking rate and highest diet quality. Alcohol consumption rate and BMI in Chinese were significantly lower, whereas calorie intake was significantly greater than other ethnicities.

Demographic characteristics regarding study variable by ethnics and ***data*** sources in the total samples (N = 43,914).

| ***Data* sources** | **NHANES** | | | **CHNS and HDNNCDS** |  |
| --- | --- | --- | --- | --- | --- |
| **Ethics** | **Caucasian (*N* = 11,325)** | **African (*N* = 5010)** | **Hispanic (*N* = 7274)** | **Chinese (*N* = 20,305)** | ***P* value\*** |
| Age (years) | 52.3 (19.2) | 47.8 (17.6) | 45.6 (17.3) | 44.9 (14.2) | <0.001 |
| Males [*N* (%)] | 5656 (49.9) | 2422 (48.3) | 3553 (48.8) | 8708 (42.9) | <0.001 |
| Smoking [*N* (%)] | 2308 (20.4) | 1006 (20.1) | 881 (12.1) | 2675 (23.0) | <0.001 |
| Alcohol consumption [*N* (%)] | 9267 (88.3) | 3659 (73.0) | 5419 (74.5) | 6114 (30.1) | <0.001 |
| BMI (kg/m2) | 28.4 (6.5) | 30.5 (7.9) | 28.6 (6.1) | 23.5 (3.4) | <0.001 |
| High school education [*N* (%)] | 6373 (56.3) | 2807 (56.0) | 2910 (40.0) | 8091 (39.8) | <0.001 |
| Calorie intake (kcal/d) | 2098 (855) | 2036 (918) | 2010 (851) | 2301 (815) | <0.001 |
| Fiber intake (g/d) | 16.4 (8.5) | 13.8 (7.7) | 17.8 (9.6) | 16.7 (9.1) | <0.001 |
| Fat intake (g/d) | 80.0 (39.2) | 77.5 (41.9) | 70.9 (37.3) | 57.7 (32.0) | <0.001 |
| Hypertension [*N* (%)]a | 4401 (38.9) | 2291 (45.7) | 2117 (29.1) | 5267 (25.9) | <0.001 |
| SBP (mm/Hg) | 124.0 (18.9) | 127.1 (20.1) | 122.0 (18.8) | 126.9 (20.1) | <0.001 |
| DBP (mm/Hg) | 69.1 (13.3) | 71.1 (14.5) | 69.1 (12.4) | 79.2 (10.2) | <0.001 |
| AHEI score | 26.9 (9.7) | 27.4 (9.7) | 28.5 (9.7) | ? | <0.001 |
| DBI score | ? | ? | ? | 31.7 (8.3) | ? |

Continuous variables are presented as the mean (standard derivation).

Generalized linear models and chi-square tests were used to probe for differences in continuous variables (adjusted for age and sex) and dichotomous variables.

BMI body mass index, SBP systolic blood pressure, DBP diastolic blood pressure, AHEI alternative healthy eating index, DBI diet balance index.

\*P value for the difference of study variables across ethnics.

aHypertension was defined as self-reports of a history of hypertension diagnosis, and/or systolic pressure ≥140 mm/Hg, and/or diastolic pressure ≥90 mm/Hg, and/or receiving treatment for hypertension.

Alcohol consumption, diet quality, and risk of hypertension

Associations of alcohol consumption, diet quality, and risk of hypertension are presented in Table . Compared to abstainers, light alcohol consumption was significantly associated with decreased risk of hypertension in Caucasians (OR: 0.82, 95% CI: 0.70–0.96) and Hispanics (OR: 0.78, 95% CI: 0.64–0.95) with adjustment with age, sex, smoking, regular exercise habits, education level, and survey years. After further adjustment for dietary covariates or diet quality indexes, this association became nonsignificant. Heavy alcohol consumption was significantly associated with increased risk of hypertension in Caucasians (OR: 1.35, 95% CI: 1.10–1.66), Hispanics (OR: 1.20, 95% CI: 0.95–1.50) and Chinese (OR: 1.38, 95% CI: 1.20–1.59) with adjustment for age, sex, smoking, regular exercise habits, education level, survey years, BMI, dietary covariates, and diet quality index, whereas alcohol consumption in Africans was not associated with risk of hypertension. Compared to the highest diet quality group, the ORs (95% CI) of the lowest group were 1.18 (1.05–1.56), 1.23 (1.08–1.32), and 1.34 (1.20–1.49) in Caucasians, Hispanics, and Chinese, with adjustment for age, sex, smoking, regular exercise habits, education level, and survey years.

Association of alcohol consumption and diet quality with risk of hypertension.

| **Hypertension** | | **Cases/*N*** | **Model 1** | **Model 2** | **Model 3** |
| --- | --- | --- | --- | --- | --- |
| **OR (95% CI)** | **OR (95% CI)** | **OR (95% CI)** |
| Caucasian | Alcohol consumption |  |  |  |  |
| ?Abstainers | 582/1232 | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |  |
| ?0?0.5 drinks per week | 757/1463 | 1.14 (0.95?1.37) | 1.12 (0.93?1.35) | 1.12 (0.93?1.35) |  |
| ?0.5?7 drinks per week | 1232/2971 | 0.82 (0.70?0.96) | 0.86 (0.73?1.01) | 0.87 (0.74?1.02) |  |
| ?7?14 drinks per week | 704/2146 | 0.95 (0.79?1.13) | 1.01 (0.85?1.21) | 1.01 (0.85?1.21) |  |
| ?14?21 drinks per week | 273/1041 | 0.98 (0.79?1.21) | 1.05 (0.85?1.31) | 1.04 (0.84?1.30) |  |
| ?>21 drinks per week | 420/1646 | 1.28 (1.05?1.56) | 1.40 (1.14?1.72) | 1.35 (1.10?1.66) |  |
| ?*P* for trend |  | <0.001 | <0.001 | <0.001 |  |
| AHEI |  |  |  |  |  |
| ?Quartile 1 | 1185/2749 | 1.00 (ref.) | 1.00 (ref.) | ? |  |
| ?Quartile 2 | 1149/2803 | 1.08 (0.96?1.22) | 1.04 (0.92?1.18) | ? |  |
| ?Quartile 3 | 1008/2602 | 1.09 (0.96?1.24) | 1.03 (0.90?1.17) | ? |  |
| ?Quartile 4 | 1059/3171 | 1.18 (1.05?1.34) | 1.11 (0.96?1.26) | ? |  |
| ?*P* for trend |  | 0.069 | 0.542 | ? |  |
| African | Alcohol consumption |  |  |  |  |
| ?Abstainers | 359/809 | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |  |
| ?0?0.5 drinks per week | 371/573 | 1.12 (0.69?1.83) | 1.10 (0.66?1.83) | 1.10 (0.66?1.82) |  |
| ?0.5?7 drinks per week | 438/1020 | 0.90 (0.56?1.45) | 0.91 (0.55?1.50) | 0.91 (0.55?1.50) |  |
| ?7?14 drinks per week | 367/931 | 1.03 (0.64?1.66) | 1.10 (0.67?1.80) | 1.09 (0.66?1.80) |  |
| ?14?21 drinks per week | 196/522 | 1.05 (0.64?1.74) | 1.14 (0.68?1.93) | 1.14 (0.67?1.92) |  |
| ?>21 drinks per week | 245/613 | 1.18 (0.73?1.93) | 1.27 (0.77?2.11) | 1.24 (0.75?2.08) |  |
| ?*P* for trend |  | 0.694 | 0.576 | 0.660 |  |
| AHEI |  |  |  |  |  |
| ?Quartile 1 | 617/1170 | 1.00 (ref.) | 1.00 (ref.) | ? |  |
| ?Quartile 2 | 583/1159 | 1.13 (0.83?1.55) | 1.13 (0.81?1.56) | ? |  |
| ?Quartile 3 | 555/1320 | 0.86 (0.64?1.15) | 0.85 (0.63?1.15) | ? |  |
| ?Quartile 4 | 536/1361 | 1.16 (0.86?1.56) | 1.19 (0.88?1.62) | ? |  |
| ?*P* for trend |  | 0.115 | 0.090 | ? |  |
| Hispanic | Alcohol consumption |  |  |  |  |
| ?Abstainers | 466/1306 | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |  |
| ?0?0.5 drinks per week | 325/805 | 0.90 (0.72?1.13) | 0.84 (0.67?1.06) | 0.85 (0.67?1.07) |  |
| ?0.5?7 drinks per week | 383/1319 | 0.78 (0.64?0.95) | 0.81 (0.66?0.99) | 0.81 (0.66?1.00) |  |
| ?7?14 drinks per week | 254/1070 | 0.87 (0.70?1.09) | 0.87 (0.69?1.09) | 0.87 (0.69?1.09) |  |
| ?14?21 drinks per week | 136/689 | 0.84 (0.64?1.10) | 0.83 (0.63?1.09) | 0.83 (0.63?1.08) |  |
| ?>21 drinks per week | 343/1536 | 1.27 (1.01?1.58) | 1.22 (0.97?1.53) | 1.20 (0.95?1.50) |  |
| ?*P* for trend |  | <0.001 | 0.001 | 0.003 |  |
| AHEI |  |  |  |  |  |
| ?Quartile 1 | 611/1741 | 1.00 (ref.) | 1.00 (ref.) | ? |  |
| ?Quartile 2 | 513/1745 | 0.88 (0.75?1.05) | 0.89 (0.64?0.92) | ? |  |
| ?Quartile 3 | 525/1899 | 0.97 (0.81?1.15) | 0.89 (0.75?1.07) | ? |  |
| ?Quartile 4 | 468/1889 | 1.23 (1.08?1.32) | 0.96 (0.80?1.15) | ? |  |
| ?*P* for trend |  | 0.088 | 0.028 | ? |  |
| Chinese | Alcohol consumption |  |  |  |  |
| ?Abstainers | 3500/10673 | 1.00 (ref.) | 1.00 (ref.) | 1.00 (ref.) |  |
| ?0?7 drinks per week | 925/3352 | 1.02 (0.92?1.12) | 1.02 (0.92?1.13) | 1.01 (0.91?1.12) |  |
| ?7?14 drinks per week | 328/1144 | 1.18 (1.01?1.38) | 1.18 (1.00?1.39) | 1.17 (0.99?1.38) |  |
| ?>14 drinks per week | 514/1615 | 1.41 (1.23?1.62) | 1.41 (1.22?1.62) | 1.38 (1.20?1.59) |  |
| ?*P* for trend |  | <0.001 | <0.001 | <0.001 |  |
| DBI |  |  |  |  |  |
| ?Quartile 1 | 1606/5081 | 1.00 (ref.) | 1.00 (ref.) | ? |  |
| ?Quartile 2 | 1273/4229 | 1.15 (0.91?1.12) | 1.12 (1.01?1.24) | ? |  |
| ?Quartile 3 | 1293/4620 | 1.22 (1.11?1.35) | 1.20 (1.09?1.33) | ? |  |
| ?Quartile 4 | 1067/4525 | 1.34 (1.20?1.49) | 1.32 (1.18?1.47) | ? |  |
| ?*P* for trend |  | <0.001 | <0.001 | ? |  |

***Data*** are ORs and its 95% confidence interval.

Model 1 was adjusted by age, sex, BMI, smoking rate, survey years, and high school education level for Caucasian, African, Hispanic and Chinese; additionally adjusted for rural status for Chinese.

Model 2 was further adjusted by total calorie intake, dietary fat, fiber and Na.

Model 3 was adjusted by all variables in model 2 and diet quality indexes.

Figure presented the association between alcohol consumption and the risk of hypertension in flexible models by diet quality. ORs for the association between alcohol consumption and risk of hypertension showed a different varying trend in the group with the highest and lowest diet quality. The ORs in the lowest diet quality groups showed significant linear trends in Caucasians (P = 0.005), Hispanics (P = 0.022), and Chinese (P = 0.001), whereas the ORs did not show significant increasing trends in the highest diet quality groups (P = 0.187 for Caucasians, 0.567 for Hispanics, and 0.138 for Chinese).

Association between alcohol consumption and risk of hypertension by diet quality.

a and b for Caucasians, c and d for Africans, e and f for Hispanics, g and h for Chinese when taking account of low and high diet quality, resepectively.

Figure presented the joint associations of diet quality and alcohol consumption with in flexible model risk of hypertension. Associations between alcohol consumption and risk of hypertension significantly varied with changing in the AHEI score and DBI score in Caucasians (P = 0.002), Hispanics (P = 0.006), and Chinese (P < 0.001), respectively. The associations between alcohol consumption and risk of hypertension gradually changed to linear association with decreasing overall diet quality. More, no significant joint association was observed between AHEI score and alcohol consumption in Africans (P = 0.274).

Joint association of overall diet quality and alcohol consumption with risk of hypertension.

a, b, c and d represented Caucasians, Africans, Hispanics, and Chinese, respectively.

Alcohol consumption, changes in diet quality, and future risk of hypertension

Supplementary Table presented the associations of alcohol consumption and changes in diet quality with future risk of hypertension in CHNS with 14 years follow-up by Cox’s proportional-hazards regression. Compared to abstainers, heavy alcohol consumption was significantly associated with future increased risk of hypertension with adjustment for covariates (HR: 1.24, 95% CI: 1.05–1.46). Decreasing diet quality was significantly associated with future increased risk of hypertension with adjustment for covariates (P = 0.014).

Figure presented the association between alcohol consumption and risk of hypertension in groups with increasing and decreasing diet quality. The HR in the decreasing diet quality group showed a significant linear trend (P = 0.020), whereas it did not show a significant increasing trend in the increasing diet quality group (P = 0.127). The joint association of changes in diet quality and alcohol consumption with future risk of hypertension was presented in the Fig. . The association between alcohol consumption and future risk of hypertension significantly varied by decreasing diet quality (P for interaction = 0.004) with gradually changing to linear association with decreasing diet quality.

Association between alcohol consumption and subsequent risk of hypertension, and joint association of changing in diet quality and alcohol consumption with subsequent risk of hypertension.

a and b for Chinese when taking account of increasing and decreasing diet quality. c represented the joint association of changes in diet quality and alcohol consumption with future risk of hypertension.

Sensitivity analysis

A sensitivity analysis performed the subgroup analysis in the HDNNCDS subjects (N = 9704) who measured dietary information through FFQ. Results of subgroup analyses were consistent with the results of the total sample, indicating that methods of a dietary survey may not influence the results of this study (Supplementary Table and Fig. ).

Further, the concentrations might vary a lot across different alcoholic beverages, it might suggest that the amount of alcohol in gram is also a good indicator of alcohol intake. And as is well-known, one standard drink is equal to 13.6 g of absolute alcohol [–]. Then we converted the alcohol consumption to grams and run the same analyses. And both results remain highly consistent which suggested the reproducibility of our conclusions (Supplementary Fig. ).

Discussion

In this study, using NHANES, CHNS, and HDNNCDS, we found that overall diet quality significantly influenced the association between alcohol and risk of hypertension with significant increasing trends in the context of lowest diet quality and nonsignificant increasing trends in the context of highest diet quality in cross-sectional ***data***. Besides, the impact of changes in diet quality on the association between alcohol and future risk of hypertension was also demonstrated in prospective analysis, showing a similar changing trend by diet quality found in the cross-sectional ***data***.

Diet is a complex mixture of interacting components that affect health as a whole [], and previous studies have also reported that alcohol may have different health effects depending on other dietary factories in the whole diet. The present study, therefore, hypothesized that overall die quality might modify the association between alcohol consumption and risk of hypertension. To validate this hypothesis, this study firstly examined the impact of overall diet quality on the association between alcohol consumption and risk of hypertension using cross-sectional ***data*** from CHNS. Results indicated that the association between alcohol consumption and risk of hypertension was significantly influenced by overall diet quality. Further, to strengthen the generalizability of this finding to other populations, this study analyzed cross-sectional ***data*** from NHANES including multiple ethnics, and the impact of overall diet quality on this association was consistently observed in American Caucasians and Hispanics. In the context of high diet quality, light-to-moderate alcohol consumption was significantly associated with decreased risk of hypertension in Caucasians, and heavy alcohol consumption was associated with a nonsignificant increased risk of hypertension in Caucasians, Chinese, and Hispanics. On the contrary, in the context of low diet quality, light-to-moderate alcohol was not associated with decreased risk of hypertension, and heavy alcohol consumption was consistently significantly associated with increased risk of hypertension in Caucasians, Chinese, and Hispanics. To provide more evidence supporting our findings, this study also examined the impact of changes in diet quality overtime on the association between alcohol consumption and subsequent risk of hypertension with a 14-year follow-up in CHNS. Results indicated that changes in diet quality overtime also significantly influenced the association between alcohol consumption and subsequent risk of hypertension, showing similar changing trends found in the cross-sectional ***data*** by diet quality. Besides, dietary survey methods in the CHNS and NHANES were 3-day food records, respectively, which were relatively accurate in recording dietary intakes, but limited in reflecting long-term dietary habits. To minimize bias of dietary survey for our findings, the HDNNCDS, which used FFQ to record long-term dietary habits, was included in this study to examine the above hypothesis. The results consistently showed the significant impact of dietary quality on the association between alcohol consumption and hypertension regardless of dietary survey methods, adding more credence to our findings.

Further, this study observed that associations between alcohol consumption and risk of hypertension were dynamically changing from nonsignificant increasing trend to linear association with decreasing overall diet quality. Few population-based studies may partially support the impact of overall diet quality on this association. It has been reported that increasing alcohol consumption was likely significantly associated with increased risk of cirrhosis only in subjects with high saturated fat diet [], and moderate red wine consumption was probably associated with decreased risk of cardiovascular disease only in high flavonols diet []. Animal and cell studies may provide potential mechanisms for the impact of diet quality on the health effects of alcohol. It has been reported that even moderate alcohol consumption can cause more hepatic inflammation and cellular apoptosis in preexisting nonalcoholic steatohepatitis induced by high-fat diet [], and high-fat diet also influences the effect of alcohol on hepatic triglyceride accumulation and expression of pro-inflammatory genes, potentially via Toll-like receptor 4 signaling [].

In this study, high diet quality is characterized by higher intakes of fruit, vegetables, and beans in Chinese, and by whole grain, fruit, vegetables, and nuts in Caucasians and Hispanics, whereas low diet quality is characterized by higher intakes of red meat products. Most of the food items in the context of high diet quality have been emphasized with their protective roles in the development of hypertension through improvement in body weight regulation, a blunted counter-regulatory response of the renin–angiotensin system and an improvement in upregulation of nitric oxide bioavailability [–], and food items in the context of low diet quality have been abundantly found to be associated with hypertension through low-grade chronic inflammation and endothelial dysfunction [–]. These common mechanisms underlying the development of hypertension shared by diet quality and alcohol may explain why diet quality influenced the association between alcohol consumption and risk of hypertension.

The strength of this study is that it used two National nutrition survey ***data*** including multiple ethnics, strengthening the generalizability of these findings to other populations. The hypothesis in this study was not demonstrated in American Africans. The differences of drinking patterns due to history, socioeconomics, and lifestyle, and the different mechanisms of hypertension between American Africans and other ethnics may be possible reasons for the disparate results [, ], and future studies focusing on Africans from other regions are still needed to examine the impact of diet quality on this association. Further, this study examined the hypothesis based on cross-sectional and prospective ***data***, which may provide confirmative evidence on this issue. Besides, three methods of dietary survey were used in this study, with two is relatively accurate, and another reflecting long-term dietary habits. However, this study also has certain limitation. As in any observation study, this study is limited by the possibility of residual confounding or unaccounted for confounding, the presence of which would affect the accuracy of estimates. However, it has been consistently reported that both diet quality and alcohol were independent risk factors for hypertension. We would, therefore, expect that the unmeasured confounder may affect the results slightly.

In conclusion, this study firstly demonstrated that light-to-moderate alcohol consumption might have a potential beneficial effect on the risk of hypertension in relative high diet quality, and it may have more harmful effects in low diet quality across different ethnics, emphasizing that when examining health effects of alcohol, it should consider what kinds of overall diet quality is alcohol in. Public health strategies and health guidelines for alcohol use should be made considering the impact of overall diet quality.

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**Notes**

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FACTUAL PRESENTATION

COMPREHENSIVE AND ENHANCED PARTNERSHIP AGREEMENT BETWEEN THE EUROPEANUNION AND THE REPUBLIC OF ARMENIA (SERVICES)

Report by the Secretariat

This report, prepared for the consideration of the Comprehensive and Enhanced Partnership Agreement between the European Union and the Republic of Armenia, has been drawn up by the WTO Secretariat on its own responsibility and in full consultation with the Parties. The factual presentation reproduces as closely as possible the terminology used in the Agreement and in the comments provided and does not imply official endorsement or acceptance by the Secretariat of such terminology. The report has been drawn up in accordance with the rules and procedures contained in the Decision for a Transparency Mechanism for Regional Trade Agreements ( WT/L/671 ) and thus does not imply any value judgement by the Secretariat regarding the contents of the Agreement.

Any technical questions arising from this report may be addressed to Peter Milthorp (tel:+41 22 739 5016) . Any statistical questions arising from this report may be addressed to Ms. Rowena Cabos (tel: +41 22 739 5185) .

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Key Facts

Parties to the Agreement: European Union and the Republic of Armenia

Date of Signature: 24 November 2017

Date of Entry into Force: 1 June 20181 (provisional application)

Date of Notification: 23 August 2019

Full implementation: 1 June 2018

1TRADE ENVIRONMENT

1.1 The Comprehensive and Enhanced Partnership Agreement (hereinafter referred to as 'the Agreement') concluded between the European Union (hereinafter the EU) and the Republic of Armenia (hereinafter Armenia) is the EU's 41st and Armenia's 10th notified regional trade agreement (RTA) .

1.2 In 2018, with a population of 513.9 million, the EU's GDP was estimated at USD 18,783 billion, while that of Armenia, with a population of 2.96 million was estimated at USD 12.4 billion.

1.1Trade in services

1.3 In 2018, the EU's shares of total commercial services exports and imports were 25.13% and 20.62% respectively, while Armenia's share was 0.035% for exports and 0.04% for imports of services. With total commercial services exports of USD 1,089 billion, and imports of USD 865 billion, the EU was the world's largest exporter and importer of commercial services. Armenia was the 81stlargest exporter (USD 2,018 billion) and 85th largest importer (USD 2.174 billion) .

1.4 Charts 1.1a, 1.1b and 1.2 below shows global trade in commercial services for the EU and Armenia (all based on ***data*** for the period 2010-2018) . The EU had a positive balance in its global trade in services, and Armenia a negative balance. For both Parties, trade in services has grown during the period. Travel and transportation services account for a large share of services traded by the Parties with other business services also showing important exports and imports for the EU.

Chart 1.1a EU: Trade in commercial services with world, 2010-2018

Note: Based on BPM6.

Source: EU authorities and ***Eurostat***.

Chart 1.1b EU: Bilateral total trade in services, 2010-2018

Source: EU authorities (2015-2017) and ***Eurostat***.

Chart 1.2 Armenia: Trade in commercial services with world, 2010-2018

Note: Based on BPM6.

No imports for Manufacturing services on physical inputs owned by others (2010-2018); no trade ***data*** for Charges for the use of intellectual property i.e (2010-2018) .

Exchange rates to convert USD to Euro for 2010-2018 are: 2010 (0.76); 2011 (0.72); 2012 (0.78); 2013 (0.75); 2014 (0.75); 2015 (0.90), 2016 (0.90), 2017 (0.89) and 2018 (0.85) .

Source: WTO ***Statistics*** database and Armenian authorities (2015-2017) .

1.5 Charts 1.3 and 1.4 below depict each Party's foreign direct investment stocks with the world as well as the Party's FDI flows with the world which have grown steadily during the period 2013-17. While the EU is a net investor in the world, Armenia is a net recipient of FDI. Over the period there has been a steady increase in inward and outward FDI in the EU. Armenia's inward and outward FDI levels have remained stable. The EU is a net investor in Armenia. Its FDI stock in Armenia increased significantly in 2016 (1,662 million € in 2018) .

Chart 1.3 EU: FDI stock and flow with Armenia and world, 2013-2017

Source: ***Eurostat***.

Chart 1.4: Armenia: FDI stock and flow with world and FDI stock with EU

Note: Exchange rates to convert USD to Euro for 2013-2017 are: 2013 (0.75); 2014 (0.75); 2015 (0.90); 2016 (0.90); 2017(0.89) and 2018 (0.85) .

Source: UNCTAD and Armenian authorities (2015-2017) .

2CHARACTERISTIC ELEMENTS OF THE AGREEMENT

2.1Background information

2.1 The Agreement is concluded between the EU and the European Atomic Energy Community and their Member States, of the one part, and Armenia of the other part. The Agreement was signed by the Parties on 24 November 2017 and entered into force (provisionally) on 1 June 2018.2 It was notified to the WTO on 23 August 2019 under Article V of the GATS in document S/C/N/959 .

2.2 The text of the Agreement is available from the following websites:

European Union: [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:22018A0126(01)*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:22018A0126(01))

Armenia: [*https://www.mfa.am/filemanager/eu/CEPA\_ARM\_1.pdf*](https://www.mfa.am/filemanager/eu/CEPA_ARM_1.pdf) (the Armenian text)

2.3 The Agreement contains 7 Titles and 12 Annexes (Table 2.1) .

2.4 Title I contains objectives and general principles of the Agreement. With regard to trade, the Agreement aims to establish enhanced trade cooperation allowing for sustained regulatory cooperation in relevant areas, in compliance with the rights and obligations arising from WTO membership. This Factual Presentation focusses mainly on Title VI of the Agreement which deals with trade and trade related matters.

Table 2.1 Structure of the Agreement

Titles, Chapters

Title/description

Preamble

Title I

Objectives and General principles

Title II

Political Dialogue and Reform: Cooperation in the field of Foreign and Security Policy

Title III

Justice, Freedom and Security

Title IV

Economic Cooperation

Title V

Other Cooperation Policies

Title VI

Trade and Trade Related Matters

Chapter 1

Trade in Goods

Chapter 2

Customs

Chapter 3

Technical Barriers to Trade

Chapter 4

Sanitary and Phytosanitary Matters

Chapter 5

Trade in services, establishment and electronic commerce

Chapter 6

Current payments and movement of capital

Chapter 7

Intellectual Property

Chapter 8

Public Procurement

Chapter 9

Trade and Sustainable Development

Chapter 10

Competition

Chapter 11

State owned enterprises

Chapter 12

Transparency

Chapter 13

Dispute Settlement

Title VII

Financial Assistance, and Anti-Fraud and Control Provisions

Title VIII

Institutional, General and Final Provisions

Annexes

Annex I

Transport of Title V: Other Cooperation policies

Annex II

Energy of Title V: Other cooperation policies

Annex III

Environment of Title V: Other Cooperation policies

Annex IV

Climate Action of Title V: Other Cooperation policies

Annex V

Cooperation in the field of the Information Society of Title V: Other Cooperation policies

Annex VI

Consumer Protection of Title V: Other Cooperation Policies

Annex VII

Employment, Social Policy and Equal Opportunities of Title V: Other Cooperation policies

Annex VIII

Trade in Services and Establishment

Annex VIII-A

Reservations on Establishments of the EU

Annex VIII-B

Commitments on Cross-Border Services of the EU

Annex VIII-C

Reservations on Key Personnel, Graduate Trainees and Business Sellers of the EU

Annex VIII-D

Reservations on Contractual Service Suppliers and Independent Professionals of the EU

Annex VIII-E

Reservations to Establishment of the Republic of Armenia

Annex VIII-F

Commitments on Cross Border Services of the Republic of Armenia

Annex VIII-G

Reservations on Contractual Services Suppliers and Independent Professionals of the Republic of Armenia

Annex IX

Legislation of the Parties and Elements for Registration, Control and Protection of Geographical Indications

Annex X

List of Protected Geographical Indications

Annex XI

Additional Covered Public Procurement

Annex XII

Anti-Fraud and Control Provisions of Title VII: Financial Assistance and Anti-Fraud and Control Provisions

1.1 Chapters 1-4 of Title VI deal with trade in goods. The Parties agree to provide each other most favoured nation (MFN) and national treatment in trade in goods (Articles 113 and 114 respectively) . They agree not to impose or maintain duties, taxes or other charges on exports in excess of those imposed on like goods destined for their domestic markets (Article 116); nor prohibitions or restrictions other than duties, taxes or other charges on imports or exports of any goods from or destined for the other Party (Article 117) . Article XI of the GATT 1994 including its interpretative notes is incorporated into and made part of the Agreement mutatis mutandis. The Parties also agree that freedom of transit is essential for attaining the objectives of the Agreement and provide for freedom of transit in accordance with Article V of GATT 1994, including its interpretative notes, and incorporates these into the Agreement mutatis mutandis (Article 120) . The Agreement also has provisions on trade defence which maintains the Parties' rights and obligations under the relevant WTO Agreements (Article 121);3 and exceptions under which the Parties' existing rights and obligations under Article XX of the GATT 1994 apply to trade in goods (Article 122) . The Parties also reaffirm their obligations under the WTO's TBT and SPS Agreements with respect to technical barriers to trade and sanitary and phytosanitary measures (Chapters 3 and 4) . They agree to pursue transparency and cooperation in these areas in order to facilitate access to each others' markets. In Title VIII the Parties set out the governance framework for the Agreement.

3PROVISIONS ON TRADE IN SERVICES AND INVESTMENT

3.1 Title VI, Trade and Trade-Related matters, Chapter 5, Articles 141-203 concern trade in services, establishment and electronic commerce. The Chapter is composed of 8 sections, Section A, General Provisions (Articles 141-142), Section B, Establishment (Articles 143-147), Section C, Cross-Border Supply of Services (Articles 148-152), Section D, Temporary presence of natural persons for business purposes (Articles 153-157), SectionE, Regulatory Framework (Articles 158-192), Section F, Electronic Commerce (Articles 193-199) Section G, Exceptions (Articles 200-202) and Section H, Investment (Article 203) .

1.2 Annex VIII sets out the reservations and commitments of the Parties. Annex VIII-A contains the reservations of the EU on establishment in accordance with Article 144 of the Agreement; AnnexVIII-B contains the list of commitments of the EU on cross-border services in accordance with Article151 of the Agreement; Annex VIII-C contains the reservations of the EU on key personnel, graduate trainees and business sellers in accordance with Articles 154 and 155 of the Agreement; and Annex VIII-D contains the reservations of the EU on contractual service suppliers and independent professionals in accordance with Articles 156 and 157 of the Agreement. As regards Armenia, Annex VIII-E contains the reservations of Armenia on establishment in accordance with Article 144 of the Agreement; Annex VIII-F contains the list of commitments of Armenia on cross-border services in accordance with Article 151 of the Agreement; and Annex VIII-G contains the reservations of Armenia on contractual service suppliers and independent professionals in accordance with Articles 156 and 157 of the Agreement.

3.1Scope and definitions

3.2 In Article 141 the Parties reaffirm their respective commitments under the WTO Agreement and set down arrangements for the progressive reciprocal liberalisation of establishment and trade in services and for cooperation on electronic commerce. Article 141.2 provides that nothing in the Chapter shall be construed as imposing any obligation on the Parties with respect to government procurement under Chapter 8. The Chapter also does not apply to subsidies granted by a Party which are covered under Chapter 10 and to measures affecting natural persons seeking access to the employment market of a Party, nor does it apply to measures regarding citizenship, residence or employment on a permanent basis. In Article 141.6 the Parties have agreed that nothing in the Chapter shall prevent a Party from applying measures to regulate the entry of natural persons into, or their temporary stay in, its territory, including measures necessary to protect the integrity of, and to ensure the orderly movement of natural persons across its borders, provided that such measures are not applied in such a manner as to nullify or impair the benefits accruing to any Party under the terms of a specific commitment in this Chapter and the Annexes to the Agreement.

3.3 The definitions used in the Chapter are set out in Article 142. Article 143 provides that the section applies to measures adopted or maintained by the Parties affecting establishment in all economic activities with the exception of: (a) mining, manufacturing and processing of nuclear materials; (b) production of and trade in arms, munitions and war material; (c) audio-visual services; (d) national maritime cabotage, and (e) domestic and international air transport services, whether scheduled or non-scheduled, and services directly related to the exercise of traffic rights, other than: (i) aircraft repair and maintenance services during which an aircraft is withdrawn from service; (ii) the selling and marketing of air transport services; (iii) computer reservation system ('CRS') services; (iv) ground handling services; and (v) airport operation services.

3.4 Article 148 (on cross border supply of services) provides that the Section applies to measures of the Parties affecting the cross border supply of services for all services sectors with the exception of audio-visual services; national maritime cabotage; and domestic and international air transport services, (whether scheduled or non-scheduled) and services directly related to the exercise of traffic rights.4

.2Denial of Benefits

3.5 While there are no denial of benefits provisions per se, Article 142(f) provides that notwithstanding the preceding paragraphs5, shipping companies established outside the European Union or the Republic of Armenia and controlled by nationals of the Member States or of the Republic of Armenia, respectively, shall also be beneficiaries of the provisions of this Agreement, if their vessels are registered in accordance with their respective legislation, in a Member State or in the Republic of Armenia and fly the flag of that Member State or of the Republic of Armenia.

.3General provisions on trade in services

3.3.1Market access

3.6 Article 149.1 provides that with respect to market access through the cross-border supply of services, each Party shall accord services and service suppliers of the other Party treatment not less favourable than that provided for in the specific commitments contained in Annexes VIII-B and VIII-F (EU and Armenia respectively) . For service sectors in respect of which market access commitments have been scheduled, each Party shall not adopt or maintain, either on the basis of a regional subdivision or on the basis of its entire territory, unless otherwise specified in Annexes VIII-B and VIII-F, limitations on the number of services suppliers, whether in the form of numerical quotas, monopolies, exclusive service suppliers or the requirements of an economic needs test; limitations on the total value of service transactions or assets in the form of numerical quotas or the requirement of an economic needs test; or limitations on the total number of service operations or on the total quantity of service output expressed in terms of designated numerical units in the form of quotas or the requirement of an economic needs test (Article 149.2) .

3.3.2National and MFN treatment

3.7 On national and MFN treatment for establishment, Article 144.1 provides that subject to reservations listed in Annex VIII-E, Armenia shall grant, upon entry into force of the Agreement: (a) as regards the establishment of subsidiaries, branches and representative offices by natural or juridical persons of the EU, treatment no less favourable than that accorded to its own juridical persons, branches and representative offices or to any third-country juridical persons, branches and representative offices, whichever is the better; and (b) as regards the operation of subsidiaries, branches and representative offices by natural or juridical persons of the EU in Armenia, once established, treatment no less favourable than that accorded to its own juridical persons, branches and representative offices or to any juridical persons, branches and representative offices of any third-country juridical persons, whichever is the better.

3.8 Article 144.2 provides that subject to reservations listed in Annex VIII-A, the EU shall grant, upon entry into force of the Agreement; (a) as regards the establishment of subsidiaries, branches and representative offices by natural or juridical persons of Armenia, treatment no less favourable than that accorded by the EU to its own juridical persons, branches and representative offices or to any third-country juridical persons, branches and representative offices, whichever is the better; and (b) as regards the operation of subsidiaries, branches and representative offices by natural or juridical persons of Armenia in the EU, once established, treatment no less favourable than that accorded to their own juridical persons, branches and representative offices; or to any juridical persons, branches and representative offices of any third-country juridical persons, whichever is the better.

3.9 The Parties have agreed that subject to reservations listed in Annexes VIII-A and VIII-E, they shall not adopt any new measures which introduce discrimination as regards the establishment on their territory of juridical persons of the other Party or in respect of the operation of such juridical persons, once established, in comparison with their own juridical persons (Article 144.3) .

3.10 In Article 150 (on national treatment) the Parties have agreed that for committed sectors inscribed in Annexes VIII-B and VIII-F, and subject to any conditions and qualifications set out therein, each Party shall grant to services and service suppliers of the other Party, treatment no less favourable than that it accorded to its own like services and service suppliers. Article 150.2 provides that a Party may meet the requirement of paragraph 1 by according to services and service suppliers of the other Party treatment that is either formally identical or formally different from that accorded to its own like services and service suppliers. Formally identical or formally different treatment shall be considered to be less favourable if it modifies the conditions of competition in favour of services or service suppliers of the Party compared to like services or service suppliers of the other Party (Article 150.3) . Article 150.4 notes that specific commitments assumed under the Article shall not be construed as requiring any Party to compensate for inherent competitive disadvantages which result from the foreign character of the relevant services or service suppliers.

3.3.3Commercial presence

3.11 As noted above Section B of Chapter 5 of the Agreement governs establishment, and Article144 (on national and MFN treatment for establishment) provides general obligations that are subject to reservations listed in Annex VIII-E for Armenia and the EU.

3.12 Article 147 concerns the standard of treatment for branches and representative offices. Article147.1 provides that Article 144 does not preclude a Party from applying particular measures concerning the establishment and operation in its territory of branches and representative offices of juridical persons of the other Party not incorporated in the territory of the former Party if those measures are justified by legal or technical differences between such branches and representative offices as compared to branches and representative offices of juridical persons incorporated in the territory of the former Party or, as regards financial services, for prudential reasons (Article 147.1) . Article 147.2 provides that the difference in treatment shall not go beyond what is strictly necessary as a result of such legal or technical differences or, as regards financial services, for prudential reasons.

3.13 In Article 146 the Parties have agreed that nothing in the Chapter shall limit the rights of investors of the Parties to benefit from more favourable treatment set out in any existing or future international agreement relating to investment to which an EU Member State and Armenia are parties.

3.14 In Section H on Investment the Parties shall jointly review the environment and legal framework for investment, no later than three years after the entry into force of the Agreement and at regular intervals thereafter. On the basis of that review they shall consider the opportunity for starting negotiations on supplementing the Agreement with provisions on investment (Article 203) .

3.3.4Movement of natural persons

3.15 Article 153 (on temporary entry of natural persons for business purposes) sets out definitions of terms used in section C of Chapter 5, i.e key personnel, business visitors for establishment purposes, intra-corporate transferees managers, specialists, graduate trainees, business sellers, contractual service suppliers, independent professionals and qualifications.

3.16 Under the Agreement, the Parties affirm their respective obligations in their commitments under the WTO GATS in relation to the entry and temporary stay of contractual service suppliers (Article 156.1) .

3.17 Annex VIII-C sets out the EUs' reservations on key personnel, graduate trainees and business sellers of Armenia. The reservations list the economic activities liberalized pursuant to Article 151 of the Agreement for which limitations apply on key personnel and graduate trainees in accordance with Article 154 of the Agreement and on business sellers in accordance with Article 155 of the Agreement and specifies such limitations. Paragraph 10 of Annex VIII-D provides that the EU shall, per Article 156 of the Agreement, allow contractual service suppliers of Armenia through the presence of natural persons and lists the covered professional services sub-sectors. Paragraph 11 does the same in respect of Article 157 of the Agreement for independent professionals and sets out additional Member State level reservations. Annex VIII-D lists the reservations of the EU on contractual service suppliers and independent professionals from Armenia.

3.18 Annex VIII-G contains Armenia's reservations on contractual service suppliers and independent professionals. Paragraph 1 provides that Armenia agrees to allow the supply of services into its territory by contractual service suppliers and independent professionals of the EU through the presence of natural persons. The covered sectors are listed in paragraph 10 of Annex VIII-G.6

3.19 Consistent with its reservations in Annexes VIII-D and VIII-G, each Party shall allow the supply of services into its territory by key personnel, contractual services suppliers, independent professionals and business sellers of the other Party, subject to a number of specific conditions (Table 3.1) .

1 According to the Parties the Agreement shall enter into force on the first day of the second month following the date of deposit of the last instrument of ratification or approval. As of 20 April 2020, the Republic of Armenia, the European Parliament and 21 EU Member States have ratified the Agreement.

2 Provisional entry into force: 1 June 2018. The United Kingdom was a Member State of the European Union until 31 January 2020. The European Union and the United Kingdom have agreed a Withdrawal Agreement pursuant to Article 50 of the Treaty on European Union, which provides for a time-limited transition period during which European Union law, with limited exceptions as provided for in the Withdrawal Agreement will apply to and in the United Kingdom. Further details are available in the communication from the United Kingdom ( WT/GC/206 ) dated 1 February 2020 and the note verbal from the European Union ( WT/LET/1462 ) dated 27 January 2020 notifying WTO members that the United Kingdom is treated as a member State of the European Union for the purposes of relevant international agreements for the duration of the transition period.

3 Article XIX of GATT 1994 and the Agreement on Safeguards, contained in Annex 1A to the WTO Agreement; Article 5 of the Agreement on ***Agriculture*** contained in Annex 1A of the WTO Agreement on special safeguard provisions; Article VI of GATT 1994, the Agreement on Implementation of Article VI of the GATT 1994 contained in Annex 1A to the WTO Agreement and the Agreement on Subsidies and Countervailing Measures contained in Annex 1A to the WTO Agreement. These rights and obligations are not subject to the Agreement's dispute settlement provisions.

4 Other than: (i) aircraft repair and maintenance services during which an aircraft is withdrawn from service; (ii) the selling and marketing of air transport services; (iii) computer reservation system ('CRS') services; (iv) ground handling services; and (v) airport operation services (Article 148) .

5 On definitions of 'juridical person' and 'juridical persons of a Party'.

6 (a) legal services (CPC 861); (b) accounting and bookkeeping services (CPC 862); (c) taxation services (CPC 863); (d) architectural services (CPC 8671); (e) engineering services (CPC 8672); (f) integrated engineering services (CPC 8673); (g) urban planning and landscape architectural services (CPC 8674); (h) medical and dental services (CPC 9312); (i) veterinary services (CPC 932); (j) consultancy services related to the installation of computer hardware (CPC 841); (k) software implementation services (CPC 842); (l) ***data*** processing services (CPC 843); (m) ***data*** base services (CPC 844); (n) maintenance and repair services of office machinery and equipment including computers (CPC 845); (o) other computer services, including ***data*** preparation services (CPC 849); (p) R&D services (CPC 851-853); (q) real estate services: involving own or leased property (CPC 821); (r) real estate services: on a fee or contract basis (CPC 822); (s) rental/leasing services without operators: relating to aircraft (CPC 83104); (t) rental/leasing services without operators: relating to other transport equipment (CPC 83101, 83102); (u) rental/leasing services without operators: relating to other machinery and equipment (CPC 83106-83109); (v) advertising services (CPC 871); (w) market research and public opinion polling services (CPC 864); (x) management consulting service (CPC 865); (y) services related to management consulting (CPC 866); (z) technical testing and analysis services (CPC 8676); (aa) consulting services incidental to manufacturing (CPC 884, 885); (bb) maintenance and repair of equipment (not including maritime vessels, aircraft or other transport equipment) (CPC 633, 8861-8866); (cc) printing, publishing (CPC 88442); (dd) convention services (CPC 87909); and (ee) translation and interpretation services (CPC 87905) .

7 Source: GATS/SC/137 .

8 Under the GATS the maximum possible stay for natural persons in the ICT category ranges from 5 years for two EU Member States (EE, LV) down to one year, extendable (PL and SI) . Under the Agreement the maximum stay is 90 days, representing a reduction in the permitted maximum stay.

9 24 month period for NL, 90 days in any six month period for EE, six months in any 12 months period for computer and related services for SE.

10 Business Services, communication Services, construction and related services, distribution services, education services, environmental services, financial services, health related and social services, tourism and travel related services, recreational and cultural and sporting services, transport services.

11 On public utilities, a reservation at EU level only provides that economic activities considered as public utilities at a national level or local level may be subject to public monopolies or exclusive rights given to private operators.

12 Annex VIII-B sets out committed sectors (and any applicable reservations) at mode 1 and 2 level. Annex VIII-A covers commitments on mode 3.

13 Article 144.1 notes that Armenia's reservations on national treatment and MFN in respect of establishment are contained in Annex VIII-E. The EU's reservations on national treatment and MFN in respect of establishment are contained in Annex VIII-A.

14 Annex VIII-C contains the EU's reservations in respect of key personnel and graduate trainees and business sellers (Articles 154 and 155) .

15 Annex VIII-D contains the EU's reservations on contractual service suppliers and independent professionals (Articles 156 and 157) .

16 Service providers in this sector may be subject to obligations to safeguard general interest objectives related to the conveyance of content through their network in line with the EU regulatory framework for electronic communications.

17 Storage and warehouse services of fuels transported through pipelines, wholesale trade services of solid, liquid and gaseous fuels and related products and wholesale trade services of electricity, steam and hot water, retail sales of fuel oil, bottled gas, coal and wood and retail sales of electricity, (non-bottled) gas, steam and hot water.

18 Wholesale trade services of solid, liquid and gaseous fuels and related products and wholesale trade services of electricity, steam and hot water; retail sales of fuel oil, bottled gas, coal and wood and retail sales of electricity, (non-bottled) gas, steam and hot water and services incidental to energy distribution

19 Ground handling services, airport management, and passenger transportation, freight transportation.

20 Defined in Article 164.2(b) as the permanent provision of a minimum set of postal services of specified quality at all points in the territory of a Party.

21 Article 144, National treatment and MFN in establishment, Article 150, National treatment in cross-border supply of services subject to commitments.

22 Annex 1 to Chapter 1 'Transport of Title V: Other Cooperation' on the approximation of EU transport policy by Armenia also concerns transport services.

23 The conditions in Article 318.5 are that: (a) the Party to which the request is made does not respond to the request for consultations within 10 days of its receipt; (b) consultations are not held within the timeframes laid down in paragraph 3 or 4 of this Article; (c) the Parties agree not to have consultations; or (d) consultations have been concluded and no mutually agreed solution has been reached.

24 If the Parties cannot agree on the composition of the arbitration panel within 14 days, each Party shall, within five days appoint an arbitrator from that Party's sub-list established pursuant to Article 339. If either Party fails to appoint an arbitrator, one shall be selected by lot by the chairperson of the Partnership Committee, from the sub-list of that Party established pursuant to Article 339. If the Parties are unable to reach an agreement on appointment of a chairperson of the arbitration panel within 14 days, the chairperson of the Partnership Committee or the chairperson's delegate shall, upon the request of either Party, select the chairperson of the arbitration panel from the sub-list of chairpersons established pursuant to Article 339 within five days of any request from the Parties to do so (Article 321.4 and 5) .

25 The arbitration panel may seek information and opinions as it deems appropriate, and may receive amicus curiae briefs per Article 336. Article 338 provides that the arbitration panel shall interpret the provisions of the Title in accordance with customary rules of interpretation of public international law, including those codified in the Vienna Convention on the Law of Treaties of 1969. The arbitration panel may also take into account relevant interpretations in reports of WTO panels and of the Appellate Body adopted by the WTO Dispute Settlement Body.

26 Also protected under Article 218.7

27First time publication of a previously unpublished work following the lapse of original protection is 25 years. The economic rights of audio-visual performers are exclusive for 50 years from the date of the performance. Economic rights of producers of the first fixation of afilm expire 50years after the fixation is made. Economic rights of broadcasting organisations expire not less than 50 years after the first transmission of abroadcast, whether that broadcast is transmitted by wire or over the air, including by cable or satellite.

28And Annexes IX and X to the Agreement.

29 In Title V (Other Cooperation Policies), Chapter 3, Articles 45-50 the Parties agree to develop and strengthen cooperation on environmental issues thereby contributing to the long-term objective of sustainable development and greening the economy (Article 45) . Their cooperation is to aim at preserving, protecting, improving and rehabilitating the quality of the environment, protecting human health, utilising natural resources in a sustainable manner and promoting measures at international level to address regional or global environmental problems. A number of such problem areas are listed for cooperation in Article 46.1 Articles 47 and 48 set out additional cooperation obligations in the environmental sphere. In Article 50 Armenia has agreed to carry out approximation of its legislation to the Acts of the EU and international instruments referred to in Annex III in accordance with the provisions of that Annex. In Chapter 4, Articles 51-56 the Parties agree to cooperate on combatting climate change.

30 They in particular reference (a) freedom of association and the effective recognition of the right to ***collective*** bargaining; (b) elimination of all forms of forced or compulsory labour; (c) effective abolition of child labour; and (d) elimination of discrimination in respect of employment and occupation (Article 274.2) .

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[***In vitro antileishmanial potentialities of essential oils from Citrus limon and Pistacia lentiscus harvested in Tunisia***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:693W-H831-F129-P1DY-00000-00&context=1516831)

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**Body**

Introduction

Leishmaniasis is a tropical and sub-tropical disease caused by the protozoan Leishmania parasites and transmitted by the bite of infected female phlebotomine sandflies (Traoré et al. ). Its most common form, cutaneous leishmaniasis (CL), is endemic in 89 countries and about 0.6 to 1 million new cases occur worldwide annually (WHO ). Among Leishmania species, L. major and L. tropica represent species that cause most CL cases in the Old World (Karami et al. ). Lesions caused by L. major appear as severely inflamed, exudative, large, and may be complicated by superficial and secondary bacterial infections. Spontaneous healing is generally observed within 2 to 8 months leaving often indelible scars on the exposed parts of the body, which usually causes serious disability and social prejudice (Aoun and Bouratbine ; Traoré et al. ).

Currently, in the absence of a vaccine, the use of pentavalent antimonial drugs, given parenterally or intra-lesionally as the first line treatment of CL, presents several limitations related to their reported toxicity (pancreatitis, cardiotoxicity, hepatotoxicity, etc.), high cost, drug resistance, and risk of relapse (Chakravarty and Sundar ). In case of treatment failure, alternative drugs can be used such as amphotericin B, paromomycin, pentamidine, or miltefosine. Despite their good clinical results, adverse side effects, such as nausea, anemia, fever, and possibly drug resistance, are limiting factors in their use (Akbari et al. ). Therefore, to reduce these side effects, different innovative formulations of amphotericin B have been developed like liposomal forms (AmBisome®), lipidic complex forms, and colloidal dispersion forms. However, their high cost is the main limiting factor of their use and is a barrier to effective disease control, especially in underdeveloped countries (Pham et al. ).

Consequently, the development of new drugs, less or nontoxic, more efficient, and cheaper, which would be accessible especially for low-income people, is becoming a priority (Oryan ). Within this framework, the WHO recommends the use of traditional medicine where appropriate health services are inaccessible (Rocha et al. ). In this context, the molecule screening of medicinal plants could be a way to identify alternative natural, cheaper, and safe sources of antileishmanial molecules. Medicinal plants are a source of a wide range of bioactivity due to the presence of secondary metabolites, acting through diverse modes of action. Within the group of natural products, essential oils (EssOils) are oily odorant products extracted by several extraction methods, from different parts of the plant raw material. Owing to their complex composition in terpenes, EssOils are known to have a broad spectrum of interesting biological activities including antileishmanial properties (El Asbahani et al. ). Moreover, their physicochemical properties, such as low density (around 0.94 g/m3) and lipophilicity, that allows a rapid diffusion through the cell membrane, can enhance the targeting of EssOils active components to intracellular parasites (Anthony et al. ).

The present work deals with the investigation of antileishmanial potentialities of EssOils extracted from medicinal and aromatic plants from Tunisian flora. Indeed, this latter is a rich source for bioactive molecules with interesting antiparasitic activity against different Leishmania strains such as L. major, L. infantum, or L. amazonensis, as many times reported in literature (Attia et al. ; Essid et al. ; Hajaji et al. ). Inspired by ***data*** on folk medicine and literature, two plants were chosen: Pistacia lentiscus (Pistacia) and Citrus limon (Citrus).

Pistacia lentiscus is a plant belonging to the family of Anacardiae. It is commonly used as a traditional cure for hypertension, gastrointestinal disorders (stomach aches and diarrhea), diseases of the urinary tract and the respiratory tract (asthma and chronic bronchitis), and for dental disorders (Rauf et al. ). Studies related to the antileishmanial potential of Pistacia lentiscus are very scarce. Recently, Bouyahya et al. () showed the high potential against L. major parasites of EssOil extracted from leaves, with myrcene and α-pinene as major compounds. An interesting activity against L. infantum of the oil extracted from Pistacia lentiscus fruit (rich with limonene and α-pinene) was also described (Bouyahya et al. ; Essid et al. ). It should be noted that minor compounds of Pistacia l. EssOil, especially terpinene (Pereira et al. ) and caryophyllene (Barros et al. ), were reported to have significant anti-proliferative effect by causing mitochondrial damage to the Leishmania genus (Machado et al. ). In the present work, this choice was inspired by previous work of Bachrouch et al. () that showed an interesting activity of EssOil extracted from Pistacia lentiscus leaves against L. donovani parasite. This finding led to a national patent (N°TN2013/0129). Additionally, leaves of Pistacial. are known in folk medicine for their wound healing activity (Aissi et al. ; Bozorgi et al. ).

In another hand, EssOil of Citrus limon was also selected because of its antiparasitic potential. This plant belongs to the Rustaceae family that is characterized by its high therapeutic potential. In folk medicine, leaves have been largely used to treat obesity, diabetes, cardiovascular diseases, and certain types of cancer (Bouzenna et al. ; Bruno et al. ). Citrus EssOil showed antioxidant, antibacterial, and anti-inflammatory properties that were interesting for the treatment of skin diseases (Sidana et al. ). Traditionally, this EssOil was frequently used to reduce skin itching and to nourish skin. Moreover, the lemon pulp could treat pimples and wrinkles or to soften facial skin (Bertuzzi et al. ; Otang and Afolayan ). Although the antileishmanial activity of Citrus limon was not investigated in previous studies, limonene, one of its major bioactive molecules exhibited an interesting antileishmanial activity in vitro against L. major and L. amazonensis parasites. When applied topically, limonene was effective against experimental CL due to L. amazonensis (Arruda et al. ).

In the present work, after extraction and characterization of EssOils from the selected plants, the antileishmanial activity was assessed in vitro against two forms of Leishmania major parasite, i.e. the axenic amastigote and the intramacrophage forms. Additionally, the cytotoxic potential of EssOils was evaluated on macrophage cells. This study allowed assessing new potential antiparasitic molecules. To our knowledge, this is the first investigation of Citrus limon and Pistacia lentiscus EssOils from different sampling sites in Tunisia for their antileishmanial potential in vitro.

Materials and methods

Chemicals and reagents

All chemicals and reagents used for this study were of analytical grade (98.0–99.9%). Reagents were purchased from Sigma Aldrich (Saint-Quentin, France). Miltefosine (HePC) was kindly supplied by Zentaris (Frankfurt, Germany). All solutions were prepared with ultra-purified water from a Millipore Synergy 185 apparatus coupled to a RiOs5TM with resistivity of 18.2 MΩ cm. Distilled water was used for the EssOil extraction by hydrodistillation.

Selection and ***collection*** of plant materials

Pistacia lentiscus and Citrus limon were ***collected*** in two different plant areas for each (see Tunisian map in Appendix A: supplementary material, Figure ). The harvesting period extended from November 2015 to February 2016. The various ***data*** (plant species, harvested part, sampling site, harvesting period, and voucher specimen) are gathered in Appendix A (Tables 8 and 9). The freshly cut plants were sorted out and dried at ambient temperature in a drying room with active ventilation. Then, they were packed in paper bags and stored at ambient temperature for 3–4 weeks before use. Plant samples were transferred to the Laboratory of Biotechnology Applied to ***Agriculture*** (INRAT, Tunisia), where voucher specimens were delivered for further references.

Essential oil extraction by hydrodistillation

Hydrodistillation is the most recommended technique for extracting volatile compounds from a plant (El Haib ). For the extraction, 300 g of dried and crushed plant were brought into contact with 3 L of distilled water and brought to a boil during 2 to 3 h, according to the extraction process kinetic, using a modified Clevenger-type apparatus. Each EssOil obtained was dried over anhydrous sodium sulfate and stored in amber vials at 4 °C until further analysis.

The extraction yields (EY) were calculated according to Eq. :

Antioxidant activity

The ability to generate free radicals could play a very important role in antileishmanial activity since free radicals are involved in the process of defense against parasites (Krauth-Siegel and Comini ; Staerck et al. ; Stafford et al. ). Leishmania is one of the rare protozoa capable of surviving in hostile environment created by the host (Stafford et al. ) because it has an antioxidant defense system, which determines its pathogenicity, and serves as protection against macrophage attack (Staerck et al. ). Then, a good antioxidant could be able to strengthen the radical response of macrophages by Reactive Oxygen Species (ROS) generation, and thus fight the proliferation of parasites (Krauth-Siegel and Comini ).

Antioxidant activity of EssOils was thus assessed using two different tests: 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2′-azinobis-3-ethylbenzothiazoline-6-sulphonate (ABTS) assays. Both tests provide radical scavenging ability of the studied sample. However, the two reagents (DPPH and ABTS) react with different kinetics and thus give different informations. In fact, the antioxidant activity of a product is always assessed using several methods because of the complexity of the involved mechanisms (Schaich et al. ).

DPPH assay

In this assay, the antioxidant activity was measured in terms of hydrogen donating or radical scavenging ability, using the stable radical 1,1-diphenyl-2-picrylhydrazyl (DPPH•) according to the method described by Ghazouani et al. (). Briefly, 100 μL of each sample (essential oil or standard) were introduced into a glass tube containing 900 μL of freshly prepared methanolic DPPH solution (0.2 mM). Samples were tested at different concentrations in order to establish a calibration curve. Concentration range depended on the EssOil antioxidant capacity. For all EssOils, preliminary tests were firstly performed at 100 mg/L. The mixture was shaken using a vortex during nearly 30 s, until obtaining a solution with a homogenous color. After an incubation time of 25 min in dark at ambient temperature, the absorbance at 524 nm was measured using a UV/visible spectrophotometer (Helios, Unicam, Cambridge, UK).

ABTS assay

The radical scavenging capacity of antioxidant for the ABTS reagent (2,2′-azinobis-3-ethylbenzothiazoline-6-sulphonate) was determined following the procedure described by Yahyaoui et al. (). The ABTS•+ radical was generated by adding a 7 mM of ABTS solution at pH = 7.4 (5 mM NaH2PO4; 5 mM NA2HPO4, and 154 mM NaCl) to a potassium persulfate solution K2S2O8 solution (2.45 mM), the pro-oxidant prepared in ultra-purified water. The mixture was incubated overnight at 4 °C and then diluted until reaching an absorbance at 734 nm ranging from 0.70 to 0.90. A total of 900 μL of ABTS solution was added to 100 μL of 100 mg/L of EssOil. Solutions were mixed using a vortex and incubated for 6 min in the dark at ambient temperature. Measurements of absorbance were performed at 734 nm.

For DPPH and ABTS tests, the percentage of inhibition (PI) of a given sample was calculated according to Eq. :where AbsControl is the absorbance of a blank experiment carried out applying the same procedure without the EssOil. AbsSample is the absorbance of the sample. IC50-AA (mg/L) is the concentration of the EssOil able to scavenge 50% of DPPH• or ABTS•+ radicals. It is determined from PI curve as a function of concentration. Ascorbic acid was used as a standard. Measurements for each sample were realized in triplicate.

Characterization of essential oils

Gas chromatography coupled with mass spectrometry

The EssOil (10 μL) was dissolved in 1 mL of ethyl acetate (HPLC grade). The sample was injected into the GC (7890A)-MS (5975C inert MSD with Triple-Axis Detector) Agilent unit under the following conditions: capillary column HP-5MS ((5% phenyl)–methylpolysiloxane (60 m × 0.25 mm, 0.25 μm film thickness) interfaced with an Agilent mass selective detector 5975 C inert MSD. The carrier gas was N2 at 1 mL/min. The injector temperature was maintained at 200 °C. Then, oven temperature was varied from 40 to 280 °C at 10 °C/min, with temperature stages at 120 °C, 280 °C, and 300 °C. The spectra were recorded in electronic impact mode (EI) with an ionization energy of 70 eV, injection volume of samples was 1 μL. The Kovats retention index (RI) of each eluent was calculated using a series of n-alkanes (C7-C30) that were analyzed in the same conditions. The identification of compounds was achieved by comparing their mass spectra with standard spectra existing library from National Institute of Standards and Technology 08 (NIST 08), Kovats indices, and mass spectra reported in the literature. Note that compositions lower than 0.2 wt% were not considered for the molecules identification.

Total amount of phenolic compounds

Phenolic compounds were quantified in order to determine if there is or not a correlation between polyphenols presence and antioxidant and/or antiparasitic activities. The total amount of phenolic compounds was determined with colorimetry using Folin-Ciocalteu method described by Yahyaoui et al. (). This reagent consists on a mixture of phosphotungstic acid (H3PW12O40) and phosphomolybdic acid (H3PMo12O40) that is reduced in presence of phenols. This reaction leads to the formation of a mixture of oxides of tungsten and molybdenum colored in blue that strongly absorbs at 765 nm.

Ethanolic solutions of EssOils were prepared at concentrations ranging from 0 to 26 mg/L. Then, 100 μL of EssOil solutions were transferred into tube then mixed thoroughly with 500 μL of Folin reagent (Sigma Aldrich, France) previously diluted in ultra-purified water at 1:10 ratio. The mixture was shaken for 30 s using a vortex then incubated for 6 min in the dark. A total of 400 μL of sodium carbonate (7.5 w/v %) was then added and mixed thoroughly for 30 s. The mixture was incubated in the dark for 15 min. The absorbance was then measured using UV/visible spectrophotometer (Helios, Unicam, Cambridge, UK) at 765 nm against a blank of distilled water (Yahyaoui et al. ).

For each sample, a control experiment was carried out applying the same procedure to a solution without the EssOil. In this assay, gallic acid, which is a phenolic acid characterized by a carboxylic function and phenolic hydroxyls, was used as a standard. A calibration curve was then obtained for gallic acid aqueous solutions at concentrations ranging from 0 to 30 mg/L. Results were expressed in terms of milligrams of gallic acid equivalent per gram of dry mass sample (mg GAE/g). All measurements were realized in triplicate.

Antileishmanial activity

Parasite cultures

Leishmania major (MHOM/PT/92/CRE26) promastigote forms were maintained in culture M-199 medium (Sigma, Saint Quentin Fallavier, France) supplemented with 40 mM HEPES, 100 μM adenosine, 0.5 mg/L hemin, 10% fetal bovine serum, and 50 μg/mL gentamycin at 26 °C in a dark environment, under an atmosphere of 5% CO2. One day before the treatment, differentiation of promastigotes into axenic amastigotes was achieved by dilution of 1 × 106 promastigotes in stationary phase of growth in 5 mL of axenic amastigote medium at pH 5.5 (15 mM KCl, 8 mM glucose, 5 mM glutamine, 1 × M199, 2.5 BBL™ trypticase ™ peptone, 4 mM hemin, 10% fetal bovine serum, 2 mM CaCl2, and 2 mM MgCl2). Axenic amastigotes were grown under 37 °C and 5% CO2.

In vitro antileishmanial activity on axenic amastigote forms

L. major axenic amastigote forms were suspended to yield 1 × 106 cells/mL and the assays were performed in 96-well microtiter plates under a volume of 100 μL per well. EssOils, priorly diluted in ethanol, were added at concentrations ranging from 100 to 10−4 μg/mL obtained by serial dilution. Miltefosine (HePC) was used as a reference compound with final concentrations ranging from 100 μM to 97.6 nM obtained by serial dilution. Triplicates were performed for each concentration. Cultures were incubated at 37 °C in the dark under 5% CO2 atmosphere. Then, plates were subjected to 3 freeze/thaw cycles. Amastigotes viability was assessed using the SYBR® green I incorporation method. This method consists in evaluating the parasite growth using SYBR® Green I, which is a dye with marked fluorescence enhancement upon contact with parasite DNA. The parasite lysis suspension was diluted at 1:1 in lysis buffer (10 mM NaCl, 1 mM Tris HCl pH 8, 2.5 mM EDTA pH 8, 0.05% SDS, 0.01 mg/mL proteinase K, and 10 X SYBR Green I) in qPCR plates. Fluorescence was measured with Mastercylcer® ep realplex (Eppendorf, France) according to the following procedure to increase the SYBR Green incorporation: 90 °C for 1 min, decrease in temperature from 90 °C to 10 °C during 5 min with fluorescence reading. This experiment was processed thrice. Antileishmanial activity against amastigote axenic form was expressed as 50% inhibitory concentration of growth (IC50) calculated using ICEstimator® ([*http://www.antimalarial-icestimator.net/MethodIntro.htm*](http://www.antimalarial-icestimator.net/MethodIntro.htm)).

In vitro antileishmanial activity on intramacrophage amastigote forms and cytotoxicity evaluation

The mouse monocyte/macrophage cell line Raw 264.7 was maintained in Dulbecco’s Modified Eagles Medium (DMEM, Applied Biosystems) supplemented with 10% heat-inactivated fetal bovine serum. Raw 264.7 cells were seeded into a 96-well microtiter plate at a density of 20,000 cells/well in 100 μL of DMEM. After incubation in a 5% CO2 incubator at 37 °C for 2 h, the culture medium was replaced by 100 μL of fresh DMEM, supplemented with 2 mM CaCl2 and 2 mM MgCl2, containing a suspension of 3.2 × 106 promastigotes in stationary phase of growth, corresponding to 16 parasite-to-cell ratio. After 12 h incubation, the macrophage infection was checked using an inverted microscope (DMIL Led, Leica Microsystems®). Culture medium was replaced by fresh DMEM, then, EssOils dilution in DMEM was processed in the same way as for the axenic test (see the “” section). Miltefosine, the positive control, was also diluted to reach concentrations ranging from 100 μM to 97.6 nM. Samples were then transferred in plates containing infected macrophages. Both infected and non-infected macrophages without any drug were used as negative controls. Non-infected macrophages treated with EssOils or miltefosine allowed to determine their cytotoxicity. Plates were left 72 h at 37 °C in 5% CO2. After incubation, the cells were visualized using an inverted microscope to check their morphology or the presence of non-internalized free parasites. The medium was subsequently removed and replaced with the lysis buffer. Plates were subjected to 3 freeze/thaw cycles. Parasites growth or cells viability were determined using SYBR® Green I incorporation as previously described in the “” section. Macrophage alone or infected and non-treated macrophages were used as controls.

Experiments were carried out three times at least. Antileishmanial activity and cytotoxicity were expressed as 50% inhibitory concentration (IC50 and CC50, respectively) and calculated using ICEstimator®, as described previously. Moreover, selectivity index (SI) was calculated according to Eq. in order to assess the selectivity of action of the treatment towards parasites.

Statistical analysis

Antioxidant activity, antileishmanial activity, cytotoxicity, and the total phenolic compounds amount were expressed as mean ± standard deviation (SD). All measurements were analyzed using one-way ANOVA (analysis of variance). Duncan test was then applied to the means to identify significant differences at a percent level of 0.05. These statistical analyzes were performed with the IBM SPSS ***Statistics*** 21.0 software®.

Results and discussion

Extraction yields

Yields of all extracted EssOils are shown in Table .

EssOil extraction yields

| **Plant** | **Harvest area** | **Extraction yield (wt%)** |
| --- | --- | --- |
| *Citrus limon* | Area 1 | 0.48 ± 0.09 a |
| Area 2 | 0.25 ± 0.06 b |  |
| *Pistacia lentiscus* | Area 1 | 0.06 ± 0.01 c |
| Area 2 | 0.06 ± 0.05 c |  |

One-way ANOVA with Duncan post-test. Means values followed by different letters (a to c) within column for a given plant are significantly different (p < 0.05)

Pistacial. exhibited the lowest extraction yield. It is worth noting that for Pistacia EssOils extracted from leaves, yields were not largely reported in literature. The study of Zaouali et al. () showed that extraction yield in oil from Tunisian Pistacia leaves was around 0.15%, which is 10-fold higher than our results.

This may be due to difference between harvest periods. Indeed, seasonal variation is usually associated with the variation of yield in oils because of the variation of a set of bioclimatic and environmental factors such as air temperature, wind exposure, air humidity, water precipitation, sunlight, and UV radiation intensity, etc. From  one year to another, environmental changes submit plants to modifications in morphology, physiology, and productivity that aim to prevent damage and adapt to stress conditions (Aissi et al. ).

Despite the differences in geographic, climatic, and ecological parameters, no notable yields variation (p > 0.05) was showed for Pistacia species. However, for Citrus l., yield was about 2-fold higher in the area 1 in comparison with area 2. To our knowledge, extraction yield of Citrus l. EssOil from leaves has never been reported in previous works. Extraction yield strongly depends on the selected part of the plant. Significantly lower yields were obtained for Citrus l. flower (0.05–0.5%), whereas, Citrus l. peels showed 10-fold greater yields around 2.5% (Arteche Garcıa et al. ). Nevertheless, we selected leaves EssOil for a matter of originality.

Chemical composition

The knowledge of the chemical composition of plant extracts is sought, not only for discovering new therapeutic substances but also for understanding the value of folkloric remedies. Prior to biological activities assessment, EssOils were subjected to GC-MS analysis in order to determine their compositions.

Chemical composition of EssOils extracted from Citrus l. leaves is given in Table . Seventeen components were identified representing 98.8% of the total composition of EssOils from area 1 and from area 2. EssOil prepared from Citrusl. of area 1 was characterized by a high content of neryl acetate (29.5%), followed by nerol (13.8%), D-limonene (12.9%), geranial (7.8%), geranyl acetate (6.6%), and neral (5.8%). In contrast, EssOil extracted from Citrus l. of area 2 presented D-limonene chemotype with a content of 30.0%. Moreover, other compounds were present in high percentage as neryl acetate (16.7%) followed by β-pinene (12.8%), nerol (6.6%), and geranyl acetate (6.5%). Composition difference between these EssOils could be more clearly illustrated by the classification of terpenes family. Indeed, for Citrus EssOil from area 1, composition was mainly dominated by oxygenated monoterpenes (~ 76%). However, Citrus EssOil from area 2 composition demonstrated that it contains similar amount of non-oxygenated (47.5%) and oxygenated monoterpenes (48.2%). For both Citrus EssOils, sesquiterpenes (oxygenated or not) were present at low content (< 4%).

Composition of Citrus limon EssOils extracted from areas 1 and 2 determined by GC-MS.

| **Compounds** | **Rt (min)** | **RI** | **Relative composition (%)** | |
| --- | --- | --- | --- | --- |
| **Area 1** | **Area 2** |
| ?-Pinene | 5.07 | 948 | - | 0.8 |
| ?-Thujene | 5.61 | 969 | - | 2.6 |
| ?-Pinene | 5.69 | 972 | 3.2 | 12.8 |
| ?-Myrcene | 5.81 | 977 | - | 1.2 |
| D-Limonene | 6.41 | 1000 | 12.9 | **30.0** |
| Linalool | 7.42 | 1038 | 2.1 | 2.6 |
| Citronellal | 8.36 | 1074 | 3.4 | 3.8 |
| (-)-Terpinen-4-ol | 8.96 | 1097 | 1.7 | 1.1 |
| ?-Terpineol | 9.23 | 1108 | 1.8 | 1.1 |
| Nerol | 10.05 | 1238 | 13.8 | 6.6 |
| Neral | 10.41 | 1252 | 5.8 | 3.4 |
| Geraniol | 10.73 | 1264 | 3.5 | 2.5 |
| Geranial | 11.26 | 1284 | 7.8 | 4.1 |
| Neryl acetate | 14.07 | 1352 | **29.5** | 16.7 |
| Geranyl acetate | 14.54 | 1382 | 6.6 | 6.5 |
| Caryophyllene | 15.52 | 1506 | 2.7 | 2.1 |
| ?-Bergamotene | 15.78 | 1512 | 0.5 | - |
| ?-Bisabolene | 17.13 | 1544 | 0.8 | - |
| (-)-Spathulenol | 18.34 | 1572 | 0.7 | 0.9 |
| Methyl arachidonate | 18.45 | 1575 | 2.0 | - |
| **Total (%)** |  |  | 98.8 | 98.8 |
| *Non-oxygenated monoterpenes (%)* |  |  | 16.1 | 47.5 |
| *Oxygenated monoterpenes (%)* |  |  | 76.1 | 48.2 |
| *Non-oxygenated sesquiterpenes (%)* |  |  | 4.0 | 2.1 |
| *Oxygenated sesquiterpenes (%)* |  |  | 0.7 | 0.9 |
| *Oxygenated diterpenes (%)* |  |  | 2.0 | - |

Rt, retention time; RI, retention index; (-), < 0.2%

In bold: major compound (chemotype)

In the literature, only a small number of studies dealt with the composition of Citrus limon EssOil extracted from leaves. Results of Citrus EssOil composition from area 2 are in accordance with the composition reported by Lota et al. (), characterized by limonene as major component, followed by β-pinene, and other components such as geranial or neral at appreciable levels. However, according to Vekiari et al. (), citral compounds (geranial and neral) are the predominant constituents of this EssOil followed by limonene, neryl acetate, geranyl acetate, and β and α-pinene. Besides, Njoroge et al. () reported that Japanese Citrus EssOil extracted from leaves was mainly constituted of geranial followed by limonene and neral. Generally, neral, geranial, geranyl acetate, and neryl acetate are characteristic of Citrus EssOil extracted from leaves and are in significantly lower quantities in EssOil extracted from the fruit peels (Lota et al. ; Vekiari et al. ). These components contribute significantly to the flavor and aroma of lemon. Their concentration is by far the most important index to determine the commercial value of lemon oil (Lota et al. ; Vekiari et al. ). High content in these components in Citrus EssOil from area 1 indicates that this EssOil is of high quality and is linked to its powerful and characteristic lemon aroma.

The composition of EssOils extracted from Pistacia lentiscus leaves from area 1 and 2 are presented in Table . Thirty-one and twenty-two components were identified representing 97.7% to 97.1% of EssOils composition of area 1 and area 2, respectively.

Composition of Pistacia lentiscus EssOils extracted from areas 1 and 2 determined by GC-MS.

| **Compounds** | **Rt (min)** | **RI** | **Relative composition (%)** | |
| --- | --- | --- | --- | --- |
| **Area 1** | **Area 2** |
| Sabinene | 4.95 | 944 | - | 1.5 |
| ?-Phellandrene | 4.96 | 945 | 3.2 | - |
| ?-Pinene | 5.07 | 948 | **16.9** | 13.6 |
| Camphene | 5.29 | 957 | 2.0 | 2.3 |
| ?-Phellandrene | 5.62 | 969 | 2.4 | - |
| ?-Pinene | 5.69 | 972 | 3.2 | 6.2 |
| ?-Myrcene | 5.81 | 977 | 11.3 | **30.0** |
| O-Cymene | 6.35 | 997 | 4.5 | 3.1 |
| D-Limonene | 6.42 | 1000 | 4.9 | 5.4 |
| Isopentyl alcohol | 6.74 | 1012 | 1.1 | 0.9 |
| ?-Nonanone | 7.30 | 1034 | 0.8 | - |
| Nitrofurazone | 7.32 | 1036 | - | 0.7 |
| 2-Ethylbutyl alcohol | 7.41 | 1038 | 0.6 | - |
| Isopentyl isovalerate | 7.49 | 1041 | 1.6 | 1.5 |
| Terpinen-4-ol | 8.96 | 1097 | 4.4 | 1.3 |
| ?-Terpineol | 9.22 | 1107 | 1.6 | 1.1 |
| ?-Thujenal | 9.42 | 1115 | - | - |
| Bornyl acetate | 11.87 | 1209 | 2.0 | 2.1 |
| 2-Undecanone | 11.99 | 1220 | 1.6 | - |
| Copaene | 14.51 | 1483 | 1.4 | - |
| ?-Elmene | 14.86 | 1491 | - | 1.2 |
| Caryophyllene | 15.52 | 1506 | 3.3 | 5.6 |
| ?-Caryophyllene | 16.21 | 1522 | 1.5 | 1.6 |
| Spatulenol | 16.35 | 1526 | 0.9 | - |
| ?-Cadinene | 16.61 | 1532 | 3.3 | 2.6 |
| Germacrene D | 16.73 | 1535 | - | 5.7 |
| ?-Cubebene | 16.72 | 1534 | 1.1 | - |
| ?-Elemene | 16.96 | 1540 | 1.0 | - |
| ?-Amorphene | 17.29 | 1548 | 4.0 | 1.8 |
| Cadina-1(2),4-diene | 17.43 | 1551 | 3.0 | - |
| ?-Calacorene | 17.77 | 1559 | 0.7 | - |
| (-)-Spathulenol | 18.34 | 1572 | 0.6 | 1.6 |
| Caryophyllene oxide | 18.44 | 1575 | 5.1 | - |
| ?-Cardinene | 19.24 | 1593 | - | 5.3 |
| ?-Muurolol | 19.24 | 1595 | 4.3 | - |
| ?-Cadinol | 19.42 | 1597 | 4.4 | 2.2 |
| ?-Bisabolol | 19.76 | 1605 | 1.1 | - |
| **Total (%)** |  |  | 97.8 | 97.10 |
| *Non-oxygenated monoterpenes (%)* |  |  | 48.4 | 62.0 |
| *Oxygenated monoterpenes (%)* |  |  | 8.0 | 4.4 |
| *Non-oxygenated sesquiterpenes (%)* |  |  | 19.8 | 25.4 |
| *Oxygenated sesquiterpenes (%)* |  |  | 15.9 | 2.2 |

Rt, retention time; RI, rentention index; (-), < 0.2%

In bold: major compound (chemotype)

Pistacia EssOil from area 1 was characterized by a high content of α-pinene (16.9%), followed by β-myrcene (11.3%), D-limonene (4.9%), o-cymene (4.5%), terpinen-4-ol (4.4%), β-pinene (3.2%), and α-phellandrene (2.4%). However, EssOil from area 2 exhibited a chemotype of β-myrcene (~ 30%). Other components were also present in appreciable quantities such as α-pinene (13.6%), β-pinene (6.2%), and D-limonene (5.4%). However, these two EssOils had more similar composition in terms of terpene classes. Indeed, for both Pistacia leaves EssOils, non-oxygenated monoterpenes were the most abundant with a content between 48 and 62%, followed by the non-oxygenated sesquiterpenes that did not exceed 25.5%. Nevertheless, Pistacia EssOil from area 1 was slightly more abundant in oxygenated monoterpenes and sesquiterpenes. In the literature, there are insufficient ***data*** on EssOils composition of Pistacia genus. Only few species have so far been studied. EssOil extracted from leaves has been described in several studies to be rich in α-pinene, among other common constituents including β-myrcene, β-pinene, carvacrol, limonene, β-caryophyllene, verbenone, α-terpineol, and linalool (Rauf et al. ). Regarding Pistacial. from Tunisian flora, some previous studies described the EssOil composition extracted from leaves harvested from the same ***collection*** sites as ours. Regarding Pistacia from area 1, authors reported an EssOil composition considerably different from our results, rich in terpinen-4-ol, β-caryophyllene, and α-terpineol (Bachrouch et al. ). Aissi et al. () found that α-pinene was the most abundant compound of Pistacia EssOil from area 2 followed by limonene, terpinen-4-ol, β-caryophyllene, germacrene, and ɣ-cardinene. These results are not in accordance with ours. This difference could be due to many reasons such as differences in procedures applied: drying conditions of the plant material, extraction duration, EssOil storage conditions, etc. Furthermore, significant differences in composition could be noticed for EssOils harvested from different sampling areas. It seemed that plant genetic characteristics and environmental conditions such as geography, altitude, temperature, day length, and ***nutrients*** might play a key role in the synthesis of bioactive molecules and thus in extract composition. All these parameters have an impact on the biosynthesis pathways and then on the main characteristic molecules and their percentage (Aissi et al. ; Amhamdi et al. ; Asai et al. ). For example, EssOils composition can be affected by seasonal variations such as water restriction, luminosity rate or the presence of predators altering the secondary metabolism of the plant. These variations may alter the EssOil composition throughout the year (Bitu et al. ). On the other hand, studies highlighted the influence of seasonality on the in vitro biological efficiency, such as the antifungal activity of Psidium myrtoides and Psidium saluarte EssOils (Macedo et al. ; Macedo et al. ). Therefore, understanding the environmental conditions of the plant and the seasonal events that contribute to alter the quality of active compounds are essential to support pharmacological studies aiming to investigate EssOil greatest therapeutic potential. Interestingly, the odor of the two samples of EssOils from area 1 and area 2 was different, which reflected a difference in composition of volatile molecules.

Phenolic compounds and antioxidant activity of essential oils

Total phenolic compounds determined for all extracted EssOils are listed in Table .

Total phenolic compounds (TFC) of different EssOils

|  | ***Citrus limon*** | | ***Pistacia lentiscus*** | |
| --- | --- | --- | --- | --- |
| **Area 1** | **Area 2** | **Area 1** | **Area 2** |
| TFC (EGA/g) | 3.90 ± 0.42 | 0.21 ± 0.2 | 0.48 ± 0.14 | 2.99 ± 0.28 |

TFC, total phenolic compounds, expressed in (EGA/g) equivalent of gallic acid per gram of dried extract

Results showed that phenolic compounds did not exceed 5 equivalents of gallic acid per gram of dried extract for all EssOils.

Regarding the antioxidant activity, the inhibition concentration at 50%, IC50-AA, (expressed in mg/L) for all EssOils samples and assessed by DPPH and ABTS tests are shown in Table . The reference antioxidant was ascorbic acid (vitamin C).

Antioxidant activity of different EssOils determined by DPPH and ABTS tests

| **IC50-AA (mg/L)** | **Reference vitamin C** | ***Citrus limon*** | | ***Pistacia lentiscus*** | |
| --- | --- | --- | --- | --- | --- |
| **Area 1** | **Area 2** | **Area 1** | **Area 2** |
| DPPH | 3.1 ± 0.2 | > 100 | > 100 | > 100 | > 100 |
| ABTS | 2.1 ± 0.2 | > 100 | > 100 | > 100 | > 100 |

IC50-AA, inhibition concentration at 50%

Compared to ascorbic acid, no significant activity was found for all EssOils of the two plant species. This may be due to the dominance of non-phenolic compounds in these EssOils (Tables  and ). This was confirmed by Folin-Ciocalteu test that showed that these EssOils did not contain significant amount of polyphenols (Table ).

Phenolic compounds and terpenes with conjugated double bonds are responsible of substantial antioxidant activity (Dhifi et al. ). As shown in the previous section, chemical compositions of extracted EssOils (Tables and ) are abundant in non-oxygenated monoterpenes such as α-pinene, β-myrcene or limonene. These monoterpenes hydrocarbons have no antioxidant effect (Farag et al. ).

The presence of hydroxyl group could play a role in radical scavenging activity of an EssOil (Farag et al. ). However, geranyl acetate, present in Citrus EssOil, did not exhibit any antioxidant activity (Quintans Júnior et al. ). Other compounds in Citrus EssOil could present an important antioxidant activity thanks to the phenolic structure such as for nerol and geraniol. These phenolic compounds have redox properties and could play an important role in neutralizing free radicals (Dhifi et al. ). However, it seems that they were not present in sufficient amount in our samples to exert a significant antioxidant activity.

Antileishmanial activity in axenic amastigotes and intramacrophage amastigotes, and cytotoxicity

All EssOils were tested for their antileishmanial activity against L. major parasite (axenic amastigotes form and intramacrophage amastigotes). A sample was considered highly effective against the parasite when IC50 value was lower than 10 μg/mL, and moderately effective when IC50 was between 10 and 20 μg/mL. A sample with IC50 value higher than 20 μg/mL was not considered promising. The cytotoxicity of all EssOils was also evaluated by calculating the selectivity index (SI). An EssOil was considered selective to parasite and safe to macrophage when its SI value was higher than 10 (Le et al. ).

Results presented in Table showed that IC50 obtained for both axenic and intramacrophage amastigote forms were significantly different (p < 0.05) depending on the harvesting region. This could be attributed to the difference of EssOils composition induced by the different environmental and climatic conditions that the plant underwent (previously described in the “” section).

Antileishmanial activity and cytotoxicity of studied EssOils and miltefosine (HePC) as a reference compound

| **Plant/harvest area** | | **IC50 axenic amastigotes (?g/mL)** | **IC50 intramacrophage amastigotes (?g/mL)** | **CC50 (?g/mL)** | **Selectivity index (SI)** |
| --- | --- | --- | --- | --- | --- |
| *Citrus limon* | Area 1 | 12.1 ± 1.8 a,A | 4.2 ± 1.3 ab,A | 49.6 ± 7.2 a,B | 11.7 |
| Area 2 | 24.0 ± 3.6 b,A | 13.8 ± 0.7 b,B | 48.2 ± 4.2 a,C | 3.5 |  |
| *Pistacia lentiscus* | Area 1 | 0.5 ± 0.2 a,A | 12.5 ± 1.4 b,B | 68.5 ± 4.2 b,C | 3 |
| Area 2 | 56.1 ± 20.5 c,A | 35.6 ± 0.7 c,A | > 100 c,B | > 1 |  |
| HePC*\** | 2.7 ± 0.4 a,A | 2.0 ± 0.6 a,A | 62.1 ± 4.4 b,B | 31.4 |  |

a–c Means within a column with different letters were significantly different (p < 0.05)

A–C Means within a line with different letters were significantly different (p < 0.05)

HePC, hexadecylphosphocholine (miltefosine), the positive control

\*IC50 and CC50 of HePC are expressed in μM

The best growth inhibitory effect on axenic amastigotes form of the parasite was observed for Citrus EssOil from area 1 and Pistacia EssOil from area 1. The antileishmanial activities of these EssOils were comparable (p > 0.05) to the activity of miltefosine, the reference drug. However, Citrus EssOil from area 2 and Pistacia EssOil from area 2 did not show any interesting inhibitory activity against axenic amastigote form of L. major, as their IC50 values were higher than 20 μg/mL. Concerning the activity against intramacrophage amastigote form, Citrus EssOil from area 1 exhibited the best inhibitory effect with IC50 < 10 μg/mL. Moreover, this activity was close to the IC50 value obtained with miltefosine (p > 0.05). However, EssOils of Citrus area 2 and of Pistacia area 1 presented a moderate activity with IC50 values ranging between 11 and 15 μg/mL. Moreover, as for the axenic amastigotes form, no significant activity (p > 0.05) was noticed for EssOil of Pistacia from area 2 against the intracellular amastigotes form.

According to these results, antileishmanial activity varied significantly from the axenic to intramacrophage amastigotes forms. Indeed, Citrus EssOil from area 2 was significantly more active (p < 0.05) against the intracellular form since the IC50 value was 2-fold lower than that for the axenic form. Consequently, the antileishmanial potential may be dependent on the proper cell functions of macrophages. In this context, De Muylder et al. () tested the antileishmanial activity of naloxonazine. This compound exhibited no activity against axenic amastigote form but showed a good effect against intracellular amastigotes. Naloxonazine has an indirect action on pathogens via macrophage activation. Currently, this kind of compounds is of a particular interest for targeting host factors that are essential for parasite development. This emerging strategy is assumed to be less prone to induce drug resistant pathogens. It also offers the possibility to repurpose drugs by exploiting compounds currently used for diseases unrelated to microbial infections (De Muylder et al. ).

Conversely, IC50 values could also increase from the free-living amastigote to intracellular amastigote. This case was observed for Pistacia EssOil from area 1 that exhibited a high inhibitory effect on the axenic form and a moderate inhibitory effect against intramacrophage form. This could be explained by the localization of the parasite inside the parasitophorous vacuole that constitutes a serious hurdle for small molecules, like terpenes in our case. Indeed, active molecules need to cross three biological barriers and resist to both neutral and acidic pH (De Rycker et al. ). It is important to point out that in literature, requirements of specific compounds to display activities against intracellular forms are higher (Leal et al. ). Nevertheless, compounds that exert an effect only against the free amastigote form may be of interest since these small molecules may be able to reach the vacuole and exhibit their antiparasitic effect after further chemical optimization. Other alternative delivery strategy, like encapsulation and targeting, could also be promising for such compounds (Leal et al. ).

It is relevant to consider treatment toxicity on macrophage cells. SI values showed that EssOil of Citrus from area 1 exhibited a selective antiparasitic effect with SI values higher than 10 (SI ~ 12). Thus, this EssOil is considered safe for macrophages. However, despite the good antiparasitic effect of Citrus EssOil from area 2 and Pistacia EssOil from area 1, high cytotoxicity was observed with low selectivity values of 3.5 and 3, respectively. This study demonstrated that EssOil of Citrus from area 1 may be a promising source for active molecules against Leishmania major parasite.

To have a general overlook at antileishmanial activity and cytotoxicity of the studied EssOils and to analyze the observed effects, we gathered in Table literature ***data*** of EssOils extracted from these plants and their major compounds.

Profile of in vitro antileishmanial activity and cytotoxicity of EssOils and their major compounds from Citrus limon and Pistacia lentiscus in literature

| **Plant** | **Whole plant EssOil/Major compounds** | **Antileishmanial activity** | | **Cytotoxicity** | | **Ref.** |
| --- | --- | --- | --- | --- | --- | --- |
| ***L. species*/form** | **IC50 (?g/mL or ?M)\*** | **Cell line/animal** | **CC50/LD50** |
| *Citrus limon* | Whole EssOil | nd | nd | LIM1863 | 5.75?7.92 ?g/mL | Jomaa et al. () |
| Limonene | *L. major*/ama | 354 ± 33 | LLCMK2 | > 1012 ?M | Arruda et al. () |  |
| *L. amazonensis*/ama | < 300 |  |  |  |  |  |
| *L. chagasi*/prom | 185 ± 19 | HEK-293 |  |  |  |  |
| *L. braziliensis*/prom | 201 ± 17 |  |  |  |  |  |
| ß-pinene | *L. major*/prom | 200.1 | HL-60 | 29.6 ?g/mL | Mikus et al. () |  |
| Citrals: neral/geranial | *L. donovani*/prom | 19 | Kidney epithelial cells | 22.4 ?g/mL | Zheljazkov et al. () |  |
| *L. infantum*/prom | 42 | Raw 264.7 | No toxicity | Machado et al. () |  |  |
| *L. amazonensis*/prom | 8.0 ± 0.1 | J774G8 | 50.0 ± 0.1 ?g/mL | Santin et al. () |  |  |
| *L. amazonensis*/ama | 25.0 ± 0.3 |  |  |  |  |  |
| *L. major*/prom | 36 | Raw 264.7 | No toxicity | Machado et al. () |  |  |
| *L. tropica*/prom | 34 |  |  |  |  |  |
| Geranyl acetate | nd | nd | Rat | 6330 mg/kg | Jenner et al. () |  |
| *Pistacia lentiscus* | Whole EssOil | *L. donovani*/prom | 4?7.5 | nd | nd | Bachrouch et al. () |
| *L. major/prom* | 17.52 ± 1.26 | nd | nd | Bouyahya et al. () |  |  |
| nd | nd | SH-SY5YSK-N-BE (2) C | 13.6 ± 0.5 ?g/mL26.3 ± 1.2 ?g/mL | Piccolella et al. () |  |  |
| ?-pinene | *L. major*/prom | 19.80 ± 0.23 | HL-60 | 2.5 ?g/mL | Mikus et al. () |  |
| *L. infantum*/prom | 17.60 ± 0.88 | Raw 80 | 230.3 ± 1.3 ?g/mL | Essid et al. () |  |  |
| ß-myrcene | *L. infantum*/prom | 164 | Raw 264.7 | No toxicity | Machado et al. () |  |
| Cymene | *L. major*/prom | 219.17 ± 0.50 | Raw 80 | nd | Essid et al. () |  |
| *L. infantum*/prom | 156.17 ± 0.45 | nd | 115.4 ?g/mL | Escobar et al. () |  |  |
| *L. chagasi*/prom | 149.1 ± 1.0 | Vero | 157.3 ?g/mL |  |  |  |
| *L. chagasi*/ama | > 30 | THP-1 | nd |  |  |  |
| Terpinen-4-ol | *L. major*/prom | 335.9 | Hs 578THL-60 | No toxicity20.5 ?g/mL | Sibanda et al. () |  |
| Mikus et al. () |  |  |  |  |  |  |
| Phellandrene | *L. major*/prom | 32.8 | HL-60 | 29.6 ?g/mL | Mikus et al. () |  |

\*IC50 expressed in μg/mL for essential oils and in μM for major compounds

Prom, promastigote; ama, amastigote; nd, not determined

For the best of our knowledge, Citrus limon EssOil was analyzed in our study for the first time for its antileishmanial potential. As seen above, the EssOil from Citrus limon leaves exhibited good growth inhibitory effect against especially intracellular L. major regardless the harvesting region. Unfortunately, the activity of EssOil of area 2 was cytotoxic and not selective to parasites as SI value was by far less than 10. In literature, it has been shown that Citrus limon EssOil were cytotoxic on LIM1863 colon carcinoma cell line with low CC50 values ranging from 5.75 to 7.92 μg/mL (Jomaa et al. ). Besides, Citrus EssOil from area 1 was characterized by a remarkable intracellular activity and a good selectivity of action on L. major. The difference between Citrus EssOils from both areas is obviously due to the difference in composition of these EssOils obtained from different sites. Citrus EssOil from area 1 was characterized by higher content on neryl acetate (29.5%), nerol (13.8%), and citral compounds (total of 14.4%) than area 2. Among these compounds, only citral compounds, including geranial and neral, were widely studied for their antileishmanial activity. However, tests were basically performed on the promastigote stage of different Leishmania species. Citral did not reveal a significant growth inhibitory effect against L. major, L. tropica, L. infantum promastigotes, and L. amazonensis amastigotes (Machado et al. ; Santin et al. ). However, it exhibited good inhibitory effect on L. amazonensis and L. donovani promastigotes (Santin et al. ; Zheljazkov et al. ). Ultrastructure characterization performed with Transmission Electron Microscopy revealed that protozoa of L. amazonensis treated with citral compounds showed drastic alteration in their morphology, such as the presence of exocytic projections in the flagellar pocket, and swollen mitochondria, with plasma membrane blebs seeming to detach from the parasite surface (Santin et al. ). These findings could indicate a specific activity of citral compounds related to the Leishmania live-stage and species. Hence, citral might contribute to the good inhibitory effect of Citrus EssOil from area 1 in our study. Note that citral compounds were also present in Citrus EssOil from area 2 but not in appreciable amount. On the other hand, citral did not exhibit a cytotoxic effect on the parasite host cell (Raw 264.7) (Machado et al. ) but revealed a toxic action on J774 G8 and kidney epithelial cells (Santin et al. ; Zheljazkov et al. ). Therefore, the cytotoxic effect of the extracted EssOil should further be investigated in different cell lines to confirm its safety. Moreover, Arruda et al. () showed that limonene exhibited significant activity against L. major amastigote intramacrophage form and L. amazonensis-infected macrophages (with 78% reduction in infection rates). In vitro antiparasitic activity evaluation of limonene showed that this nontoxic anticancer monoterpene efficiently inhibited the non-mevalonate pathway of isoprenoid synthesis in parasites (Plasmodium falciparum) (Moura et al. ). Antileishmanial efficacy was also assessed in cutaneous leishmaniasis experimental model in BALB/c infected mice. Treated topically or intrarectally with limonene, mice exhibited significant reduction in lesion area and significant decrease in parasite load. Moreover, limonene was able to enhance the percutaneous permeation of drugs (Arruda et al. ). These findings could explain the moderate activity against intracellular L. major observed for Citrus EssOil from area 2 whose major compound was limonene.

Regarding Pistacia lentiscus EssOils, a previous study confirmed the interesting activity of this EssOil from Tunisian flora with IC50 ranged between 4 and 7.5 μg/mL (Bachrouch et al. ). More recently, a study proved that EssOil extracted from Pistacia leaves with myrcene and α-pinene as major compounds displayed an important activity against Leishmania species, especially L. major (Bouyahya et al. ). α-pinene, the major compound of the active Pistacia EssOil from area 1 (16.7%), also exhibited a moderate antileishmanial activity against two species of promastigote, L. infantum and L. major, with IC50 values of 17.60 ± 0.88 μM (Essid et al. ) and 19.80 ± 0.23 μM (Mikus et al. ), respectively. However, activity was not noticed for other compounds present in appreciable amount in Pistacia EssOil from area 1, such as ß-myrcene, o-cymene, terpinen-4-ol, and phellandrene (Escobar et al. ; Essid et al. ; Machado et al. ; Mikus et al. ; Sibanda et al. ). Conversely, minor compounds in Pistacia EssOil such as caryophyllene were reported to inhibit efficiently Leishmania genus (Pereira et al. ). Caryophyllene and α-caryophyllene, present at low amount (< 6%) in the active EssOil (Pistacia area 1), caused a mitochondrial damage to both promastigotes and amastigotes of Leishmania. This mechanism of action was mainly attributed to the inhibition of isoprenoids biosynthesis (Santos et al. ). Interesting activity observed for Pistacia EssOil of area 1 could also be attributed to a synergistic effect between different terpenes. In addition, major compounds presented a considerable toxicity for several cell lines such as Vero and Raw 80 (Escobar et al. ; Essid et al. ). This could explain the cytotoxicity observed for Pistacia EssOils in our study.

The mechanism by which EssOils exert inhibition on parasite growth is still obscure because specific cellular targets have not been identified yet. However, previous studies have suggested that the antileishmanial activity is related to cell membrane disruption by virtue of essential oils composition in terpenes that contribute to their lipophilic characteristics. Indeed, these diverse compounds led to multiple mechanisms of action affecting either polysaccharides or fatty acids and phospholipids layers in plasma membranes of Leishmania parasites, which results in lyses and release of molecules (Pereira et al. ). Terpenes properties allow their diffusion through the parasite cell membrane affecting intracellular metabolic pathways and organelles (Brenzan et al. ; Ultee et al. ). Moreover, other studies indicated that EssOils activity could also be linked to the capacity of an EssOil to interact with mitochondrial membranes by generating free radicals that oxidize parasite macromolecules leading ultimately to its death by apoptosis or necrosis (Tariku et al. ; Ultee et al. ). It is important to point out that the latter hypothesis did not correspond to the mechanism of action of EssOils studied here. Indeed, we proved in this work, through antioxidant activity assessment and polyphenols quantification, that none of the EssOils showed an ability to generate free radicals entities. Thus, the interesting antileishmanial activity of the studied EssOils could probably be attributed to the lipophilic properties of terpenes.

Conclusion

This study showed the high potential of the EssOil extracted from leaves of Citrus limon from area 1 of Tunisia to inhibit the Leishmania major (axenic and intracellular amastigotes) growth, without having a cytotoxic effect on host cell. Selective activity proved the safety of this EssOil for macrophages. This study demonstrated for the first time the antileishmanial activity of EssOil extracted from Citrus leaves. This interesting result could be linked, either to the activity of major compounds previously reported such as citral compounds, or to synergistic effect between different EssOil compounds. On the other hand, Pistacia EssOil from area 1 displayed a moderate antileishmanial activity with important toxicity towards macrophages. Despite this observed cytotoxicity, the encapsulation of this EssOil could be a promising strategy, which could eventually reduce its toxicity and therefore improve its antiparasitic efficacy. The promising results of this study offer prospects for further investigations such as the antileishmanial evaluation of major compounds of active EssOils, and their mixture. A bioguided fractionation of EssOils could allow identifying molecules that are responsible of the observed effects. Moreover, an assessment of EssOils activity against other Leishmania species and the test of cytotoxicity on another cell line could be considered. In addition, in vivo evaluations of EssOils and their major isolated components could be performed on the L. major/BALB/c mice model. This research could contribute to the discovery of new effective drugs against leishmaniasis.

**Acknowledgments**

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**Notes**

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**End of Document**



[***Federal Register: Prior Label Approval System: Expansion of Generic Label Approval Pages 56538 - 56548 [FR DOC #2020-17340]***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:60V8-SJN1-F0YC-N0GH-00000-00&context=1516831)

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**Body**

Washington: Office of the Federal Register has issued the following notice:DEPARTMENT OF AGRICULTUREFood Safety and Inspection Service9 CFR Parts 352, 354, and 412[Docket No. FSIS-2019-0019]RIN 0583-AD78Prior Label Approval System: Expansion of Generic Label ApprovalAGENCY: Food Safety and Inspection Service, USDA.ACTION: Proposed rule.-----------------------------------------------------------------------SUMMARY: The Food Safety and Inspection Service (FSIS) is proposing to amend its inspection regulations to expand the circumstances under which FSIS will generically approve the labels of meat, poultry, and egg products. FSIS is also proposing to cease evaluating generically approved labels submitted to FSIS for review.DATES: Submit comments on or before November 13, 2020.ADDRESSES: FSIS invites interested persons to submit comments on this document. Comments may be submitted by one of the following methods: Federal eRulemaking Portal: This website provides commenters the ability to type short comments directly into the comment field on the web page or to attach a file for lengthier comments. Go to [*http://www.regulations.gov*](http://www.regulations.gov). Follow the on-line instructions at that site for submitting comments. Mail, including CD-ROMs, etc.: Send to Docket Clerk, U.S Department of ***Agriculture***, Food Safety and Inspection Service, 1400 Independence Avenue SW, Mailstop 3758, Room 6065, Washington, DC 20250-3700. Hand or Courier-Delivered Submittals: Deliver to 1400 Independence Avenue SW, Room 6065, Washington, DC 20250-3700. Instructions: All items submitted by mail or electronic mail must include the Agency name and docket number FSIS-2019-0019. Comments received in response to this docket will be made available for public inspection and posted without change, including any personal information, to [*http://www.regulations.gov*](http://www.regulations.gov). Docket: For access to background documents or comments received, call (202) 720-5627 to schedule a time to visit the FSIS Docket Room at 1400 Independence Avenue SW, Room 6065, Washington, DC 20250-3700.FOR FURTHER INFORMATION CONTACT: Rachel Edelstein, Acting Assistant Administrator, Office of Policy and Program Development, by telephone at (202) 720-0399.SUPPLEMENTARY INFORMATION:Executive Summary To prevent the introduction of adulterated or misbranded products into commerce, the Food Safety and Inspection Service (FSIS) implements a prior approval program for labels intended to be used on federally inspected meat, poultry, and egg products (9 CFR part 412). Without approved labels, these products may not be sold, offered for sale, or otherwise distributed in commerce. Certain categories of labels or renderings of such labels (sketch labels) must be submitted to FSIS for review and approval before use. However, FSIS considers certain labels that comply with the Agency's labeling rules to be ``generically'' approved. Such labels are not submitted to FSIS, because they are deemed approved and may be applied to product in commerce. Generic label approval has been in place in some form since 1983. FSIS has previously expanded the categories of labeling claims eligible for generic approval, most recently in 2013 (78 FR 66826, November 7, 2013). FSIS has also published a proposed rule that, if finalized as proposed, would permit generic approval for egg product labels (83 FR 6314, February 13, 2018). FSIS is now proposing to expand the[[Page 56539]]categories of meat, poultry, and egg product labels that it will deem generically approved and thus not required to be submitted to FSIS. Specifically, under this proposal the following labels would no longer need to be submitted to FSIS for approval: (1) Labels on products for export that deviate from FSIS requirements; (2) labels that list ingredients in the ingredients statement as being certified ``organic'' (e.g , organic garlic) under the ***Agricultural*** Marketing Service (AMS) National Organic Program; (3) labels that display geographic landmarks, such as a foreign country's flag, monument, or map; (4) labels that make ``negative'' claims identifying the absence of certain ingredients or types of ingredients (e.g , statements such as ``No MSG Added,'' ``Preservative Free,'' ``No Milk,'' ``No Pork,'' or ``Made Without Soy''); and (5) labels of products that receive voluntary FSIS inspection (e.g , exotic species under 9 CFR part 352). Finally, FSIS is proposing to cease evaluating labels submitted to FSIS that are eligible for generic approval. These reforms would result in an estimated 33.8 percent reduction in label submissions (based on fiscal year 2019 ***data***) and reduce Agency costs expended to evaluate the labels (see Table 1). There will not be any negative food safety impacts from this proposal, based on FSIS's experience evaluating these types of labels and the ability of inspection personnel to continue to verify labeling requirements in the field. There is no cost burden for the industry or FSIS for the proposed rule. This is shown in Table 1 below, which summarizes the costs and benefits of the proposed rule. Industry would experience cost savings of $468,864, annualized at the 7 percent discount rate over 10 years, from the reduction in preparing and submitting certain labels for FSIS evaluation. FSIS would experience cost savings of $235,690, annualized at the 7 percent discount rate over 10 years, from the reduction in label evaluations. Table 1--Summary of Annualized Costs and Benefits---------------------------------------------------------------------------------------------------------------- Costs Cost savings Net benefits----------------------------------------------------------------------------------------------------------------Industry........................................................ $0 $468,864 $468,864Agency.......................................................... 0 235,690 235,690 ----------------------------------------------- Total....................................................... 0 704,554 704,554----------------------------------------------------------------------------------------------------------------Note: Estimates are annualized using a 7 percent discount rate over 10 years.Table of ContentsI. Background A. Current Label Regulations B. Current Prior Label Approval System C. Generic Label ApprovalII. Proposed RuleIII. Surveillance and EnforcementIV. Executive Orders 12866 and 13563V. Regulatory Flexibility Act AssessmentVI. Executive Order 13771VII. Paperwork Reduction ActVIII. E-Government ActIX. Executive Order 12988X. Executive Order 13175XI. USDA Non-Discrimination StatementXII. Environmental ImpactXIII. Congressional Review ActXIV. Additional Public NotificationI. Background The Federal Meat Inspection Act (FMIA) (21 U.S.C 601 et seq.), Poultry Products Inspection Act (PPIA) (21 U.S.C 451 et seq.), and Egg Products Inspection Act (EPIA) (21 U.S.C 1031 et seq.) direct the Secretary of ***Agriculture*** to maintain inspection programs designed to ensure that meat, poultry, and egg products are safe, wholesome, not adulterated, and properly marked, labeled, and packaged. These laws prohibit the sale of products under any false or misleading name, marking, or labeling and require the Secretary to approve product marking and labeling (21 U.S.C 457(c), 607(d), and 1036(b)). The Department's longstanding interpretation of these provisions is that they require the Secretary or his or her representative to approve all labels to be used on federally inspected and passed, domestic and imported, meat, poultry and egg products, before the products may be distributed in commerce. To implement these provisions, FSIS uses a prior approval program for labels on federally inspected meat, poultry, and egg products (9 CFR part 412). Without approved labels, meat, poultry, and egg products may not be sold, offered for sale, or otherwise distributed in commerce.A. Current Label Regulations The meat, poultry, and egg products labeling regulations require that meat, poultry, and egg products are truthfully labeled, and that the labeling provides the necessary product information for consumers to make informed purchasing decisions. There are up to eight features required on meat, poultry, and egg product labels. The required features include: (1) The standardized, common or usual, or descriptive name, of the product (9 CFR 317.2(e), 381.117, and 590.411(c)(1)); (2) an ingredients statement containing the common or usual name of each ingredient of the product listed in descending order of predominance (9 CFR 317.2(f), 381.118, and 590.411(c)(1)); (3) the name and place of business of the manufacturer, packer, or distributor (9 CFR 317.2(g), 381.122, and 590.411(c)(2)); (4) an accurate statement of the net quantity of contents (9 CFR 317.2(h), 381.121, and 590.411(c)(4)); (5) the inspection legend, including the number of the official establishment (9 CFR 312.2(b), 317.2(i), 381.96, 381.123, and 590.411(c)(5)); (6) a handling statement if the product is perishable, e.g , ``Keep Frozen'' or ``Keep Refrigerated'' (9 CFR 317.2(k), 381.125(a), and 590.410(a)(1)-(2)); (7) nutrition labeling for applicable meat and poultry products (9 CFR part 317, subpart B; part 381, subpart Y; and 590.411(e)); \1\ and (8) safe handling instructions if the meat or poultry component of the product is not ready-to-eat (9 CFR 317.2(l) and 381.125(b)). In addition, imported meat, poultry, and egg products must bear the country of origin under the product name (9 CFR 327.14(b)(1), 381.205(a), and 590.950(a)(2)).--------------------------------------------------------------------------- \1\ Nutrition labeling for egg products must comply with the provisions of 21 CFR part 101, promogulated under the Federal Food, Drug, and Cosmetic Act and the Fair Packaging and Labeling Act [9 CFR 590.411(e)].--------------------------------------------------------------------------- These required features must appear on the immediate containers of domestic products (9 CFR part 317, subpart A, and part 381, subpart N) and imported products (9 CFR part 327 and part 381, subpart T; 590.411(c); and 590.950(a)). The meat inspection regulations define an ``immediate container'' as ``the receptacle or other covering in which any product is directly contained or wholly or partially enclosed'' (9 CFR 301.2). The EPIA and poultry products inspection regulations define an ``immediate container'' as ``any consumer package; or any other container in which poultry products,[[Page 56540]]not consumer packaged, are packed'' (21 U.S.C 1033(d)(1) and 9 CFR 381.1(b)). The principal display panel, information panel, or other surface of the product label must prominently display the mandatory features. The first six features described above, and the labeling of country of origin for imported products in accordance with 9 CFR 327.14 and 381.205, have been required by the meat and poultry inspection regulations for decades. FSIS published regulations that require the nutrition labeling of cooked or heat-treated multi-ingredient meat and poultry products and the display of safe handling instructions in 1993 and 1994, respectively. Given industry's familiarity with these requirements, FSIS typically finds establishments in compliance with its labeling regulations. The regulations contain other provisions to ensure that no statement, word, picture, design, or device that is false or misleading in any particular, or that conveys any false impression, or that gives any false indication of origin, identity, or quality, appears in any marking or other labeling (9 CFR 317.8, 381.129, and 590.411(f)(1)). Pursuant to the authority contained in section 7(e) of the FMIA (21 U.S.C 607(e)), section 8(d) of the PPIA (21 U.S.C 457(d)), and section 7(b) of the EPIA (21 U.S.C 1036(b)), the Administrator of FSIS may withhold the use of any marking or labeling that is false or misleading, within the meaning of the FMIA, PPIA, and EPIA and their implementing regulations.B. Current Prior Label Approval System Under the current regulations, FSIS evaluates sketches of some labels for approval, and approves others generically, i.e , without submission to FSIS for sketch approval. A sketch label is a printer's proof or other version that clearly shows all required label features, size, location, and indication of final color (9 CFR 412.1(d)). To obtain sketch label approval, domestic meat and poultry establishments, egg product plants, and certified foreign establishments that are eligible to export product to the United States, or their representatives, are required to submit sketch labels to FSIS for evaluation, except when the label is generically approved by the Agency under 9 CFR 412.2 These firms submit sketch labels accompanied by FSIS Form 7234-1 (11/16/2011), ``Application for Approval of Labels, Marking or Device,'' to the Agency for evaluation. In addition to the required label information, any special claims or statements that the establishment intends to make (e.g , quality claims, animal production raising claims, product origin claims, or ***nutrient*** content claims) must be included on the label, along with documentation supporting the claim. The label application must contain the basic information about the establishment and the product, including: 1. Establishment number; 2. Product name; 3. Product formulation; 4. Processing procedures and handling information; 5. Firm name and address; 6. Total available labeling space of the container; 7. Size of the principal display panel; and 8. The Hazard Analysis and Critical Control Point category under which the establishment is producing the meat or poultry product. FSIS's Labeling and Program Delivery Staff (LPDS), in the Office of Policy and Program Development (OPPD), verifies that sketch labels comply with the applicable requirements. Since July 1, 1996, a final version of a verified sketch label does not have to be submitted to the Agency for evaluation and approval (60 FR 67444, December 29, 1995).\2\ All labels are subject to verification for compliance with Agency regulations by FSIS inspectors to ensure that they are accurate, truthful, and not misleading.--------------------------------------------------------------------------- \2\ On February 13, 2018 FSIS published the Egg Products Inspection Regulations proposed rule (83 FR 6314). If the rule is finalized as proposed, FSIS will also not require submission of final versions of sketch labels for egg products.---------------------------------------------------------------------------C. Generic Label Approval FSIS allows certain meat, poultry, and egg product labels that bear all required labeling features and that comply with the Agency's labeling regulations to be generically approved (9 CFR 412.2(a)(1)). Generically approved labels do not need to be submitted to FSIS for sketch approval before they can be used on products in commerce. Generic label approval requires that all mandatory label features are prominent and conform to FSIS regulations. Although such labels are not submitted to FSIS for approval, they are deemed to be approved and, therefore, may be applied to product in accordance with the Agency's prior label approval system. Generic label approval has been in place in some form since 1983. That year, FSIS promulgated regulations that granted limited label approval authority to Inspectors-In-Charge (IICs) at official establishments and provided generic approval to limited types of labels (e.g , labels for raw, single ingredient meat and poultry products) (48 FR 11410, March 18, 1983). The rulemaking's intent was to reduce the number of labels and other materials submitted for FSIS evaluation and to ease the paperwork burden on official establishments. Even with the changes made by the rule, the number of labels submitted to the Agency continued to grow. During fiscal year 1991, the Agency processed approximately 167,500 labels. Of these, FSIS approved approximately 87,500 final labels and 60,000 sketch labels. FSIS disapproved approximately 20,000 labels. On December 29, 1995, FSIS published a final rule that outlined the types of labels and modifications to labels that were deemed to be approved without submission to FSIS, provided that the label displayed all mandatory label features in conformance with applicable Federal regulations (60 FR 67444). The following labeling was deemed generically approved in that final rule: Labels on products with a standard of identity specified in FSIS regulations or Food Standards and Labeling Policy Book \3\ (``Policy Book''); labels for raw, single-ingredient products that do not bear special claims; labels for containers of meat and poultry products sold under contract specifications to the Federal Government; labels for shipping containers that contain fully labeled immediate containers; labels for products not intended for human food (e.g , for the pharmaceutical industry) and for poultry heads and feet to be exported for processing as human food, provided specific regulatory requirements are met; meat and poultry inspection legends that comply with 9 CFR parts 312, 316, and 381, subpart M; labeling on inserts, tags, liners, posters, and like devices that are not misleading and do not reference products; labels for consumer test products not intended for sale; and labels that were previously sketch approved by FSIS and contain no modifications or only certain listed modifications.--------------------------------------------------------------------------- \3\ Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/Labeling-Policies.---------------------------------------------------------------------------*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/Labeling-Policies.---------------------------------------------------------------------------) The 1995 final rule also transferred responsibility for maintaining labeling records from IICs to official establishments in the United States and to foreign establishments certified as meeting U.S requirements under foreign inspection systems. For labels that still required FSIS review, the final rule removed the requirement that firms submit final labels for FSIS approval; thus, today, firms must only submit[[Page 56541]]sketch labels. In the preamble to the 1995 final rule, FSIS stated that it intended to expand generic labeling after it completed an assessment of the modified system (60 FR 67444, 67448). As explained in the preamble to the 2011 rule, FSIS completed this assessment in 1998 (76 FR 75809, December 5, 2011). FSIS surveyed industry to measure the effects of the generic approval program and sampled 1,513 labels for compliance with Federal regulations and policies. FSIS concluded that the great majority of establishments effectively used generically approved labels and that the gradual implementation of generic label provisions under the 1995 final rule was effective. In 2011, FSIS published a proposed rule to replace the extensive list of generically approved meat and poultry labeling with a simpler set of label categories required to be submitted for Agency approval. FSIS proposed to require submission of: Labels for temporary approval, labels for products produced under religious exemption, labels for export with labeling deviations, and labeling with special statements and claims (76 FR 75809). FSIS also proposed to combine the label approval regulations for meat and poultry products (9 CFR 317.4 and 381.132) into a new part, 9 CFR part 412. FSIS finalized the 2011 proposed rule on November 7, 2013 (78 FR 66826). The final rule codified the labeling categories and combined the meat and poultry labeling regulations as proposed. However, upon consideration of comments, FSIS finalized the rule with four changes (78 FR 66826, 66827). First, FSIS decided to continue to review generic labels that establishments voluntarily submit for approval; but, the Agency also made clear that such labels would receive lower review priority than non-generic labels. Second, FSIS clarified that special statements or claims (except for ``natural'' and negative claims) that are defined in FSIS's regulations or in the Policy Book are deemed to be generically approved. Third, FSIS determined that a label bearing a child-nutrition (CN) box will not be considered to have a special statement or claim on it that would require sketch approval by FSIS because such information was evaluated for approval by AMS. Finally, the Agency stated that it would no longer add new entries to the Policy Book; however, already existing entries may be revised or removed. In the regulatory text of the 2013 final rule, FSIS stated that it would assess compliance by selecting samples of generically approved labels from establishments [9 CFR 412.2(a)(2)]. Additionally, after the final rule was published, FSIS received questions about the effectiveness of generic approval. To address these concerns and to establish a protocol for the future national assessment, the FSIS Office of Policy and Program Development (OPPD) conducted a limited assessment of labels. OPPD conducted this assessment over a three-week period in September 2016.\4\ Labeling policy experts traveled to five Federal meat and poultry establishments within the commuting area of FSIS headquarters in Washington, DC. Both large and small establishments were visited, including at least one corporation. In each establishment, the labeling policy experts assessed compliance of a representative sample of the generically approved label records on file. At the close of each assessment, the labeling policy experts held a closeout meeting with the FSIS inspection personnel and the establishment management. At this meeting, the labeling policy experts explained any deficiencies, determined if temporary approval was needed for deficient labels, and made recommendations for changes in the establishment's generic label approval and records management process. An assessment summary letter of this closeout meeting was provided to the establishment, inspection personnel, and the FSIS Office of Field Operations District Manager.--------------------------------------------------------------------------- \4\ Methodology available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-policies/assessment-generically-approved-label.---------------------------------------------------------------------------*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-policies/assessment-generically-approved-label.---------------------------------------------------------------------------) This assessment found a high level of compliance with the requirements. During examination of 270 labels, FSIS identified only three labels with deficiencies necessitating label revocation, and none of these deficiencies involved food safety. During the closing meetings with establishments, inspection and industry personnel determined that more outreach would significantly improve compliance. FSIS has initiated more outreach regarding labeling requirements, as discussed later in this document. On February 13, 2018, FSIS published the proposed rule, Egg Products Inspection Regulations (83 FR 6314). This rule proposed several changes to FSIS's egg product inspection program, one of which adopted by reference FSIS's generic label approval regulation into the egg products regulations (9 CFR 590.412). If the rule is finalized as proposed, egg products will be eligible for generic approval of product labels on the same basis as meat and poultry product labels.II. Proposed Rule Since the 2013 rulemaking that established the categories of labels requiring sketch approval, FSIS has gained significant, additional experience evaluating labels required to be submitted and approved. From that experience, the Agency has concluded that the current label regulations continue to require industry to submit for approval a significant number of labels that could successfully be generically approved. FSIS is therefore proposing changes to its regulations to reduce the number of labels submitted for evaluation by FSIS and to lessen the paperwork burden on official establishments. The reduction in staff time spent approving these labels would allow the Agency to better focus on other consumer protection and food safety activities, such as developing guidance materials, answering labeling policy questions, providing outreach to stakeholders, and ensuring inspection program personnel (IPP) effectively verify that establishments meet labeling requirements. All labels used at official establishments would still be subject to FSIS verification activities in the field. These activities are further described in the section III. ``Surveillance and Enforcement'' below. First, FSIS is proposing to extend generic label approval to products only intended for export that deviate from domestic labeling requirements, by removing 9 CFR 412.1(c)(2). FSIS maintains an Export Library that lists requirements for exported products that foreign authorities have officially communicated to FSIS, including labeling requirements.\5\ At times, foreign country labeling requirements conflict with domestic requirements. FSIS regulations (9 CFR 317.7 and 381.128) permit export product labels to deviate from FSIS's domestic labeling requirements in order to comply with foreign country requirements or to be marketed more easily in a foreign country.\6\ FSIS IPP verify whether product for export meets requirements listed in the Export Library, including[[Page 56542]]labeling, when certifying products for export. Verification of foreign requirements is ultimately determined by each foreign country's competent authority.--------------------------------------------------------------------------- \5\ The Export Library is available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/international-affairs/exporting-products/export-library-requirements-by-country*](https://www.fsis.usda.gov/wps/portal/fsis/topics/international-affairs/exporting-products/export-library-requirements-by-country). \6\ Although there is no specific equivalent regulation for egg products, FSIS follows the same policy because such products, intended exclusively for export, must comply with foreign countries' requirements and are therefore not considered misbranded.--------------------------------------------------------------------------- Second, FSIS is proposing to revise the types of ``special statements and claims'' requiring label submission by providing for generic approval of three additional types of claims. FSIS has observed through its prior label approval system that errors, omissions, and misrepresentations are rare on these types of labels. The proposed changes are to be made by amending 9 CFR 412.1(e) and 412.2(b). The following types of claims would be generically approved: a. ``Organic'' claims that appear in a product label's ingredients statement, which designate an ingredient as certified ``organic'' under AMS's National Organic Program. The ingredients statement on these product labels designates specific ingredients as organic (e.g , organic garlic). FSIS would no longer require the submission and evaluation of supporting documentation to verify that such ingredients are indeed certified as organic by an AMS-recognized third-party certifier. However, FSIS would continue to require that labels certifying a total product as organic to be submitted for FSIS evaluation. b. ``Geographic landmarks'' displayed on a product label, such as a foreign country's flag, monument, or map. For example, the following claims displayed on a product label would no longer require sketch approval: A polish flag depicted on a Polish sausage product label, or an outline of the State of Nevada depicted on a product label for beef produced in Nevada. c. ``Negative'' claims made on product labels that identify the absence of certain ingredients or types of ingredients. For example, statements such as ``No MSG Added,'' ``Preservative Free,'' ``No Milk,'' ``No Pork,'' or ``Made Without Soy,'' on product labels that do not list these ingredients in the ingredients statement would no longer have to be evaluated by FSIS before use. However, FSIS evaluation of labels that bear negative claims relating to the raising of the animal from which the product is derived (e.g , ``no antibiotics administered'') or negative claims relating to the use of genetically modified ingredients would continue to be required. Third, FSIS is proposing to permit generic approval of the labels of products that receive voluntary FSIS inspection. FSIS provides several types of voluntary inspection services under the authority of the ***Agricultural*** Marketing Act (AMA) (7 U.S.C 1621 et seq.), including inspection for: Rabbits (9 CFR part 354), certain non-amenable species of livestock and poultry animals, such as elk, bison, and migratory water fowl (9 CFR part 352, subpart A, and 9 CFR part 362); and products containing meat or poultry but are not under FSIS jurisdiction, e.g , closed-faced sandwiches (9 CFR 350(c)). At present, labels for some products produced under these voluntary inspection programs are not covered under the Agency's generic approval regulations at 9 CFR 412. FSIS is proposing to permit generic approval for them on the same basis as amenable meat, poultry, and egg products by amending the relevant program regulations where needed to include references to 9 CFR part 412.\7\ For clarity, FSIS will also modify 9 CFR 352.1 to update the section heading and remove unnecessary language.--------------------------------------------------------------------------- \7\ The regulations providing for voluntary inspection of non-FSIS-jurisdiction products that contain meat or poultry (9 CFR 350(c)) and products containing non-amenable species of poultry (9 CFR part 362) already adopt 9 CFR part 412 by reference. For this reason, FSIS does not need to make additional regulatory changes to these parts in order to permit generic approval of labels for products receiving these services.--------------------------------------------------------------------------- Finally, FSIS is proposing to cease evaluating generically approved labels submitted voluntarily to LPDS for review. In the 2013 rulemaking that expanded the categories of labels eligible for generic approval, commenters requested to be allowed to continue submitting generic labels for FSIS guidance, evaluation, and approval. FSIS agreed to continue evaluating generic labels that were submitted, giving such labels secondary priority after labels requiring evaluation. Since the 2013 final rule, producers have become more familiar with FSIS's generic labeling requirements, and FSIS has provided additional guidance to assist them in designing compliant labels. Therefore, FSIS's evaluation of otherwise generic labels no longer represents an efficient use of Agency resources. Comprehensive labeling guidance, including the FSIS Compliance Guideline for Label Approval,\8\ is available at FSIS's website.\9\ Information available includes a PowerPoint presentation titled ``Labeling 101,'' \10\ which is used by the Agency as a teaching tool at workshops on meat and poultry label requirements. FSIS also provides guidance on allergen labeling and nutrition labeling,\11\ a Label Submission Checklist,\12\ a glossary of meat and poultry labeling terms,\13\ the Policy Book, and questions and answers on various topics, such as generic approval, and the labeling of ingredients.\14\--------------------------------------------------------------------------- \8\ Available at: [*https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES*](https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES). \9\ Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling). \10\ Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-policies/basics-of-labeling/basics-labeling*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-policies/basics-of-labeling/basics-labeling). \11\ Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-policies/nutrition-labeling-policies/nutrition-labeling*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-policies/nutrition-labeling-policies/nutrition-labeling). \12\ Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-procedures/label-submission-checklist*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/labeling/labeling-procedures/label-submission-checklist). \13\ Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/meat-and-poultry-labeling-terms/meat-and-poultry-labeling-terms*](https://www.fsis.usda.gov/wps/portal/fsis/topics/food-safety-education/get-answers/food-safety-fact-sheets/food-labeling/meat-and-poultry-labeling-terms/meat-and-poultry-labeling-terms). \14\ Available at: [*https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES.---------------------------------------------------------------------------*](https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES.---------------------------------------------------------------------------) FSIS will continue to conduct outreach to assist label submitters with labeling compliance in the form of webinars, industry group meetings, training for inspectors, guidance documents published on the FSIS website, and archived public askFSIS questions. Additionally, FSIS provides significant resources to assist label submitters on labels that require FSIS approval prior to use. These include askFSIS, a web portal that allows industry, IPP, and other stakeholders to submit technical and policy-related questions directly to OPPD.\15\ Establishments may also contact FSIS for assistance with labeling questions. FSIS offers resources to assist small and very small plants, including the Small Plant Help Desk, which may be contacted by phone or email and answers questions on FSIS requirements.\16\--------------------------------------------------------------------------- \15\ Available at: [*https://askfsis.custhelp.com/*](https://askfsis.custhelp.com/). See also, FSIS Directive 5620.1 Rev. 1, Using askFSIS, available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulations/directives*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulations/directives). \16\ The latest information on these resources is available at: [*https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/haccp/resources-and-information/svsp-brochure.---------------------------------------------------------------------------*](https://www.fsis.usda.gov/wps/portal/fsis/topics/regulatory-compliance/haccp/resources-and-information/svsp-brochure.---------------------------------------------------------------------------) In June 2020, the USDA Office of Inspector General (OIG) concluded an audit of FSIS product labeling oversight (OIG audit #24601-0002-23, ``Controls Over Meat, Poultry, and Egg Product Labels'').\17\ In response to the audit recommendations concerning FSIS oversight of generic labeling, the Agency agreed that it would continue to enhance its outreach efforts to ensure establishments are aware of applicable mandatory labeling features for generic[[Page 56543]]labels. FSIS also agreed to update its internal policies to improve IPP label verification activities. Such verification activities are described in section III. ``Surveillance and Enforcement'' below. FSIS does not believe that the audit's findings or FSIS's responses to the audit affect this proposal.--------------------------------------------------------------------------- \17\ The audit report is available at: [*https://www.usda.gov/oig/webdocs/24601-0002-23.pdf.---------------------------------------------------------------------------III*](https://www.usda.gov/oig/webdocs/24601-0002-23.pdf.---------------------------------------------------------------------------III). Surveillance and Enforcement Official establishments are required to label meat, poultry, and egg products with labels that are neither false nor misleading and that comply with FSIS's regulations. This is true whether the labels require sketch approval or may be generically approved. Establishments are required to keep records of all labels in accordance with 9 CFR 320.1(b)(10) for meat products, 9 CFR 381.175(b)(6) for poultry products, and 9 CFR 590.200(c) for egg products. These records must include a copy of the final label, the product formulation, processing procedures, and any supporting documentation needed to show that the label complies with the Federal meat, poultry, and egg regulations. Such records must be made available to any duly authorized representative of the Secretary upon request (9 CFR 320.4 and 590.200(b)). IPP periodically perform a General Labeling Task assigned through FSIS's Public Health Inspection System (PHIS) as part of their regular label verification activities. This task is described in FSIS Directive 7221.1, Prior Labeling Approval. It includes verifying that establishments maintain records of the selected labels in accordance with 9 CFR 320.1(b)(10), 381.175(b)(6), and 590.200(c). IPP also verify that final labels applied to product contain all mandatory labeling features and are otherwise in compliance with the applicable regulations by evaluating establishments' labeling records and the labels themselves (e.g , to verify that the ingredients statement on the label matches the product formula). IPP document in PHIS any noncompliance found, e.g , if a required labeling feature is missing or if a label requires LPDS evaluation but such evaluation is not documented in the records.\18\ Establishments may take corrective action by obtaining label approval through LPDS, bringing the labels into compliance with a pressure sensitive sticker, or by replacing the noncompliant labels with labels that have received prior approval and are in compliance with FSIS's regulations. Final labels that are not in compliance with the regulations may still be granted temporary approval under the conditions listed in 9 CFR 412.1(f). IPP will retain any product bearing a label not in compliance with regulatory requirements as well as those that require, but have not received, LPDS approval. Pursuant to 9 CFR 500.8, FSIS may rescind approval of any false or misleading labels.\19\--------------------------------------------------------------------------- \18\ If IPP are not performing the General Labeling task but observe a product label that is not in compliance with Federal meat and poultry regulations, they will initiate a directed General Labeling task, retain affected product, and document the noncompliance in PHIS as described above. \19\ If FSIS rescinds or refuses to approve a label, it must explain its reasoning in a written notice, provide an opportunity for the establishment to modify the label, and advise the establishment of its appeal rights (9 CFR 500.8(b)).--------------------------------------------------------------------------- FSIS relies on these verification tasks, in addition to evaluation by LPDS, to ensure that meat, poultry, and egg product labels are truthful and not misleading. Designating some product labels as generically approved, while maintaining inspection activities for all labels, promotes the effective use of Agency resources. This expansion of generic label approval will not affect consumer protection because FSIS will continue to evaluate labeling that has consumer safety or economic implications, e.g , special statements and claims and requests for temporary approval. For example, FSIS will continue to review labeling that claims product is organic or all natural, makes statements regarding the raising of the animals from which products were derived, displays nutrition factual statements (e.g , 10 g protein per serving) on the label, or includes certified claims (e.g , ``Certified Gluten Free'') on the label.\20\--------------------------------------------------------------------------- \20\ For an extensive list of labeling that requires FSIS approval, see the FSIS Compliance Guideline for Label Approval. Available at: [*https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES.---------------------------------------------------------------------------*](https://www.fsis.usda.gov/wps/wcm/connect/bf170761-33e3-4a2d-8f86-940c2698e2c5/Label-Approval-Guide.pdf?MOD=AJPERES.---------------------------------------------------------------------------) FSIS invites public comment on these proposed changes and requests ***data*** and additional suggestions for ways to make FSIS's generic labeling program more effective and efficient. FSIS considered three alternatives to this proposal: Taking no action; the proposed rule, except industry would still have the option to have LPDS evaluate labels that would otherwise be generically approved; and allowing all labels to be generically approved. Although FSIS ultimately decided on the current proposal, the Agency will continue to consider the alternatives described below (under the section titled ``Alternative Regulatory Approaches'') based on the information received.IV. Executive Orders 12866 and 13563 Executive Orders (E.O.s) 12866 and 13563 direct agencies to assess all costs and benefits of available regulatory alternatives and, if regulation is necessary, to select regulatory approaches that maximize net benefits (including potential economic, environmental, public health and safety effects, distributive impacts, and equity). E.O 13563 emphasizes the importance of quantifying both costs and benefits, of reducing costs, of harmonizing rules, and of promoting flexibility. This proposed rule has been designated a ``significant'' regulatory action under section 3(f) of E.O 12866. Accordingly, the rule has been reviewed by the Office of Management and Budget under E.O 12866.Need for the Rule The proposed rule would expand the types of meat, poultry and egg product labels that can be generically approved by FSIS. This would reduce the number of labels evaluated by FSIS and reduce the costs to industry. The labels submitted for FSIS evaluation are becoming more complex and more time-consuming for industry to prepare and for FSIS to evaluate. The proposed rule would improve the efficiency of the label approval system by expanding generic labeling and making the system more convenient and cost efficient for the industry. This proposed rule also would enhance market efficiency by promoting a faster introduction of new products into the marketplace to meet consumer demand.Baseline Based on FSIS's Label Submission and Approval System (LSAS) \21\ ***data***, FSIS evaluated 15,459 unique labels during the 2019 fiscal year (FY). Of these, 5,229 (33.8 percent) would have been generically approved under the proposed rule. This amount (5,229) includes 632 labels currently eligible for generic approval, which firms voluntarily submitted for FSIS review. Many of the 15,459 labels were evaluated by FSIS more than once because they were returned to the producer to primarily make other types of corrections and then resubmitted for FSIS evaluation. FSIS has observed through its prior label approval system that corrections on the types of claims FSIS is proposing to generically approve are rare. In FY 2019, there were 26,158[[Page 56544]]label adjudications, which included each time a label was evaluated. See Table 2 below for additional details.--------------------------------------------------------------------------- \21\ FSIS's Label Submission and Approval System (LSAS) is a web-based software application that integrates and implements an electronic label application process for establishments to submit label applications to FSIS. Table 2--Label Evaluations and Adjudications, FY 2016-2019 [Pre proposed rule]---------------------------------------------------------------------------------------------------------------- FSIS labels 2016 2017 2018 2019----------------------------------------------------------------------------------------------------------------Labels FSIS Would Not have Evaluated Under the 8,534 5,812 6,025 5,229 Proposed Rule.................................. Total Labels FSIS Evaluated \*............... 22,846 17,958 17,635 15,459 Total Label Adjudications \*\*................ 30,857 25,125 27,580 26,158----------------------------------------------------------------------------------------------------------------\* This is the total number of labels FSIS evaluated, including the labels that would have been generically approved under the proposed rule.\*\* Label adjudications include some labels being revaluated. FSIS expanded the types of labels and label changes that may be generically approved several times, starting in 1983 when the Agency evaluated 130,000 labels. In 1991, the number of labels evaluated peaked at 167,500. The 1995 final rule (60 FR 67444) amended the prior label approval process by expanding the types of labels and label changes that may be generically approved. From 2003-2010, the number of label adjudication per year averaged 57,457, with a minimum of 43,255 in 2003 and a maximum of 66,061 in 2010. The 2013 final rule (78 FR 66826, November 7, 2013) further expanded generic labeling, decreasing the number of label adjudications to 30,857 in FY 2016 (Table 2). FSIS also proposed to permit generic approval for certain egg product labels in 2018 (83 FR 6314, February, 13, 2018). The number of FSIS label adjudications decreased after the expansions of generically approved labels. However, the remaining label submissions after each expansion are more time-consuming for industry to prepare and for FSIS to evaluate. This is because the labels requiring submission after each expansion are generally more complex, with special statements or claims that require FSIS to evaluate a significant amount of supporting documentation.Expected Costs of the Proposed Rule The proposed rule would not impose any new cost on producers that submit labels for FSIS evaluation. Instead, the proposed rule would reduce the regulatory burden on producers that currently submit labels for evaluation and does not change the recordkeeping requirements. Producers already are using generically approved labels and maintaining all labeling records, and thus are experienced in submitting labels for FSIS evaluation.Expected Benefits of the Proposed Rule Industry Impacts Industry would realize cost savings from the reduction in FSIS label submissions under the proposed rule. Industry is required to use FSIS Form 7234-1 (OMB control number: 0583-0092) for the initial FSIS label submission. The estimated time to complete this form is 75 minutes per response, which includes reviewing instructions, searching existing ***data*** sources, gathering and maintaining the ***data*** needed (recordkeeping), and completing and reviewing the ***collection*** of information.\22\ FSIS estimates 15 minutes of the 75 minutes are dedicated to recordkeeping. The recordkeeping time is not included in the proposed rule's regulatory impact analysis because the recordkeeping requirements are not changing under the proposed rule; that is, even if the establishment does not need to submit the label to FSIS, the establishment is still required to maintain records to support the label. Therefore, the average industry time to prepare one label submission for FSIS evaluation is 60 minutes (75 minutes-15 minutes). FSIS also assumed food scientists and technologists would perform this work at a mean hourly wage of $36.63 \23\ A benefits and overhead factor of two \24\ was applied to estimate the total labor cost per label submission of $73.26 --------------------------------------------------------------------------- \22\ FSIS Form 7234-1 Application for Approval of Labels, Marking or Device. Last modified 11/16/2011. Available at: [*https://www.fsis.usda.gov/wps/portal/fsis/forms/*](https://www.fsis.usda.gov/wps/portal/fsis/forms/). \23\ BLS Occupational Employment ***Statistics***, Occupational Employment and Wages, May 2019. 19-1021 Food Scientists and Technologists. <[*https://www.bls.gov/news.release/pdf/ocwage.pdfoes/current/oes191012.htm#nat*](https://www.bls.gov/news.release/pdf/ocwage.pdfoes/current/oes191012.htm#nat) Accessed on 4/30/2020. Last Modified 03/30/2020. \24\ To be consistent with analyses done by the Department of Health and Human Services, this analysis accounts for fringe benefits and overhead by multiplying wages by a factor of 2.--------------------------------------------------------------------------- To determine the annual reduction of label submissions, FSIS relied on the average number of labels that FSIS would not have evaluated under the proposed rule from 2016 to 2019, which was 6,400 labels, ((8,534 + 5,812 + 6,025 + 5,229)/4), Table 2. Accordingly, FSIS estimates a decrease of 64,000 label evaluations over 10 years under the proposed rule (6,400 \* 10). As shown in Table 3, FSIS estimates that industry would realize a discounted cost savings of $3,293,105 (at a 7 percent discount rate) and $3,999,505 (at a 3 percent discount rate) by FSIS generically approving an additional 64,000 labels over a 10-year period. The cost savings would be $468,864 when annualized at the 7 and 3 percent discount rate, over 10 years. Table 3--Estimated Industry Cost Savings [2019 Dollars]------------------------------------------------------------------------ Present value Present valueTotal industry cost savings from reduced cost savings cost savings need for FSIS label evaluation at 7% at 3%------------------------------------------------------------------------Total over 10 years..................... $3,293,105 $3,999,505Annualized total over 10 years.......... 468,864 468,864------------------------------------------------------------------------[[Page 56545]]Agency Impacts During FY 2019, FSIS employed 14 labeling analysts in LPDS with an average hourly salary of $64.75 (($47.52 \* 36.25%) + 47.52 = $64.75 for a GS-13 step 1,\25\ with an adjusted benefits factor of 36.25 percent).\26\ On average, LPDS analysts evaluate labels four hours per day, five days a week, at a cost of $18,130 per week. If the proposed rule is adopted, LPDS analysts would evaluate labels for three hours per day, five days a week, at a cost of $13,598 per week, because of the reduction in labels submitted to FSIS.--------------------------------------------------------------------------- \25\ Salary Table 2019-DCB for the locality pay area of Washington-Baltimore-Arlington, DC-MD-VA-WV-PA. Effective January 2019. Available at: [*https://www.opm.gov/policy-****data****-oversight/pay-leave/salaries-wages/salary-tables/pdf/2019/DCB\_h.pdf*](https://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/salary-tables/pdf/2019/DCB_h.pdf). \26\ Nussle, Jim. (2008). M-08-13: MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES. Executive Office of the President. Available at: [*https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2008/m08-13.pdf.---------------------------------------------------------------------------*](https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2008/m08-13.pdf.---------------------------------------------------------------------------) If this proposed rule is adopted, the Agency would realize a discounted cost savings of $1,655,388 (at a 7 percent discount rate) and $2,010,484 (at a 3 percent discount rate) for adjudicating fewer labels over a 10-year period. The cost savings would be $235,690 when annualized at the 7 and 3 percent discount rate over 10 years. See Table 4 for additional details. However, this cost savings from fewer staff hours dedicated towards adjudicating labels would be redirected towards other Agency priority initiatives, such as developing and updating policy and guidance documents, answering questions from askFSIS and other sources, and performing outreach activities. We also anticipate an overall faster label review process from the decline in LPDS label evaluations. This would allow new labels to enter the market faster. Table 4--Estimated Agency Cost Savings [2019 Dollars]------------------------------------------------------------------------ Present value Present value Total agency cost savings from reduced cost savings cost savings need for FSIS label evaluation at 7% at 3%------------------------------------------------------------------------Total over 10 years..................... $1,655,388 $2,010,484Annualized total over 10 years.......... 235,690 235,690------------------------------------------------------------------------Net Benefits This proposed rule would be net beneficial because it would reduce the costs to establishments, from submitting fewer labels for FSIS evaluation, while imposing no additional cost burden. The net benefit derived from the proposed rule is estimated to be $4,948,493 ($3,293,105 in establishment savings plus $1,655,388 in Agency savings) discounted at the 7 percent discount rate over a 10-year period. When annualized at the 7 percent discount rate over 10 years, the net cost savings is estimated to be $704,554. See Table 5 for details. Table 5--Estimated Agency Cost Savings [2019 Dollars]------------------------------------------------------------------------ Total agency and industry cost savings Present value Present value from reduced need for FSIS label cost savings cost savings evaluation at 7% at 3%------------------------------------------------------------------------Total over 10 years..................... $4,948,493 $6,009,989Annualized total over 10 years.......... 704,554 704,554------------------------------------------------------------------------Alternative Regulatory Approaches The Agency considered three alternatives to the proposed rule. The proposed rule was chosen as the least burdensome regulatory approach. The summary of the costs and benefits for the considered alternatives are outlined in Table 6 below. Table 6--Regulatory Alternatives Considered---------------------------------------------------------------------------------------------------------------- Alternative Benefits Costs Net benefit----------------------------------------------------------------------------------------------------------------(1) Take No Action............... No Benefit............... No potential industry or Net benefits are less Agency cost savings. than alternative 3.(2) The Proposed Rule, Except Industry could benefit Potential for Net benefits are less Industry Would Still Have the from additional FSIS inefficient use of than alternative 3. Option to Have LPDS Evaluate evaluation. Agency resources. Although industry could Labels that Would Otherwise be Industry would also marginally benefit from Generically Approved. incur costs of additional FSIS submitting the labels evaluation, sufficient and waiting for FSIS guidance is available evaluation. for labels that can be generically approved. Also, industry and the Agency would incur costs from submitting and evaluating such labels.[[Page 56546]] (3) The Proposed Rule............ Potential industry cost No Cost................. Net benefits are savings of $468,864 and $704,554 annualized at Agency cost savings of the 7 percent discount $235,690, annualized at rate over 10 years. the 7 percent discount rate over 10 years.(4) Allow All FSIS Labels to be The Agency and industry Costs include Net benefits are less Generically Approved. would benefit from time potentially increasing than alternative 3 as savings by eliminating the number of the potential costs of FSIS label evaluation. misbranded products. misbranded products from eliminating FSIS label evaluation outweighs the time savings benefit.----------------------------------------------------------------------------------------------------------------Alternative 1--No Action (Baseline) FSIS considered keeping the current regulations and taking no action. Taking no action would mean that industry and the Agency would not experience costs savings from the reduction of labels submitted for FSIS evaluation under the proposed rule. Industry would therefore not realize the estimated reduction of 64,000 label submissions over 10 years and would not experience an annualized cost savings of $468,864 at the 7 percent discount rate over 10 years. The Agency would not experience time savings from the reduction of label evaluations. Therefore, the Agency rejects this alternative.Alternative 2--The Proposed Rule, Except Industry Would Still Have the Option To Have LPDS Evaluate Labels That Would Otherwise be Generically Approved FSIS considered an alternative of proposing the same generically approved label categories except FSIS would continue to evaluate those labels that would otherwise be generically approved. Currently, industry can submit labels that can be generically approved for voluntary FSIS evaluation, although this evaluation is not needed prior to entering the market. When industry submits these types of labels for voluntary FSIS evaluation, they are reviewed with a lower priority than other labels, and thus take more time for FSIS to approve. Although industry may marginally benefit from the additional FSIS evaluation, the process is inefficient and raises unnecessary costs. Industry could more quickly get FSIS assistance on these types of labels through other guidance, such as askFSIS. In addition, FSIS would have to take the time to process and evaluate these labels, when reviewer time could be spent on higher priorities, such as food safety and policy related issues (e.g , concerning allergens). Industry would also incur costs in preparing and submitting the labels for FSIS evaluation while they could get FSIS help through other outlets without incurring these expenses. For these reasons, FSIS rejects this alternative.Alternative 3--The Proposed Rule The proposed rule yields cost savings for both the industry and the Agency. There is no additional cost burden from the proposed rule. The potential cost savings for industry is $468,864, annualized at the 7 percent discount rate over 10 years. This covers the time industry saves from not preparing and submitting the labels for FSIS evaluation. The potential cost savings for FSIS is $235,690, annualized at the 7 percent discount rate over 10 years. This covers the time FSIS saves from not evaluating the proposed generically approved labels. Since there is no additional burden for this proposed rule, FSIS determined this to be the preferred alternative.Alternative 4--All Labels Are Generically Approved FSIS also considered an alternative that would allow all labels to be generically approved, requiring no prior approval by FSIS. This alternative may increase the number of misbranded products going into commerce, as LPDS would no longer verify the information on complex labels. An increase in misbranded products that contain incorrect, false, or misleading information may result in a loss of consumer confidence in information on food labels. There is also cost associated with discarding and reprinting misbranded labels that the industry may suffer. Therefore, FSIS believes the labels that would still require prior evaluation under the proposed rule, such as labels with animal raising or natural claims, benefit from LPDS evaluation due to the complex nature and need for supporting documentation of these claims. This alternative would yield time savings for industry from no longer preparing and submitting labels for FSIS evaluation. FSIS would also experience time savings from no longer evaluating these labels. However, the potential costs of misbranded products entering commerce, resulting from the elimination of all LPDS label evaluation, would outweigh the benefits of the time savings.V. Regulatory Flexibility Act Assessment The FSIS Administrator has made a preliminary determination that this proposed rule would not have a significant economic impact on a substantial number of small entities in the United States, as defined by the Regulatory Flexibility Act (5 U.S.C 601). This determination was made because small producers would experience costs savings from the reduced number of label submissions for FSIS evaluation. Based on LSAS and the Public Health Information System (PHIS) \27\ ***data***, FSIS estimates 92.3 percent (4,825/5,229) of the label submissions in 2019, which would have been generically approved under the proposed rule, are from small or very small Hazard Analysis and Critical Control Point (HACCP) sized establishments. Under the HACCP size definitions, large establishments have 500 or more employees and small establishments have fewer than 500 but more than 10 employees. Very small establishments have fewer than 10 employees or annual sales of less than $2.5 million. Small and very small establishments, like large establishments, follow the same standards for generic and sketch approval of labels. Small and very small producers, therefore, would not be disadvantaged because the proposed[[Page 56547]]rule would minimize the regulatory burden on all producers.--------------------------------------------------------------------------- \27\ PHIS is FSIS's electronic ***data*** analytic system, used to ***collect***, consolidate, and analyze ***data*** in order to improve public health.--------------------------------------------------------------------------- Based on 2019 LSAS ***data***, about 12 percent (627/5,229) of labels that would have been generically approved under the proposed rule, were submitted from 19 label consultant firms. These firms are very small, usually having one to four employees. Many of these firms provide a range of services, including label courier services, label consultation and regulatory compliance, or label design. This proposed rule may impact their label courier business. However, the impact on these firms is small as their other business, such as label consultations, would not be affected. Therefore, this proposed rule would not have a significant economic impact on the small label consultant firms.VI. Executive Order 13771 Consistent with E.O 13771 (82 FR 9339, February 3, 2017), FSIS has estimated that this proposed rule would yield cost savings. Assuming a 7 percent discount rate, a perpetual time horizon, and a starting year of 2021, the proposed rule, if finalized, is estimated to yield approximately $502,337 (2016$) in annual cost savings. Therefore, if finalized as proposed, this rule would be an E.O 13771 deregulatory action.VII. Paperwork Reduction Act FSIS has reviewed the paperwork and recordkeeping requirements in this proposed rule in accordance with the Paperwork Reduction Act (44 U.S.C 3501, et seq.). The Administrator has determined that the proposed rule would not create any additional ***collection***, paperwork, or recordkeeping burdens. FSIS is proposing to expand the circumstances under which it will generically approve the labels of meat, poultry, and processed egg products. Under this final rule, more official and foreign establishments will be able to use the generic approval of product labels. As a result, fewer labels will need to be submitted and evaluated by FSIS. The relevant information ***collection***, 0583-0092, Marking, Labeling, and Packaging, will have a net reduction of 6,400 burden hours because of the increased use of generic labeling.VIII. E-Government Act FSIS and USDA are committed to achieving the purposes of the E-Government Act (44 U.S.C 3601, et seq.) by, among other things, promoting the use of the internet and other information technologies and providing increased opportunities for citizen access to Government information and services, and for other purposes.IX. Executive Order 12988, Civil Justice Reform This proposed rule has been reviewed under Executive Order 12988, Civil Justice Reform. Under this rule: (1) All State and local laws and regulations that are inconsistent with this rule will be preempted; (2) no retroactive effect will be given to this rule; and (3) no administrative proceedings will be required before parties may file suit in court challenging this rule.X. Executive Order 13175, Consultation and Coordination With Indian Tribal Governments This rule has been reviewed in accordance with the requirements of Executive Order 13175, Consultation and Coordination with Indian Tribal Governments. Executive Order 13175 requires Federal agencies to consult and coordinate with tribes on a government-to-government basis on policies that have tribal implications, including regulations, legislative comments or proposed legislation, and other policy statements or actions that have substantial direct effects on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes or on the distribution of power and responsibilities between the Federal Government and Indian tribes. The USDA's Office of Tribal Relations (OTR) has assessed the impact of this rule on Indian tribes and determined that this rule does not to our knowledge, have tribal implications that require tribal consultation. If a tribe requests consultation, FSIS will work with the OTR to ensure meaningful consultation is provided where changes, additions, and modifications identified herein are not expressly mandated by Congress.XI. USDA Non-Discrimination Statement In accordance with Federal civil rights law and U.S Department of ***Agriculture*** (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.How To File a Complaint of Discrimination To file a complaint of discrimination, complete the USDA Program Discrimination Complaint Form, which may be accessed online at [*http://www.ocio.usda.gov/sites/default/files/docs/2012/Complain\_combined\_6\_8\_12.pdf*](http://www.ocio.usda.gov/sites/default/files/docs/2012/Complain_combined_6_8_12.pdf), or write a letter signed by you or your authorized representative. Send your completed complaint form or letter to USDA by mail, fax, or email: Mail: U.S Department of ***Agriculture***, Director, Office of Adjudication, 1400 Independence Avenue SW, Washington, DC 20250-9410. Fax: (202) 690-7442. Email: [*program.intake@usda.gov*](mailto:program.intake@usda.gov) Persons with disabilities who require alternative means for communication (Braille, large print, audiotape, etc.), should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).XIII. Environmental Impact Each USDA agency is required to comply with 7 CFR part 1b of the Departmental regulations, which supplements the National Environmental Policy Act regulations published by the Council on Environmental Quality. Under these regulations, actions of certain USDA agencies and agency units are categorically excluded from the preparation of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) unless the agency head determines that an action may have a significant environmental effect (7 CFR 1b.4(b)). FSIS is among the agencies categorically excluded from the preparation of an EA or EIS (7 CFR 1b.4(b)(6)). FSIS has determined that this proposed rule, which would refine the Agency's existing label approval program, will not create any extraordinary circumstances that would result in this normally excluded action having a significant individual or cumulative effect on the human environment. Therefore, this action is appropriately subject to the categorical exclusion from the preparation of an environmental assessment or environmental impact statement provided under 7 CFR 1b.4(6) of the U.S Department of ***Agriculture*** regulations.XIII. Congressional Review Act Pursuant to the Congressional Review Act at 5 U.S.C 801 et seq., the Office of Information and Regulatory Affairs has determined that this document is not a[[Page 56548]]``major rule,'' as defined by 5 U.S.C 804(2).XIV. Additional Public Notification Public awareness of all segments of rulemaking and policy development is important. Consequently, FSIS will announce this Federal Register publication on-line through the FSIS web page located at: [*http://www.fsis.usda.gov/federal-register*](http://www.fsis.usda.gov/federal-register). FSIS will also announce and provide a link to it through the FSIS Constituent Update, which is used to provide information regarding FSIS policies, procedures, regulations, Federal Register notices, FSIS public meetings, and other types of information that could affect or would be of interest to our constituents and stakeholders. The Constituent Update is available on the FSIS web page. Through the web page, FSIS is able to provide information to a much broader, more diverse audience. In addition, FSIS offers an email subscription service which provides automatic and customized access to selected food safety news and information. This service is available at: [*http://www.fsis.usda.gov/subscribe*](http://www.fsis.usda.gov/subscribe). Options range from recalls to export information, regulations, directives, and notices. Customers can add or delete subscriptions themselves and have the option to password protect their accounts.List of Subjects9 CFR Part 352 Food labeling, Meat inspection, Reporting and recordkeeping requirements.9 CFR Part 354 Administrative practice and procedure, Animal diseases, Food labeling, Meat inspection, Rabbits and rabbit products, Reporting and recordkeeping requirements, Signs and symbols.9 CFR Part 412 Food labeling, Food packaging, Meat and meat products, Meat inspection, Poultry and poultry products, Reporting and recordkeeping requirements. For the reasons set forth in the preamble, FSIS is proposing to amend 9 CFR Chapter III as follows:PART 352--EXOTIC ANIMALS AND HORSES; VOLUNTARY INSPECTION01. The authority citation for part 352 continues to read as follows: Authority: 7 U.S.C 1622, 1624; 7 CFR 2.17(g) and (i), 2.55 02. In Sec. 352.7:0a. Revise the section heading;0b. Remove from the introductory text the phrase ``Wording and form of inspection mark.''; and0c. Add a sentence at the end of the introductory text. The revision and addition read as follows:Sec. 352.7 Marking and labeling of inspected products.\* \* \* \* \* All labels intended for use on inspected and passed exotic animal products must be approved in accordance with Part 412 of this chapter.\* \* \* \* \*PART 354--VOLUNTARY INSPECTION OF RABBITS AND EDIBLE PRODUCTS THEREOF03. The authority citation for part 354 continues to read as follows: Authority: 7 U.S.C 1622, 1624; 7 CFR 2.17(g) and (i), 2.55 04. Revise Sec. 354.60 to read as follows:Sec. 354.60 Approval of official identification. All labels intended for use on inspected and passed rabbit products which bear any official identification must be approved in accordance with Part 412 of this chapter.PART 412--LABEL APPROVAL05. The authority citation for part 412 continues to read as follows: Authority: 21 U.S.C 451-470, 601-695; 7 CFR 218, 2.53 06. In Sec. 412.1, remove and reserve paragraph (c)(2) and revise paragraph (e) to read as follows:Sec. 412.1 Label approval.\* \* \* \* \* (e) ``Special statements and claims'' are statements, claims, logos, trademarks, and other symbols on labels as defined in this paragraph. (1) The following are considered special statements and claims: (i) Those not defined in the Federal meat and poultry products inspection regulations or the Food Standards and Labeling Policy Book; (ii) ``Natural'' claims, regardless of whether they are defined in the Food Standards and Labeling Policy Book. (iii) Health claims (including graphic representations of hearts), ingredient and processing method claims (e.g , high-pressure processing), structure-function claims, claims regarding the raising of animals (e.g , ``no antibiotics administered''), products labeled as organic (except for those where only individual ingredients are labeled as organic), and instructional or disclaimer statements concerning pathogens (e.g , ``for cooking only'' or ``not tested for E. coli O157:H7''). (2) The following are not considered special statements and claims: (i) Allergen statements (e.g , ``contains soy'') applied in accordance with the Food Allergen Labeling and Consumer Protection Act. (ii) Negative claims regarding ingredients not listed in the ingredients statement (i.e , ``No MSG Added,'' ``Preservative Free,'' ``No Milk,'' ``No Pork,'' or ``Made Without Soy''). (iii) Statements that characterize a product's ***nutrient*** content in compliance with Title 9 of the CFR, such as ``low fat.'' (iv) Claims related to geographical significance, such as ``German Brand Made in the US,'' or those that make a country of origin statement on the label of any meat or poultry product ``covered commodity,'' or displays of geographic landmarks, such as a foreign country's flag, monument, or map.\* \* \* \* \*07. Revise Sec. 412.2(b) to read as follows:Sec. 412.2 Approval of generic labels.\* \* \* \* \* (b) Generically approved labels are labels that bear all applicable mandatory labeling features (i.e , product name, handling statement, ingredients statement, the name and place of business of the manufacturer, packer or distributor, net weight, legend, safe handling instructions, and nutrition labeling) in accordance with Federal regulations and do not bear special statements and claims as defined in paragraph 412.1(e) of this part. Done at Washington, DC.Paul Kiecker,Administrator.[FR Doc. 2020-17340 Filed 9-11-20; 8:45 am]BILLING CODE 3410-DM-P

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**End of Document**



[***Market wrap: Warehouse REIT rises on Covid-19 driven demand***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5YMJ-CRF1-DYX4-71XW-00000-00&context=1516831)

EGi Web News

April 9, 2020 05:43 PM GMT

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**Section:** EGI NEWS

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**Body**

Warehouse REIT gained close to 5% in trading today on the back of a market update in which it said demand for its space was rising as a result of the crisis.Housebuilder Redrow rose by 9.6% after confirming that it had been approved for £300m in Covid-19 support finance.But in a rising market – the FTSE 100 closed up by 2.9% and the FTSE 250 by 3.4% – a third of the day’s steepest falls were seen in property-focused stocks.The BMO Real Estate Investments REIT closed down 7.75% at 50p, the second-furthest fall of the session. The BMO Commercial Property lost almost 5%, while Custodian REIT dropped by 5.6% after it warned of “inevitable disruption” from the coronavirus pandemic.To send feedback, e-mail [*tim.burke@egi.co.uk*](mailto:tim.burke@egi.co.uk) or tweet @\_tim\_burke or @estatesgazette

JOURNAL : Farmers Weekly

A few inexpensive, practical changes to the housing environment can make all the difference to the health, welfare and productivity of a dairy herd says Alice Miller of Friars Moor Livestock Health.

The productive dairy cow is more likely to achieve her genetic potential when allowed to thrive in the best environment.

Reviewing the dairy housing environment on your farm may highlight areas that need improvement.

The following six key areas should be considered.

See also: 6 fresh cow checks to prevent problems after calving

1. Light levels

The level of light exposure at certain production stages can have beneficial effects on milk production. The documented research findings reflect what we see in practice.

A long photoperiod (18 hours), compared to natural day length, can increase milk yield by an average of two litres/day.

However, shorter day lengths are recommended for dry cows.

Reduced light hours at eight hours during a 60-day dry period can increase milk yield in the following lactation by 3.2kg/day.

Light levels within the shed should be at least 200 lux during the day, and in periods of darkness levels should not be less than 30 lux to ensure cows can still see to move around the building.

The best buildings expose cows to maximum natural daylight levels as well as having the option of ample artificial LED lighting, so light levels can be adjusted accordingly.

But it is worth considering that where skylights are used to increase daylight levels, ambient temperature can also rise in a “greenhouse” effect.

2. Surveillance

There has been a rise in the use of surveillance cameras on farms, with features that allow 360deg views, ability to zoom and night vision.

These are becoming invaluable tools in calving areas.

Remote surveillance avoids stressful disturbance that can delay the natural onset of calving.

Equally, unnecessary calf losses can be avoided with earlier intervention and assistance where cows are seen to be experiencing difficulties.

Cameras can also be useful in other areas, for example, ***collecting*** yards to help with oestrus detection.

3. Hygiene

Adult cattle can shed high levels of bacteria such as Johne’s, salmonella and E coli, viruses such as coronavirus and rotavirus, and parasites, including cryptosporidium, in their faeces.

It is therefore important that sick cows are not left in calving pens, since levels of contamination can increase quickly and any calves inhabiting the pen will be at risk.

Often, calving pens are sited close to the ***collecting*** yard or parlour, where they become contaminated with slurry or effluent run-off, which is another source of infection for calves.

It is important that calves are not left in the calving pens for too long to help minimise infection risks.

Calving pens should be regularly steam-cleaned, organic matter removed, allowed to dry and fresh bedding replaced.

Detergents will help remove engrained dirt and biofilms, where a multitude of pathogens can survive for months.

Disinfectants should be used after detergents at the specified dilution rate.

4. Enrichment and space

More farms are exploring the idea of offering enrichment activities for adult cattle and youngstock.

Brushes for cows and calves are in constant use when seen on farm visits, but other novel ideas offer opportunities for play, such as punch bags, tractor tyres, hay bales and padded posts.

5. Comfort

Cow comfort has significant impact on welfare and health.

Cows that spend at least 12 hours/day with a dry and comfortable place to lie will be happier and have reduced mastitis and lameness risks.

Whether loosely housed or in cubicle sheds, there should be allowance for extra lying space. (See more on cubicle sheds on the AHDB website.)

The bedding substrate should be at least 6in deep to ensure cows are comfortable, avoid hock lesions and reduce cubicle refusals.

The use of rubber matting at feed faces, ***collecting*** yards and in the parlour has been found to reduce lameness.

It is important that floor surfaces are not slippery and re-grooved regularly to avoid cow injuries and encourage confidence to display bulling behaviour safely.

6. Heat stress

The effect of heat stress on cattle has been well documented.

The upper critical temperature (UCT) of adult cattle is 25C – above this, cattle are at risk of heat stress.

It is important to consider UCT is even lower when humidity levels increase.

Heat stress is a welfare issue but will also have detrimental effects, including reduced dry matter intake, milk yield reductions, poor fertility, increased embryonic loss and more clinical mastitis.

Heat stress can be avoided by ensuring buildings are well ventilated, with unrestricted air inlets and outlets.

Where there is not enough natural ventilation, mechanical ventilation systems should be considered.

Buildings that work best are those where you can control ventilation to suit daily temperature, humidity and wind speed changes, to ensure cows can always avoid thermal extremes.

Placing fans in areas where cattle are grouped and natural ventilation maybe restricted, such as the ***collecting*** yard and parlour, should also be considered and can make a huge positive difference for the cow.

It is also important to consider that a cow’s water intake requirement may increase by 10-20% in warmer conditions, with lactating cows requiring 100-130 litres/day.

Allowing enough trough space is therefore critical.

Each month an XLVets practice offers practical help. Here, we get advice on improving dairy housing to boost production and health with Alice Miller of Friars Moor Livestock Health.

JOURNAL : Farmers Weekly

Taking the time to identify the relevant site surveys for your build and engaging with the public will help smooth any planning application, says Cumbrian farmer Robert Morris-Eyton.

In 2018, Mr Morris-Eyton put forward a planning application for a new 400-cow shed and rotary parlour on a greenfield site at Beckside Farm, Millom, in the Lake District National Park.

Approval was received in just 12 weeks and the buildings erected within about six months.

The new build is located about 150m away from the existing dairy building complex, which is connected via a concrete lane. The new set-up means the business is on track to expand from 250 to 400 cows this year.

See also: Planning for housing on farmland – 6 steps to success

Farm Facts

Beckside Farm, Millom, Cumbria

263ha plus grazing rights

350 cows, increasing to 400 head

11,000 litres a cow a year

Robert Morris-Eyton runs the unit with wife Rowena and his son, Patrick – a Farmers Weekly Livestock Farmers Focus writer

850 fell ewes

Hydro power and building business

As a qualified chartered surveyor, Mr Morris-Eyton has an excellent understanding of all aspects of the planning process.

He runs Farmers Weekly through some key learnings from his own planning application process. You can also read more about the parlour and cubicle shed in What’s in Your Livestock Shed visits a £1.4m greenfield dairy

1. Bring in specialists

Planning is not for the faint-hearted. There’s a lot to it and it is technical. Speak to a building specialist to sketch out the building and someone with planning experience such as a chartered surveyor.

Do your homework and pick the right people. We used a specialist from Devon for the slurry lagoon planning, who had written the guidelines for the Environment Agency (EA).

2. Be prepared to spend

You could spend an amount equivalent to the planning application fee in getting the application ready.

Our planning fee to the National Park was £25,000 – although usually this would go to the council.

I did a lot of the preparation, but if you paid someone to do everything, it could cost another £20,000 for a similar-sized development.

3. Identify any issues before the application

I’d recommend speaking to the EA before getting too far with designing any slurry storage.

We invited them out first and they suggested tweaks to where we would site the lagoon.

Speak to the planners before you progress, and work out where the building would fit in the landscape and whether it would work aesthetically.

4. Provide planners with everything they need

There are a lot of reports that go with an application. That’s why employing a specialist is useful as they will know what is required.

Submitting all necessary documentation with the application will increase the chances of planning going through quickly (see tips box, below).

I’d recommend carrying out an ecology report as this will highlight any ecological issues that may require mitigation. Worse-case scenario, it could stop the project all together.

We knew we had protected hedgerows, so we said in our application that we would relocate them. However, most people would opt for compensatory planting elsewhere.

Showing that you’re going to put in extra trees may also help. We probably put in about 200-300 trees.

Our building specialist, Ivor Davey of CowPlan, also produced a 3D video of the proposed development and used Google Earth to show how it would fit in its surroundings.

The £2,000 cost was well worth it because people often struggle to visualise how big something is and how it fits in the location. I also had the support of chartered surveyor Julie Liddle of Robson & Liddle.

5. Explain the reasoning behind the design

In the design statement that accompanies the planning application, we explained why we needed certain aspects of the building for cow welfare. For example, we explained that we needed the buildings 25m apart for ventilation.

If you need the eaves to be 4m high with a 20deg pitch roof, explain why – it will avoid it getting thrown back stating it needs to be 3m with a 17-deg pitch, for example.

6. Consider building materials

What are the normal building materials for the area? There’s more chance of getting planning agreed if it’s aesthetically pleasing. Our roof is anthracite grey and the weather boarding is treated green timber.

7. Engage with the public

Video

We used the 3D video of the proposed development on our Facebook page before planning was submitted.

We knew the proposal was sensitive because we are in the Lake District National Park, so we thought it beneficial to get it out there.

I think it helped. If people don’t know what’s going on, rabbits can start running with misinformation. I think it’s down to personal choice as to when you go public prior to the application.

In some areas where objections may be expected, it could give the public more time to think about it.

I also took the opportunity to attend a Whicham Parish Council meeting prior to our application.

I spoke to the councillors, put up the 3D video and explained what we were doing and why. It was very well received.

They were pleased to have an opportunity to see the visuals and how it would look in the landscape.

JOURNAL : Farmers Weekly

This season is the first where growers face managing wireworm without the key pesticide Mocap (ethoprophos) that has proved effective for some years in managing the costly pest.

This means there will be a greater reliance on less-effective alternatives in combination with with cultural controls to keep the pest in check.

Farmers Weekly looks at how growers can best manage wireworm, which in severe cases can lead to crop losses.

See also: Why wheat growers need to be extra alert for yellow rust

What are wireworms?

Wireworms are the larvae of click beetles and there are about 60 species in Britain. Only a few are pests and just three key species are responsible for most of the damage in potatoes.

These include Agriotes lineatus, Agriotes obscurus and Agriotes sputator. All three are widespread across the UK and usually occur in mixed populations in the same field.

All three are equally damaging, with low populations (<100,000/ha) causing significant economic loss. Entire crops can be written off in severe cases.

What about its lifecycle?

UK species of click beetles lay eggs in May and June close to the soil surface and under the protection of grass or weedy areas. The eggs hatch after four to six weeks and need vegetation to survive.

Larvae can spend three to five years in the soil before reaching maturity (typically in July-September), when they burrow down the profile to pupate over a three- to four-week period.

There are two main activity periods for wireworm larvae in the UK. The first is between March and May and the second between September and October, with the second activity period the most damaging to potato crops.

Which potato crops are at risk?

Potato crops planted after long-term grass (more than four years) have always been considered at greatest risk of wireworm attack, as the pest favours undisturbed soil.

Populations build and remain constant at an equilibrium under a ley. Probably about 60-70% of long-term grass fields are wireworm infested.

However, wireworm damage has increasingly been seen in arable-only rotations, and this upward trend may continue as reduced tillage regimes become the norm between potato crops.

Wireworm attacks are increasingly reported close to field edges, where grassy margins grown as part of environmental schemes are more commonplace.

Research has also shown that fields with a southern or easterly aspect are more likely to harbour significant wireworm populations, as warmer soil temperatures tend to be more favourable.

Wireworm risk-assessment calendar

Assess site characteristics – 12 months before potato crop

Pheromone traps – May-June in previous crop

Soil sampling – October-March preceding planting

Bait traps – February to March preceding planting

What cultural methods help with control?

Where possible, growers should avoid growing potatoes on land with a wireworm infestation.

In arable rotations, cultivation has the greatest effect on reducing wireworm numbers, physically killing larvae and leaving them exposed to predation. Ideally, land earmarked for potatoes should be ploughed and disc-harrowed in the autumn.

From previous experiments in commonly grown UK varieties, there is no varietal resistance to wireworm damage.

Where risk is identified and a crop will be planted, choosing an early maturing variety that is suitable for a range of markets enables the crop to be lifted early and avoid peak wireworm activity in September or October.

Wireworm also like weedy conditions, helping to protect eggs before hatching, so keeping potato fields clean between the previous crop and planting will also exhaust food supplies and help suppress numbers.

Are there any conventional chemicals left?

Growers are entering their first season without granular organophosphate insecticide Mocap (ethoprophos), which has been the most effective wireworm control agent for many years.

Nemathorin (fosthiazate) offers some reduction of wireworm damage, but not on the same level as Mocap and remains a product primarily aimed at potato cyst nematode control.

It also has a 119-day harvest interval in comparison with Mocap’s 80-day interval, making it unsuitable for short-duration crops such as salad potatoes.

Nemathorin’s approval holder, Syngenta, is developing a granular soil-applied insecticide with activity against wireworm, but it is uncertain when it will make it through registration.

Ag-chem manufacturer and former Mocap approval holder Certis is also actively looking for alternative conventional and biological insecticides to help with wireworm management.

How do I assess wireworm risk before planting?

Look for clues

Most growers will be familiar with the field history of their own land, but when renting in additional hectares, it can be more difficult to know if wireworm will be a problem.

As mentioned, aspect can influence risk, while field names (such as “Old Meadow”) and old stock fencing or water troughs can suggest a history of grazing.

Inspecting weed roots (such as sow thistle) and volunteer potatoes in stubbles for damage ahead of a crop can also reveal the presence of wireworm. They can also be spotted on top of beds when walking behind a working destoner.

In areas where potatoes are grown after grass, some growers use a hedge plough – one plough furrow or skimmer share mounted on an A-frame – towed behind a small tractor or pickup to turn over a few metres of grass turf.

This is then left 30 minutes or more before returning and inspecting for the presence or absence of wireworm on the surface.

Soil sampling

A soil-sampling method developed in the 1940s uses 20 10cm soil cores for a 4-10ha field and an aggregated sample is then analysed in the laboratory for larvae numbers.

It is best carried out in the autumn and early spring, ahead of planting.

As the limit of detection for wireworm is 62,500/ha and populations below this limit can still cause significant damage in crops, the method’s usefulness is questionable, unless infestation is high.

It is also expensive and labour-intensive, and there is a poor correlation between sample results and damage seen in the crop.

Bait trapping

Bait traps are widely considered a more effective risk-assessment method. These are small, perforated plastic containers part-filled with grain and buried in the soil for 10-14 days in late March or early April, once soil temperatures are higher than 10C.

The germinating seed gives off carbon dioxide and attracts wireworm into and around the trap, with any presence of the pest influencing site selection or any control decisions.

Bait trapping is only truly effective when there is little else in the way of food sources for the wireworms, so sites where there is a growing crop or weedy sites may mask economically damaging populations. It is also unreliable for use early in the season, when the soil is cold.

Adult trapping

Adult click beetles do not migrate and only move locally, so monitoring numbers can give a good indication of potential problems – but monitoring has to be done nearly a year ahead of planting a potato crop.

Pit fall traps and sticky traps are available, but more useful pheromone traps specific to the three main species of click beetle are now sold commercially.

Placed in or around the edge of fields destined for potatoes the following spring, pheromone traps are much less labour-intensive and much more sensitive than soil sampling.

Trapping is best done in short periods (three to four days) in early May – leaving traps longer than this risks attracting beetles from outside the field.

Although traps can detect low levels of adults and provide an early warning of potential wireworm issues in the next crop, they don’t reveal larval numbers and should be backed up by other methods such as soil sampling or bait trapping.

Are there any biocontrols?

Trials in the UK have shown that mustard biofumigation crops are ineffective against wireworm. There are, however, a number of biological control products being developed or close to market that show useful activity against wireworm.

BASF hopes to have a granular biological product containing entomopathogenic fungi Beauveria bassiana approved in late 2022, ready for 2023 potato plantings.

Currently coded BAF480BCI, BASF has managed to encapsulate the active in a granule that attracts wireworm and exposes them to the fungi, which kills them after several days.

Applied at 10kg/ha through standard granule applicators, the product has been in trials across Europe alongside Mocap. Mocap averaged a 67% reduction in wireworm tuber damage across the trials, with BAF480BCI offering a slightly less than 50% reduction.

BASF says it won’t stand up to the pressures of high wireworm populations alone, but will provide very useful results as part of an integrated control strategy where numbers are more “sensible”.

German company Biocare is another firm offering a similar product, but it uses the entomopathogenic fungus Metarhizum brunneum. At present, Attracap is only approved in Germany and Luxembourg.

Applied in-furrow, the granules absorb moisture from the soil, releasing wireworm attractant carbon dioxide, which brings the pest into contact with the fungi. After infection with the fungus, wireworms die after several days, depending on soil and temperature conditions.

The Biocontrol and Natural Product (BCNP) group at Swansea University, led by Tariq Butt, has also had some success in identifying and testing biocontrol agents, including Attracap and stains of a similar entomopathogenic fungus, Metarhizum anisopliae.

West Wales-based fresh produce grower and packer Puffin Produce provided trial sites for some of the research as part of the project, carried out by PhD student Ben Clunie.

Puffin Produce field manager Stephen Mathias says the Welsh potato-growing area sometimes suffers with wireworm, as grass often features in the potato rotation.

He reports that the good wireworm mortality results achieved in the lab using the Metarhizum agents were not transferred into the field, with moderate results achieved, so currently the biocontrols wouldn’t be suitable for use in high-pressure situations.

However, he is optimistic that with further development, biological controls such as Metarhizum spp. will play a role in the future.

Mr Clunie’s study is also looking at the potential of natural fumigants and essential plant oils to inhibit or kill wireworm, with results expected once the project ends later this year.

Wireworm – view from the field

For independent potato expert Martyn Cox, the loss of a string of aggressive actives for controlling wireworm – from the 1970s up to Mocap’s withdrawal last year – means the industry must take a longer-term view to manage the pest.

Mr Cox says regulation of pesticides will not loosen and although the biocontrols coming through are useful, they won’t be as effective as Mocap, so combining all the integrated crop-management methods outlined in this article – most importantly, cultivation – is vital.

In addition, he sees the targeting of adults before they lay eggs on crop land each year as a means of driving down populations of larvae, which can be problematic for up to five years.

One adult click beetle lays about 150-200 eggs and identifying when they are active and targeting them with pyrethroid insecticides in the years between potato crops could help reduce larvae to minimal levels.

“The issue is, this would require more management input throughout the rotation, which is not always possible with current thinking, particularly on rented potato land.

“For landlords who wants to keep that revenue stream, increasing wireworm populations will soon take that away and they need to consider the benefits of controlling the pest. It also limits appeal to growers of other high-value crops such as carrots and onions.”

Increased pyrethroid use has many downsides, due to the potential effect on the environment and beneficial insects, as well as resistance issues.

As a more environmentally acceptable alternative, Mr Cox points out that Canadian potato producers have been successfully using mass pheromone- or light-trapping of adults to break the click beetle’s lifecycle.

“Although this sounds mad, pitfall traps can catch a lot of adults and the cost is low compared with alternatives," he says.

Thanks to AHDB’s research director Bill Parker for additional information and support compiling this article

JOURNAL : Farmers Weekly

Aphid migration could be more than a month earlier in some regions this season due to the relatively mild winter, which allowed the pests to over-winter in crops.

Monitoring of cereal crops is therefore essential for the rapid identification of aphid flights and effective disease control, with late-sown crops being particularly vulnerable to attack.

Steve Ellis, entomologist at crop consultants Adas, says no reports of aphids have currently been identified in winter-sown cereals, but growers should be vigilant.

See also: Alerts a vital tool in pest and disease control this spring

“Aphid population numbers are starting from a low level, so growers should monitor crops closely to see if thresholds are reached,” says Dr Ellis.

Aphid flight

Mild weather conditions saw temperatures in January and February rise above the 30-year average, meaning aphid flights in southern counties of England are expected to be a month earlier.

The suction-trap network, which is run by Rothamsted Research, has a series of weather and insect ***data*** ***collection*** sites spread across the UK.

Sites in Kirton, Lincolnshire, witnessed a 2C rise in temperature, while further south in Silwood, Berkshire, temperatures increased by 2.5C.

In the absence of abnormal weather conditions this spring, aphids are expected to fly about four weeks earlier across the majority of England from The Wash southwards and potentially five weeks earlier than average in the Silwood area.

Further north in Scotland and northern England, aphids are predicted to fly about one to three weeks earlier, due to temperatures rising by 1.5C.

“There is concern that the mild winter will cause aphid populations to rise rapidly in the summer months as a result of their earlier migration,” says Dr Ellis.

However, he adds that this winter was the fifth wettest on record in the UK, with several Atlantic storms creating deluges across the country, which may restrict aphid migration and suppress population growth.

BYDV

Dr Ellis warns growers that barley yellow dwarf virus (BYDV) is the biggest threat to cereal crops from aphid attack, with yield losses of up to 25%.

He advises growers to ensure optimum crop nutrition to enable plants to rapidly reach growth stage 31, which is the onset of stem elongation, as greater plant maturity makes crops more tolerant to pest attack.

“Many crops are now approaching growth stage 30 so are less vulnerable to damage by aphids, but later-sown crops that are under-developed will be more at risk,” he adds.

Dr Ellis also highlights that the disease is more difficult to control in spring-sown crops than winter-sown ones because migration doesn’t end during the spring and early summer months, so particular care should be taken to monitor these crops.

Sprays and thresholds

An insecticide spray should only be applied once the threshold is reached to avoid resistance build-up.

“Before growth stage 61, the threshold is reached when 50% of tillers are infested, while beyond growth stage 61, until two weeks before the end of grain filling, the threshold is reached when two-thirds of ears are infected,” says Dr Ellis.

A full rate of pyrethroid is still an effective control method if used at the correct timing as resistance has only been detected in the grain aphid but not in the bird cherry-oat aphid.

Predicted date of first catch of cereal aphids in selected Rothamsted insect survey suction traps

Site

Bird cherry-oat aphid

Grain aphid

Rose grain aphid

Dundee

25 April - 7 June

7 May - 14 June

29 April - 16 June

Newcastle

17 April - 30 May

27 April - 30 May

26 April - 4 June

Hereford

10 February - 21 May

2 April - 7 May

11 April - 26 May

Rothamsted

25 March - 1 May

31 March - 4 May

29 March - 12 May

Starcross

3 January - 3 April

2 March - 28 April

25 January - 14 April

JOURNAL : Farmers Weekly

Almost all markets are more volatile than usual, with a heady mix of crop areas, logistical strains, massive changes in demand and consumer trends. Speculative activity is also driving further uncertainty.

Wheat

Global wheat futures were pushed slightly higher midweek by a US Department of ***Agriculture*** report revealing the lowest reported US planted area since records began in 1919. Stocks were also put at lower levels than the trade had expected.

However, the pound gained strength, pushing the UK domestic market down by about £2.50/t on last week, and putting ex-farm wheat for April in a range from £147/t to £157/t and averaging £153/t on Wednesday

(1 April).

An important factor in cereal markets is the reduction in demand for fuel during the coronavirus pandemic.

This has led to the closure of about 15% of US ethanol production capacity, for which the main feedstock is maize, with a consequent depressing effect on maize prices. This in turn influenced wheat values.

Oilseed rape

Low oil use through the economic slowdown affects vegetable oils as well as crude prices, which have dropped to just above US$20 a barrel.

Biodiesel demand has in turn fallen dramatically, resulting in lower EU rapeseed crushing volumes. This has lowered oilseed rape prices, which averaged about 50p/t down on the week to Wednesday (1 April) at almost £306/t spot ex-farm and ranging from £294/t (north-east Scotland) to £311/t.

See also: Coronavirus - advice for managing and keeping staff safe

Straights

The feed price rollercoaster ride continued this week, with some useful reductions in soya meal prices as markets calm down after last week’s talk of South American port closures drew speculative futures trading. Hi-pro meal (20t bulk load April delivery) fell by about £12/t to between £375/t and £382/t on farm.

The drop in OSR prices has been limited by the tightening of rapemeal supplies for feeding as a result of the lower crush, pushing up values.

Lower US maize demand as ethanol production capacity closes is feeding through to cheaper maize-based feed ingredients, with maize gluten for April falling by £10/t on the week to between £215/t and £222/t for April deliveries.

Beef

Deadweight prime cattle prices for the week ending 28 March remained similar to the week before, with the UK steer average gaining 1.3p/kg to stand at 337p/kg, while heifers and young bull prices were flat.

Cull cow prices dipped across the UK, with the biggest falls occurring in northern England, where values dropped by 10p/kg on the week to average 234.5p/kg.

Marketing group Meadow Quality said cull prices had been hit by an oversupply of mince on the market following the closure of fast-food outlets such as McDonald’s.

Pigs

Pig prices remain flat on the week and are still well up on year-earlier levels, with the GB standard pig price (EU spec) at 163.39p/kg for the week ending 28 March.

Market analyst Peter Crichton said it is still business as usual for the sector in most cases, but concerns persist among some abattoir operators about if they will have enough staff.

He added the rising cost of inputs, particularly protein, would erode margins to an extent.

JOURNAL : Farmers Weekly

Vets and farmers have been included on the list of key workers, published by the government amid the coronavirus pandemic.

This means farm animals are still able to receive care and farmers can obtain veterinary medicines.

However, both the British Cattle Veterinary Association and The Royal College of Veterinary Surgeons are urging vigilance to reduce the spread of the Covid-19 virus and have put in place the following guidance:

Veterinary practices should be working ‘on a similar standard to out of hours’ with farm visits to be assessed using a risk-based approach.

This means animals should only be seen in emergencies or where, in the judgement of the veterinary surgeon, urgent assessment and/or treatment is needed in order to reduce the risk of patient deterioration to the point where it may become an emergency.

When on farm, farmers and vets should keep a minimum distance of 2m apart (the size of a cow).

Personal protective equipment such as coveralls and gloves should be worn at all times.

This means farmers are going to have to use inventive approaches in non-emergency situations.

See also: Coronavirus: Marts suspend breeding stock sales

Veterinary  director Tom Greenham, of Advance Milking, believes farmers can make good use of ***data*** and smart tools and adopt a collaborative approach with vets and advisers to help maintain animal health, welfare and productivity, without any extra risk to human health.

Below, he gives some advice on how this can be achieved.

Consider if the procedure is a priority

In such times, it is both inevitable and correct that certain compromises must be considered, with management of emergencies taking priority over less urgent situations.

We have seen this in the UK health service, with non-urgent operations being cancelled for three months. For animal health, similar compromises are being made to reduce contact between livestock farmers and their veterinary teams.

Think: Is the visit necessary to preserve animal welfare or food security? Are there alternatives to outside advisers travelling to the farm?

Can your vet diagnose the problem remotely?

A remote assessment of the problem, while not as effective as a conventional visit, can help identify risk factors and help pinpoint solutions.

Observations can be discussed via phone or video call (FaceTime or Zoom), allowing the whole farm team to be involved in creating a plan of action without any face-to-face meetings.

Photos could be sent to your vet for further exploration or you could carry out a virtual, live farm tour if you have sufficient connection speed.

Having highlighted the likely cause, a practical plan of action can then be put in place.

Review ***data***

Modern ***agriculture*** generates a large amount of ***data*** that is often underused and most farm staff have all the technology they need to ***collect*** useful information in the form of a smartphone.

Review what health and performance ***data*** is already being ***collected***, for example cell counts and mastitis, and think how best it can be used to give an early warning of problems.

Milk recording may be difficult when retaining a 2m gap. However, the information is valuable, so in this case consider doing your own monthly sampling.

Adopt alternative methods of doing essential ‘non-emergency’ management

Fertility and breeding programmes may be disrupted, with far-reaching, negative consequences for production health and welfare.

It may be worth discussing blanket synchronisation programmes with your vet to ensure animal breeding continues.

Pregnancy diagnosis by milk test is available either at your monthly milk recording or as a separate sample when needed.

Phone ahead for medicines

These can be left in a designated place to avoid footfall through receptions and pharmacies.

Make sure your protocols are up-to-date

More than ever, preventing problems is better than reacting to them, so take time to review management plans for key health areas.

If staff have different areas of responsibility, then ensure they summarise the key protocols, so others can cover their work if necessary.

Keep the whole farm team updated via group chat or video call meetings. Management plans don’t have to be on hold due to social distancing.

Key take home messages:

Use ***data*** to highlight where the source of a problem may be, allowing for more efficient investigation.

Just because your vet or adviser isn’t physically on farm doesn’t mean they aren’t available to chat - keep in contact via text or phone and use photos and videos to help discuss animal health issues.

Update protocols and keep all staff in the loop in case one goes off sick.

JOURNAL : Farmers Weekly

The closure of fish and chip shops due to coronavirus has left thousands of tonnes of potatoes languishing in storage – threatening to put farmers out of business.

Although government guidelines allow takeaway food outlets to remain open, 80-90% of fish and chip shops are said to have closed their doors.

See also: Coronavirus - Guidance for farmers and contractors

The decision has seen a slump in demand for chipping potatoes.

Based in Cambridgeshire, potato merchants Abbey Produce usually supplies about 30,000t of potatoes into the chip shop trade every year.

But sales director Duncan Negus told Farmers Weekly his company hadn't been able to sell a single potato for more than a week.

Mr Negus said he understood the reasons why fish and chip shops had closed.

This included queues outside shops and government guidelines on social distancing – with police moving people on if necessary.

Help needed

But he added: “This means that growers who hold stocks for chip shops are left high and dry – potatoes are a perishable commodity with a finite time to move.”

Mr Negus said he had spoken to processors in a bid to move potatoes, but they were adequately covered because many other fast-food outlets were also shut.

Supermarket chains were also adequately supplied, he said.

“Farmers in this sector lay out vast sums of money up to 18 months in advance to crop – and if they receive no help, they will go under.”

In its latest Potato Weekly report, the AHDB said chipping markets had largely stalled due to the coronavirus lockdown.

Suppressed demand

“There are reports of chip shops cancelling orders due to closures, although some are operating in a small capacity through delivery services,” said analyst Alex Cook.

“Due to this, demand for chipping supplies [is] expected to remain suppressed until the government restrictions are lifted.”

Some growers and merchants were selling chipping stock as ware to help meet local demand – including in 25kg bags to farm shops.

“With an increasing number of consumers having turned to farm shops, it is hoped that an increasing number will return to farm shops once the pandemic has been resolved.”

Public safety

The National Federation of Fish Friers (NFFF), which represents some 10,000 fish and chip shops, said it had reluctantly advised its members to close their doors.

NFFF president Andrew Crook said: “Without help marshalling queues and with government guidelines, we cannot guarantee the safety of our employees and the general public.”

Some businesses were operating delivery services if they could do so safely and within government guidelines, said Mr Crook.

Each shop was able to feed thousands of people with a nutritious meal, and would be willing to reopen if needed to provide any assistance in a humanitarian capacity.

“We will reassess this advice on a weekly basis,” said Mr Crook.

“This is an awful situation for all. We will get through this and fish and chips will live on.”

JOURNAL : Farmers Weekly

Police are urging members of the public not to escape to the countryside to walk dogs or exercise as these actions could risk spreading the coronavirus and increase dog attacks on livestock.

Calving, lambing and field work is in full swing on farms and farmers fear that a sudden influx of people to the countryside will add an extra burden.

Insp Hagen of North Yorkshire Police’s Rural Taskforce said: “If you are walking your dog as a form of exercise in the countryside, keep it under control and on a lead near livestock.

“This advice applies all the time but please take particular care now – farmers and vets do not need any extra work.”

See also: Footpath fears over spread of coronavirus

Avoidable crime

The plea follows West Yorkshire Police reporting of 38 sheep worrying incidents in the area over the last four days, highlighting dog attacks on numerous sheep in Ilkley and Oxenhope.

These are all avoidable crimes, putting undue stress on the animals, farmers and an already resource-stretched police forces.

CLA North director Dorothy Fairburn said: “It is vital that dog owners understand their responsibilities when walking their dogs on farms or adjacent areas.

“Those using the countryside should, especially under current circumstances, be conscious that the countryside is also a place of work where the land, livestock, machinery, wildlife and environment must be respected.

“The Countryside Code is generally adhered to by the majority of people, but there are a few worrying trends either based on anti-social behaviour or a lack of awareness of the working countryside.”

Unnecessary travel

A number of rural police teams across the UK are also asking people to avoid unnecessary travel until restrictions placed on all of us to tackle the pandemic have been lifted.

They will be urging people to behave responsibly – for example, where rights of way pass close to, or through residential and ***agricultural*** properties.

It is also important that the existing government advice regarding social distancing and hand washing is adhered to.

The government’s Health Protection (Coronavirus) Regulations 2020 states people are only allowed to leave their homes for the following reasons:

Shopping for basic necessities, as infrequently as possible

One form of exercise a day – for example a run, walk, or cycle – alone or with members of your household

Any medical need, to provide care or to help a vulnerable person

Travelling to and from work, but only where this is absolutely necessary and cannot be done from home

Insp Matt Hagen, of North Yorkshire Police’s Rural Taskforce, asked rural residents to do their bit. He said: “People living in the Dales, Moors and other rural areas can also help us protect the NHS and save lives.”

Avon and Somerset Police force has been handing out leaflets to people in rural locations, near farms and beauty spots, reminding them of the restrictions.

“Each and every one of us has been instructed to avoid all unnecessary travel. You are entitled to exercise once daily. This should be by walking, running or cycling from your home address. You should not be driving to a location away from home to carry this out,” says the pamphlet.

Derbyshire Police said too many people were ignoring the advice and still making unnecessary journeys to the Peak District.

[*https://twitter.com/DerbysPolice/status/1243168931503882241*](https://twitter.com/DerbysPolice/status/1243168931503882241)

The Country, Land and Business Association (CLA) urged people to act responsibly in the countryside, limit exercise to once a day in addition to practicing social distancing, and respect the Countryside Code (PDF) which helps to protect British landscapes as well as farmers and those living there.

Three top tips for those using the countryside:

1. Livestock worrying by dogs not adequately controlled by their owners is on the increase. Please keep your dog on a lead if you are anywhere near livestock.

Even the best-trained family pet can chase sheep and wildlife if not kept under close control. Also, clear up after your dog.

2. Fly-tipping is a blight on the landscape and can cost up to £800 per incident to clear away and all at the farmer’s expense.

Please ensure you take your litter home with you and dispose of bulky waste through proper legal channels.

3. When riding a bike or driving a vehicle, slow down or stop for horses, walkers and farm animals and give them plenty of room. By law, cyclists must give way to walkers and horse- riders on bridleways.

The Countryside Code applies to all parts of the countryside in England and Wales. It aims to help everyone respect, protect and enjoy the outdoors.

JOURNAL : Farmers Weekly

Defra minister George Eustice has described farmers as “hidden heroes”, as the government considers extra help to feed the nation during the coronavirus pandemic.

It comes as the government look at ways to ensure farmers have the support and additional workers needed ahead of the busy harvest months.

See also: Coronavirus: Urgent appeal for Brits to work on farms

In an open letter to the food and drink industry, Mr Eustice said the coronavirus pandemic was perhaps the greatest health challenge the country had faced in our lifetime.

“I want to pay tribute to all those who are working around the clock to keep the nation fed,” he said.

This included people working “in our fields, processing plants, factories, wholesalers, stores and takeaways and all those moving goods around the country and to our homes”.

Seasonal workers

Mr Eustice also said he had been speaking with the industry about the “critically important issue” of seasonal workers, who usually come from Europe to pick fruit and vegetables.

“We need to mobilise the British workforce to fill that gap and make sure our excellent fruit and vegetables are on people’s plates over the summer months,” he added.

Some 70,000 seasonal workers are needed to work on UK farms annually – prompting concerns that a labour shortage could see food left to rot in fields.

Mr Eustice said: “There are already brilliant recruitment efforts under way by the industry, and I would encourage as many people as possible to sign up."

Extra support

“We will also be looking at other ways to make sure farmers have the support they need ahead of the busy harvest months, while also keeping workers safe and protected.”

In the letter, Mr Eustice said the past three weeks had been stressful and difficult for everyone working to feed the country and provide them with other essential items.

“Food retailers have faced an unprecedented increase in demand,” said Mr Eustice.

“Those working in food production and distribution have had to work harder than ever to ensure that food and drink are kept on the shelves.”

Government guidance

Mr Eustice said he was in regular dialogue with the food and drink industry, with government guidance to employers to ensure staff could do their jobs safely.

“The advice from Public Health England is that there is very little risk of the virus being spread on food or packaging,” he added.

“Everyone working in the food and drink industry has rallied in an extraordinary way to respond to this unprecedented challenge.

“Having worked in the food industry myself, I am personally enormously proud and thankful for all the work you have done in recent weeks, and will be asked to do in the weeks ahead.

“In many cases you are the hidden heroes, and the country is grateful for all that you have done.”

JOURNAL : Farmers Weekly

Freelancers and the self-employed will receive financial support during the coronavirus outbreak, the chancellor has announced.

Rishi Sunak confirmed on Thursday (26 March) that the government will support these workers by providing a taxable grant of up to 80% of their monthly net earnings, averaged over the last three years, up to £2,500 a month.

It will be available across the UK for at least the next three months and will bring self-employed workers on a par with employees furloughed under the Job Retention Scheme.

See also: Self-employed access to benefits eased due to coronavirus

Eligibility:

Trading profits of up to £50,000

Make majority of their income from self-employment

Already in self-employment with a tax return for 2019

The HMRC is working on implementing this urgently, the chancellor said, and workers will be able to access it no later than the beginning of June.

Applications can be made online and the money will be paid directly into bank accounts. Anyone who missed the tax return January deadline has an additional four weeks to do so.

Mr Sunak reiterated that workers can receive support immediately through the Business Interruption Loan Scheme or benefits access being eased, and that the income tax self-assessment has been deferred by six months.

“You have not been forgotten,” said Mr Sunak. “We all stand together.”

There are five million self-employed people in the UK, generating about £300bn for the economy.

However, it has been more complicated for the government to create a system that provides a sufficient level of support to every self-employed worker.

According to the government this is because it is not straightforward to identify who is and who isn't self-employed; defining a regular pay packet is difficult and therefore it is hard to underwrite accurately; HMRC does not hold details for all self-employed people; and the Treasury has claimed that some self-employed people may be unaffected by the current situation.

In addition, it was previously announced that income tax self-assessment payments due on 31 July 2020 will be deferred to 31 January 2021. Anyone classed as self-employed will be eligible and no application is required.

JOURNAL : Farmers Weekly

An improvement in weather conditions means farms are now buzzing with activity, but it’s imperative that employers and staff given ‘key worker’ status take all the precautions outlined by the government.

The National Association of ***Agricultural*** Contractors (NAAC) has released a guidance document that offers advice on how to manage the workload while minimising the spread of the disease.

Direct contact should be avoided wherever possible and extra precautions should be taken in areas frequented by several people, such as the diesel tank.

See also: All of our coronavirus advice and news

Cab hygiene

Tractor cab hygiene must be made a priority so, where possible, employers should enforce a one person, one machine policy.

If this is not practical, cabs must be cleaned by a member of staff wearing personal protective equipment.

Be sure to wipe down all door handles and controls and ask staff to touch surfaces/open doors with their non-dominant hand, with which they will be less likely to touch their face.

Try to avoid relying on gloves unless they are frequently changed – it’s better to prioritise frequent hand washing.

It may also be worth putting a note in the cab window, reminding people not to touch the door handle and providing a phone number with which to contact the driver.

Businesses should also consider the likelihood of staff taking time off to self-isolate. With that in mind, it might be prudent to make sure several members of the team are capable of operating high-tech equipment.

However, bear in mind the challenges of training while keeping a safe distance from team members.

See also: NAAC farm contractor charges 2019-20

Assess the risk, says the NAAC

Ensure you and your staff are fully informed and taking all necessary precautions to minimise the risk of catching or spreading the virus. It’s worth considering the following:

Encourage employees to work at home, wherever possible. Office staff should be equipped to work remotely. All access to offices and workshops should be strictly limited to essential staff only and provision must be made for keeping surfaces clean and ensuring staff have access to hand washing/hand sanitation facilities.

Discourage visitors to your yard – put up notices if necessary. Ensure delivery drivers remain at least 2m away and ask for parts to be left at a distance in a secure place. Ideally, don't sign for them – most only require a name.

Close staff tearoom/facilities to avoid all close contact, only allowing access to washrooms/toilets.

If someone becomes unwell in the workplace with a new, continuous cough or a high temperature, they should be sent home immediately.

Employees should be reminded to wash their hands for 20 seconds more frequently and catch coughs and sneezes in tissues (which should be disposed of).

Frequently clean and disinfect objects and surfaces that are touched regularly, using standard cleaning products.

Make sure all staff have been issued with the latest guidance from government.

Employees will need your support to adhere to the recommendation to stay at home to reduce the spread of the virus.

Those who follow advice to stay at home, and who cannot work as a result, will be eligible for statutory sick pay (SSP) from the first day of their absence from work.

Employers should use their discretion and respect the medical need to self-isolate in making decisions about sick pay. Use discretion regarding the need for medical evidence for employees who are unwell. This will allow GPs to focus on their patients.

Employees from defined vulnerable groups should be strongly advised and supported to stay at home.

Ask customers to avoid any contact with you and your staff wherever possible – ideally have work established remotely, prior to the job. All safety risks, locations, mapping and job requirements should be fully explained by the customer prior to your arrival.

Do not share customers' machinery off-site.

Ask customers to make you aware of any of their family or staff who have contracted the virus or who are self-isolating. This will ensure that all parties respect social distance and do not unwittingly put anyone at unnecessary risk.

Bear in mind that there may be children on the farm, which pose an added health and safety risk.

You can also download and print the NAAC's checklist for contractors visiting farms (PDF) to make sure you're following all the necessary procedures.

Useful sources of information can be found on the following websites:

NHS: Coronavirus (COVID-19)

Government website: Coronavirus - what you need to do

AHDB coronavirus FAQs

NFU coronavirus updates and advice

JOURNAL : Farmers Weekly

Thousands of temporary workers are needed on British farms to help feed the nation during the coronavirus pandemic.

Jobs are available on fruit farms, arable farms, livestock farms and in pack houses – with workers also needed to fill other vacancies.

See also: Coronavirus: Urgent appeal for Brits to work on farms

Farmers Weekly has put together the following links to help put people looking for work in touch with farm businesses who need staff.

Recruitment agencies

Hops Labour Solutions

Specialist in ***agricultural*** recruitment & seasonal labour for the farm and food industry.

The following recruitment agencies piloted the government’s seasonal workers scheme and are also looking for staff:

Concordia

Recruiter of seasonal labour for the UK ***agriculture*** and horticulture industry

T: 01273 422 218

W: [*www.concordiavolunteers.org.uk*](http://www.concordiavolunteers.org.uk)

Pro-Force Recruitment

Specialising in temporary and permanent placements to the fresh produce, ***agricultural***, horticultural, warehousing and manufacturing industries.

T: 0333 335 6262

W: [*https://pro-force.co.uk*](https://pro-force.co.uk)/

CDS Labour

CDS are a labour providing company that specialises providing van drivers, lorry drivers, farm workers, packers, pickers, trades people, admin staff and many much more sectors.

T: 03333 44 21 44

W: [*http://cdslabour.co.uk*](http://cdslabour.co.uk)/

Fruit growers

British Summer Fruits, which represents 98% of soft fruit growers, is also looking for workers to help harvest and pack fresh fruit and vegetable crops.

T: 020 7575 7654

W: [*www.britishsummerfruits.co.uk/jobs*](http://www.britishsummerfruits.co.uk/jobs)

Farm businesses and food producers

The following farm businesses and food producers have been looking for temporary workers:

Cranswick

[*https://cranswick.plc.uk/news/help-us-feed-nation*](https://cranswick.plc.uk/news/help-us-feed-nation)

G's

[*https://www.gs-fresh.com*](https://www.gs-fresh.com)/

Vicarage Nurseries

Strawberry grower Vicarage Nurseries at Bretforton, Vale of Evesham, requires 250 strawberry pickers from mid-May to October. To apply, visit: [*http://vicaragenurseries.co.uk*](http://vicaragenurseries.co.uk)

If your farm business is also looking for temporary workers, please email [*johann.tasker@proagrica.com*](mailto:johann.tasker@proagrica.com) with details and a link to your website and we will add you to this list.

DISCLAIMER: Farmers Weekly does not automatically endorse the organisations and businesses listed on this webpage.

JOURNAL : Farmers Weekly

Rural landlords and tenants must work together collaboratively and compassionately during this unprecedented time, say the Tenant Farmers Association (TFA) and Country Land and Business Association (CLA).

The call relates particularly to rent payments, notices to quit and finalising new tenancy agreements, but covers all tenancy matters, the two organisations said in a joint statement.

This means neither party should seek to take advantage of the current situation or use it as an excuse to act unreasonably.

They should consider the impact of their actions on the other and avoid taking a hard line on any issue, at what is a very difficult time, said the statement.

“It is inevitable that some tenants will struggle to meet rent payments or other tenancy obligations due to cashflow difficulties or other knock-on impacts of the coronavirus situation,” said TFA national chairman Mark Coulman.

See also: Top 8 farm tenancy issues and how to solve them

“In these circumstances we are urging landlords and tenants to work together to agree alternative arrangements. We are already hearing of positive examples of landlords and tenants working together during this trying time.

The TFA has been helping members left in difficult situations due to coronavirus restrictions.

In one case, a conversation with a TFA member’s landlord's agent led to agreement on a better frequency of rental payments to help cash flow and reduce the stress of having to find large sums of money upfront.

In a second, the member has decided in light of the recent events to give up farming, but he had just gone beyond the point at which he could break his tenancy.

Although the landlord had previously rejected his notice to quit, the TFA managed to negotiate its subsequent acceptance.

CLA president Mark Bridgeman said: “We have advised landlords to discuss with farming tenants any problems they are facing so that a mutual solution can be found, and we make sure farming businesses can carry on as well as possible in these difficult circumstances.

“We also suggest that, as far as possible, current disputes are put on hold and that formal proceedings for any non-payment of rent are used only as a matter of extreme last resort.”

JOURNAL : Farmers Weekly

Defra is facing calls to follow Northern Ireland and suspend TB tests in England amid fears that vets checking cattle for the disease could spread coronavirus.

The pandemic has seen TB tests in Northern Ireland put on hold from 30 March – other than in exceptional circumstances.

But Defra insists tests will continue in England – if they can be done safely – and says farmers who refuse to comply will see herds put under restriction.

See also: How will TB tests work during the coronavirus pandemic?

Beef and dairy producers have expressed worries that allowing vets on to farms to conduct TB tests could put farm staff at risk of spreading the Covid-19 virus.

They include older farmers at higher risk of falling seriously ill from the disease.

Ulster Farmers Union deputy president David Brown said producers would be largely relieved that tests were being suspended in Northern Ireland, although some farmers with herds under restriction or wanting to get livestock tested before summer grazing would be disappointed.

“Many farmers contacted us about farm visits, including those from vets, expressing their worry about the transmission risk it would pose,” said Mr Brown.

“Given the escalating response to this pandemic, we accept it would be irresponsible to allow routine TB testing visits to continue.”

The Animal and Plant Health Agency says it is keeping the situation under constant review for England.

The agency says it recognises the potential challenges faced by farmers, and that adjustments to TB testing instructions may be made as the coronavirus pandemic progresses.

Meanwhile, Northern Ireland's farm minister, Edwin Poots, has confirmed that all routine farm inspections in the areas of environment, EU-area-based schemes, agri-food and veterinary work will be halted until 30 April at the earliest.

JOURNAL : Farmers Weekly

Milk processor Pensworth will pay its suppliers just 25% of their standard milk price until it gets an emergency government loan as it battles a slump in demand from the food service sector.

The move will see farmers get an average of 6.25p/litre this week and for the three payment days in April unless money from the government’s Coronavirus Business Interruption Loan arrives.

In a letter to farmers sent on Monday 30 March, trading director David Kent told farmers the company was in the process of arranging a substantial funding package with its bank to bring costs in line with sales.

See also: Coronavirus: Freshways first to cut price as demand slumps

He said: “We need to take these steps to ensure we have a business going forward and can maintain our supplies to the 230 hospitals and 1,700 nursing homes we supply, along with the 100,000 doorstep customers, many of whom are elderly.”

“We will bring your payment up to date once we receive the loan, which we aim to have in place within eight weeks.”

The firm will also be increasing prices, chasing customers for payment where possible, and seeking out new sales opportunities, he said.

Pensworth joins rival processor Freshways in struggling to find a home for milk that would normally have been destined for coffee shops and caterers that have been shuttered since the coronavirus closures.

Meanwhile, processors that supply supermarkets have been benefiting from a surge in demand, with Muller announcing that it will pay 1p/litre more for milk from 1 May.

This brings their standard price to 27.25p/litre for producers who have signed up to the Muller Direct Premium 2020, a raft of animal health and welfare measures which pays a 1p/litre bonus in arrears.

Government help needed

However, NFU dairy board chairman Michael Oakes warned that rapid government action is needed to ensure coronavirus does not cause parts of the dairy sector long-term damage that would limit its ability to meet demand after the crisis is over.

He said this was likely to require a temporary relaxation in competition law to allow processors to help each other meet supply, as well as a reintroduction of intervention buying to temporarily reduce supplies coming to market.

“I know George Eustice is involved,” he said. “It has gone right to the top and we are working to find solutions for the industry – both farmers and processors.”

Intervention buying is not something the NFU likes in normal times but measures beyond financial bailouts were likely to be necessary as the situation was deteriorating, he said.

The downturn is likely to spread to the manufacturing sector as cheesemakers have also seen a drop in demand as customers have not replicated their restaurant consumption in the home.

And, with the spring flush approaching, difficulties with accessing the Chinese market will put pressure on other commodities, he warned.

JOURNAL : Farmers Weekly

Farmers are being asked to remain vigilant on workplace safety if their children are at home because of the coronavirus pandemic.

The children of farmers, farmworkers and vets have been classed as key workers, which means many will still be attending school.

However, other parents will have chosen to keep their children at home over concerns about spreading the virus further or bringing it on to the farm.

See also: Safety campaign: ‘Working farm no place for children’

With more children now at home, the Health and Safety Executive (HSE) has reminded farmers that most children who are killed in farm incidents are family members.

The key points, released in a special bulletin for farmers, are:

Children should not be allowed in the farm workplace, and for young children they should enjoy outdoor space in a secure, fenced area

Any access to the work area by children under 16, for example for education, or work experience, should be planned and fully supervised by an adult not engaged in any work activity

Children under the age of 13 years are specifically prohibited from driving or riding on any ***agricultural*** machine

The NFU has reminded farmers that children employed on a farm must have a permit from the local authority.

And that everyone in a farm workplace has a responsibility to protect, and every employer is required by law to manage any risks.

Create boundaries

NFU deputy president Stuart Roberts said juggling childcare was now another pressure for some farmers already working flat out to help keep supermarket shelves stocked.

He urged farmers to put in place whatever measures they could to keep children away from the workplace.

“I know this is not always possible, but as more children are going to be at home for the foreseeable future, boundaries are crucial in helping to protect them during this time.

“We must remember that farms are first and foremost a working environment.”

The Ulster Farmers’ Union (UFU) also urged parents to remain vigilant.

***Agriculture*** has one of the highest fatal accident rates of any industry in Northern Ireland.

UFU deputy president Victor Chestnutt said: “Children view farms as one big play area and fail to understand the consequences that go hand in hand with playing around machinery, equipment and livestock.

“It is vital that every farmer and farming family take the necessary steps to protect themselves and their family.”

Safety guides

The Farm Safety Foundation has written two new guides which could be useful for farmers who are keeping children away from school because of coronavirus.

The guides have been sent to all rural primary schools, land-based colleges, universities and national young farmers’ clubs to be shared with their pupils, students and members.

HSE has a range of resources and guides published to help those working on the farm, including keeping children safe.

JOURNAL : Farmers Weekly

Farm contractors or agri-businesses that usually pay VAT bills by direct debit should cancel them immediately if they want to defer their payment, say accountants.

There is an option to defer quarterly VAT payments from 20 March until 30 June 2020, as part of the financial measures to help companies cope with the business lockdown to combat the spread of coronavirus.

See also: Business Clinic: Will residential investment affect my VAT?

No application is required and businesses will be given until the end of the 2020-21 tax year to pay any liabilities that have accumulated during the deferral period.

Catherine Vickery, associate director for accountant Old Mill, said most of the goods sold by farmers are zero-rated for VAT, so traditionally farm businesses are more likely to be reclaiming the tax than paying it.

However, the ability to defer could be relevant for diversified businesses and those offering services where VAT might be due, such as farm shops, wedding venues, contractors and tourism enterprises.

VAT returns must still be filed during the deferral period, pointed out Alan Pearce, Vat partner at accountant and tax consultancy Blick Rothenberg.

“The chancellor’s announcement that VAT payments are being deferred was very welcome news, but many businesses need to ensure that they have instructed their banks to cancel any upcoming direct debits until 30 June,” he said.

“If they haven’t cancelled them, they should do so now, bearing in mind that banks will normally require at least one working day's notice to cancel.”

4 VAT cashflow tips

With businesses facing disruption, Mr Pearce also suggested a range of measures to ease VAT cashflow.

Ensure all sales invoices are issued promptly and declared in the VAT period to be deferred, as the VAT payment will not be required until March 2021.

Conversely, delay large purchase invoices until after the deferral period. These can offset the input VAT against liabilities that will be due to be paid immediately after the deferral period.

After the deferral period, it may also be possible for businesses such as property landlords, leasing companies and others making "continuous supplies" of services to consider issuing requests for payment instead of tax invoices and to delay accounting for VAT until they receive payment.

Review any bad debts and include the VAT claims in the next VAT return. A VAT bad debt relief claim can be made in any period that is within four years and six months from the due date of payment. Therefore, you may want to consider delaying the claim until after the VAT period that is eligible for the VAT payment deferral.

JOURNAL : Farmers Weekly

A new scheme could see thousands of British people helping to feed the nation by working on UK farms during the coronavirus epidemic.

Farm leaders and Defra officials are discussing a new system that would match interested workers with employers, as well as other incentives aimed at encouraging students and British workers to apply for jobs on the land.

See also: Coronavirus: How to find seasonal work on farms

The Country Land and Business Association suggests up to 80,000 workers will be needed over the coming months, largely due to coronavirus restrictions preventing people from overseas coming to work on UK farms and temporary staff falling ill from Covid-19.

The latest talks saw NFU president Minette Batters meet Defra secretary George Eustice this week to discuss what the union described as “innovative and creative solutions” to the problem. Other industry leaders are also involved.

National effort

NFU vice-president Tom Bradshaw said: “We are urging the British people, university students – anyone looking for work – to mobilise behind British growers in this time of national importance and pick for Britain.”

Thousands of vacancies would be opening up in fields, polytunnels, glasshouses and packhouses across the country in the coming weeks, said Mr Bradshaw.

“We need people to help deliver healthy, affordable British fruit and vegetables from field to plate.”

He added: “It is vital that government takes the lead in putting in place a range of measures to co-ordinate and support the logistics involved in mobilising the tens of thousands of British people who will be needed to bring in our fruit and veg harvest.”

Hidden heroes

Paying tribute to everyone working round the clock to keep the nation fed, Mr Eustice said farmers and others in the food supply chain faced an unprecedented challenge.

“In many cases, you are the hidden heroes, and the country is grateful for all that you have done.”

Mr Eustice said the government would be looking at other ways to make sure farmers have the support they need ahead of the busy harvest months. In the meantime, as many people as possible should sign up to the industry's recruitment efforts.

Seasonal workers were a “critically important” issue, said Mr Eustice.

“We need to mobilise the British workforce to fill that gap and make sure our excellent fruit and vegetables are on people’s plates over the summer months.”

JOURNAL : Farmers Weekly

Auctioneer firms have suspended sales of fatstock and store cattle at three Welsh livestock marts for at least three weeks amid fears over coronavirus infection, sparking fears that others may follow.

JJ Morris’ marts at Whitland and Crymych will not operate until 18 April at the earliest, while Nock Deighton has cancelled its forthcoming marts at Newcastle Emlyn.

NFU Cymru’s livestock board chairman Wyn Evans described it as a “significant blow” and said the economic consequences for farmers would be severe if further closures follow.

See also: Advice for managing and keeping staff safe

“I am not criticising any businesses that take a decision to close marts, if they feel they need to do that to keep people safe,” said Mr Evans.

“But there is no denying how vital marts are for underpinning fatstock prices, particularly sheep.”

Farmers with store cattle to sell will also be worried, he added.

“We normally see a lot of movement of store cattle at this time of the year.

“With some marts closed, farmers and dealers will travel to marts that are trading, so the numbers of people at these will increase.”

Suspensions

The Livestock Auctioneers’ Association (LAA) had already suspended sales of dairy cattle and breeding stock.

But JJ Morris said it had taken the decision to cancel all sales to protect its staff and the farming community.

“We appreciate that marts are vital for keeping the wheels turning, but with sales of dairy cattle and breeding stock suspended for three weeks, we felt it was appropriate that we should no longer continue with our marts for now,” said Huw Evans, who runs Whitland.

Nock Deighton said it took the decision to cancel its markets at Newcastle Emlyn in part due to its town centre location.

In other parts of Britain, auctioneer firms are adhering to the LAA’s strict guidelines, including pre-registration of buyers, “drop and go” when stock are delivered, and 2m separation at all times.

Safety first

LAA secretary Chris Dodds said public health was of primary importance, but believed that with these restrictions in place, marts could operate safely.

He admitted that the removal of breeding stock and dairy cattle from trading had potentially made it less cost effective for marts to operate, but a decision on whether to close marts completely was one that had to be taken by individual companies.

“Our members are doing everything in their power to make staff feel safe against what is a silent virus,” he said.

Mr Dodds added that some marts in the north of England, which operate "back-end" sales of prime sheep and cull ewes, had decided not run these as throughput would be halved since no sales of breeding stock were permitted.

Fatstock and store cattle sales were also suspended at some marts last week, principally because the lack of demand from export markets had stagnated the supply chain.

This resulted in a reduction in deadweight prices. But with most marts operating again this week, trade is predicted to pick up again.

Food supply

Hereford Livestock Auctioneers, for example, had about 1,600 prime hoggets and store hoggets booked in for sale on Wednesday (1 April) and 600 cattle the following day.

Director Richard Hyde said it was vital that marts keep operating to sustain the food supply chain. “We need to keep the public fed and keep farm cashflows going; marts are fundamental to that.”

Across the Irish Sea

The Northern Ireland Livestock Auctioneers Association took the decision on 23 March to close all marts completely for two weeks.

Marts were also closed in the Republic of Ireland, though this week the government has allowed some limited trade to resume.

For calves, farmers are being allowed to make deliveries to mart, by appointment only, to meet specific purchase orders.

For older livestock, a weighing service for lots of cattle/sheep, by appointment, may be allowed, with the mart facilitating the transaction between a buyer and a seller.

These operations are only allowed where they are deemed essential, and steps must be taken to minimise the potential for contact between people.

JOURNAL : Farmers Weekly

New entrants and company directors may struggle to receive financial support from the government’s new scheme for the self-employed.

Chancellor Rishi Sunak announced on Thursday (26 March) that self-employed workers and freelancers would receive payments during the coronavirus outbreak.

This will amount to a taxable grant of up to 80% of monthly profit, capped at £2,500, available by early June.

See also: Coronavirus: Advice for managing and keeping staff safe

The Self-Employment Income Support Scheme (SEISS) was designed to bring self-employed workers on a par with employees furloughed under the Job Retention Scheme.

To be eligible, the worker’s trading profits must be less than £50,000, with the majority of their income coming from self-employment, and they must already be in self-employment with a tax return for 2019.

HMRC will approach people who are eligible based on ***data*** they already hold to invite them to apply online.

Workers will then receive a lump sum payment of three months of backdated support directly from HMRC.

However, these rules have proven difficult for a huge number of self-employed people, meaning many will receive no government support from this scheme.

Martyn Dobinson, partner at accountant Saffery Champness, answers some of the most common queries.

Partnerships

In the case of a trading partnership, as the partners are considered independently for income tax purposes, they will each be assessed individually for this purpose on their respective shares of the partnership profits in the relevant periods.

For example, in a two-partner partnership with average profits of £90,000 – if each partner takes a 50% share and therefore has average profits of £45,000, I’d expect both partners to be eligible, assuming the other conditions are met.

Similarly, where an individual has more than one trade, I’d expect all profits from their separate trades to be amalgamated before comparison to the limits under the scheme.

Running own company

This support scheme only applies to the self-employed, which would include sole traders and partners in a partnership.

Those who are directors or employees of their own limited companies, which is not uncommon in farming businesses, cannot benefit from the SEISS but may be able to benefit from the Coronavirus Job Retention Scheme (see ‘Alternative support’).

New entrant

To be eligible for the SEISS, an individual must have submitted an income tax self-assessment return for 2018/19, but only needs to have actually traded in the 2019/20 tax year.

They must be trading when they apply, or would have been trading had it not been for Covid-19, and they must intend to continue trading in 2020/21.

If an individual doesn’t have the full three year trading history for the trading profit averaging, then the averaging will be done considering only those years in which the individual did trade, so long as the other conditions are met.

Making a loss

If a business has recently started trading and does not have a profitable history, there will be no grant paid by the government.

Alternative support

If ineligible for SEISS, workers may be able to claim government support through the Job Retention Scheme.

HM Treasury said owner-directors could apply to furlough 80% of the PAYE element of their income for salaried staff and continue to perform their statutory obligations as company directors so long as that was all they were doing.

The business may also qualify for the Coronavirus Business Interruption Loan Scheme. There are qualification criteria and financing of up to £5m for periods up to six years can be sought.

The government will provide lenders with a guarantee of 80% on each loan and will also cover the first year’s interest payments and arrangement fees.

Meanwhile, income tax payments due by the end of July 2020 have been automatically deferred to 31 January 2021.

Any VAT payments due between 20 March and 30 June have been automatically deferred to the end of the 2020/21 tax year – VAT returns should be filed as normal.

Where a business is struggling to meet its tax commitments, time to pay arrangements can be agreed with HMRC for all taxes.

In addition, self-employed workers can apply for Universal Credit or Employment and Support Allowance.

Agri-tourism enterprises

Catherine Vickery, associate director for accountant Old Mill, warns the SEISS may leave farmers who have a seasonal agri-tourism enterprise at a slight disadvantage.

The figure that self-employed workers can claim is averaged out over 12 months, even if that income is typically generated over a much shorter period.

“If most of their income only appears in the summer months they will have lost a whole year’s income,” said Ms Vickery.

“But they will only get [three or perhaps six months] pro-rata worth of relief from the government. I can see that being a major concern for businesses.”

JOURNAL : Farmers Weekly

A young farmer in Scotland has urged the public to stay at home after confronting a dog walker whose dog was not on a lead in a field of sheep.

Emma Murdoch said farmers were stressed enough with lambing, but were now worrying about catching coronavirus from people ignoring government orders by using footpaths in the countryside.

[*https://www.facebook.com/1797158695/videos/10213104192478253/*](https://www.facebook.com/1797158695/videos/10213104192478253/)

See also: Jacob Anthony: Close footpaths to stop coronavirus spread

The sheep farmer from New Galloway pleaded with the public to stop putting farmers at risk and instead follow the measures which have seen the country enter lockdown as a result of the Covid-19 health crisis.

Taking it seriously

Speaking in a video posted on Facebook, which has received more than 330,000 views, Ms Murdoch said: “Every gate you touch, every stile you touch, if you have the virus you are giving it to a farmer.

“If we give it to the rest of the family it means the whole family is shut down for 14 days, and it also means if you are ill, how do we look after our livestock? How do we produce for the nation?

“Stay safe and stay indoors when you can.”

The farmer stressed how seriously her industry was taking the pandemic, having lived through the foot-and-mouth outbreak in 2001, which devastated farms in the UK and forced the closure of public rights of way across land.

Ms Murdoch said despite taking every precaution possible, the country was unable to stop the spread of foot-and-mouth. More than six million cows and sheep were killed in an eventually successful attempt to halt the disease.

“As the general public and as a nation, we can stop this. We have been given advice by the government to stop this virus. This is not like foot and mouth, we can stay at home,” she added.

‘Close footpaths’

Elsewhere, a beef farmer in Devon has urged the government to close footpaths to help protect her family as they begin spring calving.

Ruth Burrow, 72, wrote to her MP for East Devon, Simon Jupp, to raise concern at the number of people using the footpath which passes through her farmyard, at a time when the virus is spreading rapidly.

The farmer said she and her husband would not know how to cope if their son Paul was infected at one of the busiest and most crucial times of the year.

Dogs off leads

Sarah Kyle, who is in the middle of lambing on her farm in Walton, Cumbria also asked for footpaths to be shut. She reported seeing walkers with seven dogs that were not on leads.

She said: “We are lambing. And they have drove to get here. I’ve reported it to the police and the footpaths officer, but the footpaths need to be shut down now.

“Quite asides from the risk to our lambs, what about every gate they touched?

“We, as an at-risk family, are following the rules and staying at home but the people using rights of way over our private land are not abiding by that and are bringing risk to us. We deserve to be protected better.”

JOURNAL : Farmers Weekly

The size of the county farms estate in England continues to decrease as local authorities choose to dispose of their land in favour of a one-time cash payment.

The 69th Annual Report to Parliament on Local Authority Smallholdings in England (1 April 2018 to 31 March 2019) includes ***data*** from 39 authorities that responded to the Chartered Institute for Public Finance and Accountancy (Cipfa) survey – 43 were approached.

However, in some cases, the submitted ***data*** sets were incomplete, making it difficult to draw a direct comparison with previous years.

See also: ***Agriculture*** Bill proposes significant changes to tenancies

As of 31 March 2019, the total area of land held by the 39 authorities in England that responded was 201,117 acres (for the whole estate), of which 191,171 acres were let as smallholdings (for 38 reporting authorities).

In comparison, last year’s report showed land held by local authorities totalled 220,000 acres, almost 9% more, of which 206,580 acres were let as smallholdings.

However, three fewer authorities responded this year, which the Tenant Farmers Association (TFA) called a major disappointment.

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Land changing hands

The report’s ***data*** on acquisitions and disposals indicates a decrease in the area of land held by smallholdings authorities of 1.4%. The previous year saw a decline of 2.8%.

George Dunn, TFA chief executive, said: “It should be an absolute requirement for local authorities to provide this ***data*** to Defra.

“While it looks like there has only been a small year-on-year reduction in the area of land owned by smallholding authorities, there has been a reduction of 72 tenants.

“However, how certain can we be about this when local authorities do not treat this matter sufficiently seriously?”

A total of 257 acres were acquired by three smallholdings authorities and a total of 3,126 acres were sold or otherwise disposed of by 22 smallholdings authorities in 2018-19, according to the report.

Norfolk County Council bought the majority of these acres (247), as it did in the previous year, when it bought 440 acres of the total 465 acres acquired.

Chester West and Chester Council disposed of the greatest area (670 acres), with Somerset County Council not far behind (605 acres).

Staffordshire County Council is recorded as owning 8,256 acres on 114 holdings, receiving almost £1.16m in rent in 2018-19.

However, this is sure to change dramatically in the next report, as in February 2019, it announced plans to sell 1,700 acres, comprising 16 holdings, seven of which came to the market in October.

In comparison, a total of 6,852 acres was sold or otherwise disposed of by 24 smallholdings authorities between April 2017 and March 2018.

Over the same period the year before, the total area of county council farms in England shrank by 2,217 acres.

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Disparity in estate sizes

The 38 authorities that provided ***data*** reported they owned and let 2,400 smallholdings as of 31 March 2019.

Farm business tenancies represented 62% of the agreements, with 14% of these running for less than five years.

A total of about £23m in rent was due for the holdings and the average rent was £121/acre.

Cambridgeshire County Council continues to own the largest farms estate in the country by a big margin. It lets 32,171 acres in 251 holdings, receiving almost £4.17m in rent. The next-largest estate is Lincolnshire County Council, which owns a total of 18,753 acres.

At the other end of the scale, West Berkshire Council, Milton Keynes Council and Hartlepool Borough Council each owns just five acres.

Some are recorded in the report as having no ***data*** available, such as Herefordshire Council, which sold off its entire estate over the past few years.

In total, authorities in England had a farms revenue account net surplus of £8.93m.

Chris Cardell, NFU tenants’ forum chairman, said: “As always, the county farms survey shows the service continues to deliver value, and this can be shown by the establishment of 39 new entrants into farming businesses.

“The general trends indicate yet another year of surplus income being returned to the councils involved, after taking account of non-core income that varies from year to year.

“Thankfully, the value of the county farms structure is well recognised by this government and reference to its importance can be found in the ***Agriculture*** Bill.”

JOURNAL : Farmers Weekly

Spring is perhaps finally here, and many growers are making good progress on drilling, except on heavy land, which is still too wet to work. Conditions are still challenging, with some fields having soil that more closely resembles Plasticine.

There is a huge amount of variability in crops, with forward wheats about to receive their T0 fungicides in the North, although they are still a week off in the South. Late-drilled crops are much further behind. Septoria is being seen in these more lush crops, along with stem browning.

Winter barley is also showing disease, with rhynchosporium seen in the North West, which will be tackled with the T0 spray to help maintain tiller numbers.

See also: How to manage weeds in potato crops without diquat

South: Iain Richards

Agrii (Oxfordshire)

The country may be shutting down worryingly, but our spirits are, at least, being raised by the spell of settled weather we’ve been waiting for since well before Christmas.

Our late October/early November-drilled wheats are responding nicely to their increased first nitrogen dressing, and won’t be needing their second split until they’ve finished tillering. It’s gratifying how much they have grown during the mild winter.

Those we couldn’t get in until the start of December are obviously well behind, but still looking reasonable.

T0s are a good week off and will vary more than usual, depending on the field. With the mild winter, we are seeing a good deal of septoria in our October/November drillings.

Other than where we have enough chlorothalonil in the shed, folpet will be our multisite here, combined with an azole.

The later drillings should be much cleaner by the time they get to mid-tillering – which won’t be for a while yet. So the emphasis will be far more management than disease-led – primarily plant growth regulators, phosphites, zinc and manganese.

Mildew threat

We will be very wary of mildew, which can be so damaging to the much more important lower leaves. And we’ll be particularly alert to the threat from aphids, as many of these crops haven’t had any insecticide yet.

Also responding well to the arrival of spring are oilseed rapes on our lighter land. They’re racing into yellow bud, having had a late stem extension combination of prothioconazole and Toprex (difenoconazole + paclobutrazol) to boost branching.

Crops that have sat all winter in waterlogged ground are struggling, but slowly beginning to pick up now and will flower much later.

Thankfully, there doen’t seem to be quite as many flea beetle larvae as last year and they are not so high up the plant. Looking at the crop differences, I’m sure the waterlogging has done as much damage as the flea beetles. In addition, pigeons are still a problem on many of these later crops.

We have all our spring beans in and drilled the spring barley on lighter ground. Pea drilling will follow on from the barley on the lighter land farms.

There are, naturally, huge differences between soil types here. Aided by some useful frosts, ground that was moved in the autumn is working down nicely, with a light tickle ahead of drilling.

In marked contrast, heavier land that couldn’t be moved still isn’t workable. So, it’s going to need patience and particular care in cultivation. We know only too well how easily it can bake hard, given a couple of weeks of sun and drying winds.

With the forecast set to be reasonably fair, we have enough time to get in the 20% larger spring barley area scheduled this season.

North: Helen Brown

Hutchinsons (Cumbria)

I am excited to report that spring has finally arrived in Cumbria, signalled by the casting aside of wellingtons in favour of boots.

This spring/summer is likely to be a very difficult one for many due to the ongoing coronavirus situation.

However, the past couple of weeks have brought some welcome sunshine, and it is great to see growers in fields able to get on with land work, fertiliser/manure applications and cultivations ahead of spring cropping.

Drilling of spring wheat and barley has started in some cases and, after a long winter, it is worth considering sowing spring barleys earlier rather than later, as drilling date is key to improving yield potential.

Where conditions do not allow drilling earlier, consider increasing seed rates to counteract the reduced potential for tillering by the crop.

The only thing winter cereals have in common this season is that they are all very variable. Earlier-drilled crops are approaching growth stage 30 and T0 applications have started to be applied in these situations.

Early-sown barleys and wheats look very strong and on these, I am applying an appropriate dose of trinexapac-ethyl in the T0 spray for plant growth regulation and to reduce apical dominance.

Rhynchosporium

Inevitably, the mild and wet conditions over winter mean there is disease present in winter crops, noticeably rhynchosporium in barley.

This is especially visible in forward crops with high plant populations. A fungicide application at T0 in winter barley is important for early disease control to maintain tiller numbers, as final ear numbers are directly related to yield.

However, not all winter crops are so advanced, and weed control is the priority on some of the later-sown crops where autumn residuals were not applied, which is a common scenario this spring.

Nutrition is also important in these situations to get the crop moving. These crops have lower disease and lodging pressure.

However, they also have lower yield potential, and it is important to manage crops accordingly this spring. Nitrogen use should be based on yield potential, not on historical use, but do consider the N status of soils

East: Sean Sparling

AICC/SAS Agronomy (Lincolnshire)

With 14mm of rain since my last Crop Watch piece, and a brief three-day spell of what we believe may have been summer last week, spring drilling is well and truly under way at long last.

We’ve managed to get fields sufficiently dry to drill, although in many fields, the clods are like rocks on the top and sides, but malleable within and beneath. This apparently is as good as it’s going to get this spring in Lincolnshire.

In winter wheat, yellow rust and septoria are easy to find, along with widespread stem-based browning, which is duly noted.

But the T0 is as likely to be used to correct the widespread endemic ***nutrient*** deficiencies as it is to suppress, then protect, against further disease spread. There is plenty of chlorothalonil on hand to help with that.

Strobilurins with trace elements seem the obvious T0 choice. Growth stages of winter wheat vary between emergence and growth stage 30.

Spring drilling

Spring cereal drilling continues apace as time to complete the job rapidly runs out. Many people have 7 April firmly fixed in their mind as the date to put the drill away but, as we all know, conditions are more important than calendar date in this job and the phyllochron (time interval between leaf emergence) governs all.

We would all do well to remember spring 2018, when cereals drilled at the end of April produced forage and little more. About 120-odd growing days are required – squeezing 120 days into 90 didn’t work then and won’t work now, so once you hear that cuckoo...

Sugar beet drilling is well under way into what looks like good conditions if you squint, but which, as you get closer, resembles Plasticine over Swarfega – only time will tell if the beet seed thought that was a good idea.

OSR is showing first flowers in the rare minority of good crops, and there are still some fields where you have to get on your hands and knees to make sure the plants are still there.

Rape winter stem weevil is more widespread than I’ve seen in 30 years – but still, at least I have some toilet rolls left. Onwards.

West: Stephen Harrison

Avon (AICC/Southwest Agronomy)

The proverb March comes in like a lion and goes out like a lamb has a new twist this year. March swam in like a salmon and is riding out on a cloud of dust like a camel.

The dry spell has been welcome as it allowed long-awaited spring drilling to proceed apace.

However, the picture has not been so bright for those late-drilled crops on heavy soils. A capped soil surface, poor rooting and a large night and day temperature range have left them struggling to grow and respond to nitrogen fertiliser.

I suspect the spring crops drilled in better conditions will produce improved margins.

Where attempts were made to redrill in one of the few windows over the winter, results are poor. I suspect this may be due to undressed seed scooped from the barn carrying a high fusarium load.

In good conditions, the effects are less pronounced, but if you put the crop under pressure, performance sharply tails off, so I always advocate testing farm-saved seed.

The picture is brighter on lighter soils, where good responses to nitrogen are apparent.

As agronomists, we are truly fortunate that during the coronavirus restrictions we can carry on our essential work to help ensure the nation’s food supply. We are visiting fields alone and communicating with clients online and by phone.

New way of working

This new way of working is strange, as I greatly value face-to-face meetings, but we must not abuse the responsibility entrusted to us. We must cultivate this enhanced appreciation of British-produced food into a time beyond Covid-19.

Within Crop Advisors, our agronomy and buying group, we have held our meetings using video conferencing.  Seeing complex spreadsheets on our own desktop rather than squinting at a screen is much more effective, a pointer to how we may work in the future?

Through careful planning and ordering, we are seeing chemicals arrive on farm in a timely manner, although lead times are necessarily longer.

Stay safe and spare a thought for all those outside of ***agriculture*** who are working hard to help us.

JOURNAL : Farmers Weekly

Retail demand for fresh milk and key dairy products has remained at a peak this week, as shoppers stock up amid the coronavirus lockdown.

According to AHDB Dairy the market has seen unprecedented changes as shoppers and food producers respond to new rules designed to combat the virus.

See also: Coronavirus: How financial support package will help farms

Demand for fresh milk, cheese, butter and dairy spreads are all raised, the levy board’s latest market update shows.

AHDB analyst Patty Clayton, the report’s author, explained that while supply chains were adapting to ensure food was produced and delivered, efforts were being overshadowed by the uncertainty.

She said: “Buyers are hesitant to commit, not knowing what future demand will be – which products will be needed, where will they be purchased and at what levels.”

In the current market dairy processors have no historic trends to guide them in what or how much product to make.

“In the short-term this uncertainty is likely to cause a high degree of volatility in markets,” Ms Clayton suggested.

Domestic dairy market

The main concern in the dairy supply chain is continuity of supply.

Although milk ***collections*** are continuing and the seasonal peak in production is yet to come, processors are concerned that a growing need for workers to self-isolate could disrupt supply.

“Any widespread need for self-isolation from staff could seriously affect a processing line’s ability to produce milk,” Ms Clayton warned.

“Transport networks between farm, factory and retailer would also be disrupted without access to skilled drivers,” she added.

To help reduce pressure on processing factory lines and maintain supply of basic products, food companies have agreed to streamline their product ranges.

Exports

To date, dairy product exports have remained stable despite issues with quarantine for transport drivers and increased border checks slowing deliveries across the EU.

The introduction of EU-wide measures, including fast-track or green lanes for food exports at borders and the relaxation of limits on driver hours, are expected to help overcome any delays.

Beyond Europe, an easing of restrictions at Chinese ports has helped to reduce a backlog of imports into that country.

This would also reduce the pressure on container availability in the future, Ms Clayton noted.

Wider food market

In the wider food market, the AHDB said, an initial analysis of changing demand had found that a third of shoppers admitted to stockpiling.

Grocery sales in retail are expected to have grown in March.

Early estimates suggest 33% of consumers have been stockpiling food since the coronavirus crisis worsened while 67% say they are worried about running out.

“In addition to observed stockpiling behaviour, many meals which would normally be eaten in food service have transferred to the home,” the AHDB added.

Long-life categories such as tinned, frozen and dried goods are preferred.

This has the potential to positively affect categories such as long-life milk, powdered milk, frozen meat and frozen chips.

The report said it might also benefit meat cuts that lent themselves to bulk cooking or freezing, such as mince and diced.

JOURNAL : Farmers Weekly

A dairy farmer is demanding a public apology from People for the Ethical Treatment of Animals (Peta) after the animal rights group shared a video of his daughter on its Twitter account without permission.

The video showed Peter Hynes’ daughter Georgie reading a story to dairy calves on the family farm near Cork, Ireland.

Mr Hynes, who farms 180 Holstein-Friesian cows in partnership with his wife, Paula, said their six-year-old daughter has an incredible bond with the calves.

See also: How to deal with animal activists and difficult neighbours

The dairy farmers had initially uploaded the video on their Twitter account in response to calls from Ireland’s minister for health, Simon Harris, who asked people to share ideas about what they are doing at home to pass the time during the coronavirus pandemic.

Mr Hynes posted the video of Georgie reading a story to two dairy calves, along with the message: “Education and ***agriculture*** combined because farm kids understand #StayAtHomeStaySafe Keep up the great work #RisingToTheChallenge.”

Does reading stories to calves count Simon , education & ***agriculture*** combined because farm kids understand #StayAtHomeAndStaySafe

Keep up the great work ' ' #RisingToTheChallenge pic.twitter.com/M6AUmsT9aW

Peter hynes #TeamHynes (@Peterhynes15) March 29, 2020

The tweet has received more than 230 retweets and 2,500 “likes”, and local TV, radio and other media organisations have covered the story.

No consent

But Mr Hynes said he was disgusted after Peta used the video without his consent to promote its animal rights activism.

Peta UK posted the video with the comment: “Sadly, most cows on dairy farms are slaughtered when they’re 5 or 6. We hope that these babies will be spared the horrors of the abattoir.”

Mr Hynes told Farmers Weekly: “We are all entitled to our views. I do not enforce my views on anyone else. Likewise, I do not expect them to impose their views on me.

“With GDPR rules changing over the last couple of years, it has really set a boundary. If we put something out on social media, national media organisations always ask us for our consent to use it.

“I have asked Peta UK repeatedly to remove the video, especially as it features a minor. As a charitable organisation in the UK, I think it’s an absolute disgrace they have no intention of removing it.”

Mr Hynes has reported Peta UK’s tweet to Twitter and he has spoken to his solicitor about the next steps to take. He has also sent a written complaint to the Advertising Standards Authority. A number of other farmers have offered their support and also raised their own complaints.

Animal welfare focus

The Hynes family won the Zurich / Farming Independent Farmer of the Year award in 2017. They have a high focus on animal welfare. Their herd of 180 spring calving dairy cows spend a minimum of 300 days a year at grass.

All calves are fed three litres of colostrum at birth and stay with their mothers for 12 hours. All calves are kept in group pens. In 2019 calf mortality rate at six weeks was 1%.

All male calves are sold to Irish beef farms. Most male calves are genotyped and high genetic merit calves are sold as potential stock bulls.

Mr Hynes says the farm is fully audited by the Irish food board, Bord Bia. It has hosted numerous open day public events and farm tours, welcoming visitors from the US, Canada, Australia and France.

In addition, the Hynes have raised more than 53,000 (£47,000) for charity in the past two years and are also huge supporters of mental health awareness.

Peta response

Mimi Bekhechi, Peta’s director of international programmes, said: “Peta is in full compliance with Twitter's terms of service, but it's ironic that a dairy farmer is expressing concern about consent – something he certainly doesn't have from the cows whose bodies he exploits.

“The milk they produce is for their babies, whom they love just as much as he does his, and we suspect that his little girl would choose to save the calves she's sitting with, instead of allowing them to be slaughtered, if given the choice.”

JOURNAL : Farmers Weekly

I didn’t really want to mention the C-word, but my addled brain can’t actually remember a time BC (Before Coronavirus); it’s been all-encompassing hasn’t it?  At least the weather’s nicer though, hey?

Thankfully the impact on us has been limited so far. We’ve only had to rethink meetings and encourage staff to each keep their distance at breaktime.

We have high hygiene standards on the broiler-breeder farms regardless, so my staff are au fait with it all; although we are having to ration hand sanitiser and face masks.

See also: Coronavirus: Scottish mart introduces online sales platform

As I write this, we only have two members of staff in isolation – just under 10%, but a fellow pig farmer had a quarter of his 100-strong team off last week.

My work has totally changed, what with keeping up with the PM’s and chancellor’s updates, implementing changes to work practices, sorting contingency plans in case of delays in feed deliveries, reduced capacity at the abattoirs, staff absence, change in demand – the list goes on.

Two of the biggest changes I’ll see this week are a bit closer to home. Firstly, my 74-year-old dad has conceded that he should now be staying at home to enjoy his retirement.

This is fine in principle, but in practice not so much. I’ve had to send him home twice after I caught him tinkering with computers in the office and pottering around chicken sheds.

However, I’m not sure home is the best place for him. He’s driving mum nuts and is calling me twice a day to add single items to their shopping list – mainly beer, coffee and mini eggs, so I don’t really know how they are surviving.

Secondly, I decided not to send my son to his school nursery despite him being classed as the child of a key worker. So, from tomorrow there will be an almost-four-year-old worker on the payroll, and he shall be remunerated with Pom Bears and Smarties.

I really have no idea how this is going to work, but I envisage splashing in the foot dips 372 times a day, piglet cuddling and photocopying of body parts. At least I stockpiled gin.

Sophie Hope is a Farmer Focus writer from near Cheltenham. Read her biography

JOURNAL : Farmers Weekly

It is quite unbelievable how much the world has changed since I last wrote. At the beginning of March, I was skiing with a small group in a remote part of Italy and while coronavirus was a bit of a concern, other than extra hand washing, life was good.

Fast forward a week, and there were cases in the UK and Italy was shutting down. We now have schools closed, and the stay at home policy has become much stricter.

The impact on everyone worldwide is massive and likely to be long lasting.

See also: How to manage weeds in potato crops without diquat

While ***agriculture*** is less immediately affected, as generally we are not selling direct to the public, there is still a significant impact on normal life, family activities etc.

There is also a concern about the impact of staff having to self-isolate will have, both on farms and on the supply chain being able to continue to deliver chemicals, parts and medicines as required.

We are trying to stay separate as much as possible during work, but with some livestock operations that is not always easy.

We eventually found a source of hand sanitiser and this has now been added to shared vehicles.

Rapid growth

We have continued to have dry but cold weather, with few days above 8C since mid-February.

All winter crops have been top dressed and we started drilling spring barley on 20 March, about a week ahead of average.

Seedbed conditions are very good and when it does warm up there should be some rapid growth, putting pressure on sprayer capacity.

The chaos in the economy as a result of coronavirus has seen a sharp increase in cereal prices in the past few days, giving an opportunity to sell most of the remainder of the 2019 harvest and take a bit more cover on new crop.

Meanwhile oilseeds have followed the crude oil price downwards, but at least this has allowed me to fix the price of some fuel for harvest at significantly less than the budgeted price.

I hope that everyone stays healthy in the coming months and that by harvest we might be back to a more normal situation.

JOURNAL : Farmers Weekly

We are finally off. After what seems like an interminable period, our spring planting campaign is under way.

Normally we have potatoes and onions to plant and relatively small areas of spring barley and beans to drill. However, this spring there is a whole different perspective on the workload with a greatly increased amount of drilling to do.

On the whole, the crops we established last autumn and over the winter have fared surprisingly well. It would be true to say that there are poor patches in some places, but overall, yield potential is at acceptable levels.

See also: How to manage weeds in potato crops without diquat

I have one or two whole fields which I will rip out and start again, but it is a very small percentage. Land which remained untouched after harvest is ploughing up relatively well.

Where we chitted stubbles or carried out any other cultivations post-harvest the profile is much wetter, meaning it will be longer before we can get on it.

Who could have guessed at the time that our normal practice was the wrong thing to do.

Hungry crops

Our immediate challenge is get around the oilseed rape, winter wheat and winter barley with some nitrogen as most crops look hungry.

In a normal season I would have started the first application at least two to three weeks earlier than this one, but we needed to be sensible with ground and weather conditions.

Daffodil flower picking has proved to be a major challenge this season with a number of market challenges, mostly the weather, but also the Covid-19 situation.

We are a little way from knowing the final position, but my feeling is that it will not be where I would have liked it to be.

It was not my intention to write much about the corona virus pandemic, partly because the situation is changing so rapidly and it is impossible to know where things will be by the time this goes to print.

However, it is such an unprecedented event that I feel it is inappropriate to ignore it completely.

All we can do is try to do the right thing, whatever that is, on a day-to-day basis. It does bring home the fact that people and community are the most crucial things.

Jeremy Oatey manages 1,200ha of arable land near Plymouth in Cornwall and is 2013 Farmers Weekly Arable Farmer of the Year. Cropping includes wheat, barley, OSR, oats, beans, potatoes, onions, swedes and daffodils.

JOURNAL : Farmers Weekly

The gist of my January article was, “take a deep breath before you panic this year”. That sure didn’t last long.

Much like Europe, we have descended into full-blown Covid-19 hysteria in Kansas.

The panic selling on stock markets has even taken over ***agriculture*** commodities on the Chicago Mercantile Exchange. The meltdown defies all logic and with any sort of length will bankrupt rural America – and for no good reason.

See also: Coronavirus: Landlords asked to reduce rent for farmers

Live cattle prices quickly fell from $1.28 (£1.10) a pound on the CME Futures to 85 cents (73p).

This was of course due to supply and demand, right? Wrong. Consumers have panic bought meat and driven meat prices to multi-year highs.

Much like the fire at the Tyson beef plant six months ago, the processors have not let a tragedy go to waste and are profiteering while their suppliers (rural America) struggle.

The small, family-owned businesses in our small towns are also suffering a great deal. Restaurants have been ordered to close and the one factory in our town that makes Boeing parts is all but shuttered.

I have a friend who has a small business where he takes pictures (darn good ones) of rural Kansas and sells them to hospitals and doctors’ offices for their waiting rooms.

In the name of prudence, he may lose everything. Meanwhile, in the closest Walmart, when people got done making a panic run on the milk, they moved to the butter.

Do you melt butter and stir it in water for a milk substitute? That one is dumber than the toilet paper.

I don’t dispute that the virus has the potential to be a disaster. I am not an epidemiologist, but epidemiologists aren’t economists either.

In our rush to “flatten the curve” I worry that we also didn’t talk about the true economic costs of the consequences.

These decisions are a bit beyond my pay grade, but when Trump and other world leaders talk about treating Covid-19 like the Second World War, I can’t help but wonder if they are going to leave rural America looking like Dresden or Stalingrad.

Daniel Mushrush is a Farmer Focus writer from Kansas. Read his biography.

JOURNAL : Farmers Weekly

As we get used to this weird locked-down world, I can’t help feeling fortunate that in our industry we can at least get outside and do something legitimately useful.

It is not difficult at all to remain two metres – or often two kilometres – away from the next human being, if you’re spending your days in a tractor.

It is also very fortunate that the jet stream which has plagued us all winter has pushed off to allow high pressure back in and given us some decent weather to at last get on with some drilling, and give better conditions for our ewes to lamb in.

See also: How a grower achieved best margin with £105/ha fungicide spend

With barley, beans, linseed, rye, millet and borage to get in the ground, we have our work cut out.

As Hew gets on with drilling Explorer spring barley with our Sly Boss drill, one of my jobs has been to spray off in advance with glyphosate.

Waiting for walkers

This has been interesting lately because a large percentage of the 6,000 people that live in our village are using our farm for their daily exercise.

I think this is great, and I am always pleased to see people enjoying our footpaths.

When the footpath is alongside the field I am spraying, though, and someone is walking there as I do the headland, I feel it is only right to stop spraying and let them get out of the way.

I have spent quite a bit of my time in a stationary sprayer, waving cheerfully and wishing that they would walk a bit quicker.

I have noticed some of the local dogs being walked by different humans lately.

I assume that the partner who is usually at work, finding themselves cooped up at home, now finds the dog a great asset and the perfect excuse to get out for a while.

JOURNAL : Farmers Weekly

I never thought I would be writing a Farmer Focus with a global pandemic in full flight on British shores. I think we are all still in shock. This virus is capable of bringing the world as we know it to a standstill.

The 2008 recession was awful, but never has something had such an impact across all sectors. This virus will have far-reaching economic and human affects with thousands of people dying.

Where does farming stand in all this? Ever the optimist, there is inevitably going to be volatility which we have already seen in recent days reflected in feed prices and the topsy-turvy lamb price.

See also: Coronavirus: Advice for vets and farmers

This must lead to question marks over supermarket power and the price farmers receive. I have heard numerous comments from farmers and processors who have defended the very sparse nature of the supply chain, simply because there isn’t enough money in the job to run it with any fat left over.

It is sad that it has taken these tragic circumstances for people to realise the fragility of our supply chain. The disappearance of vegans from my social media feed has been welcome, though.

In a few short weeks we have gone from a government adviser saying farmers are not needed, to us now becoming key workers. This is further recognition that farmers are vital to feed the nation, and everyone is doing what they can to step up to the plate, just as they have done in the past.

Getting behind the new Farmers Weekly #FeedTheNation campaign is a must. We now have an opportunity to showcase how we are doing our bit and promote ***agriculture*** in a positive light.

Muller says demand for milk has increased significantly. Let’s hope it continues and this can be shared out down the supply chain.

Thank god the weather has turned. Us farmers are lucky in that our lives have been relatively uninterrupted by the lockdown scenario.

The fertiliser spinner is on and the place is greening up, the floods are almost forgotten and it was good to see that Shropshire had been included in the recent round of government flood damage funding.

Stay safe and do take the situation seriously. We need a speedy conclusion to this awful situation.

Read more about Shropshire farmer Henry Wilson.

JOURNAL : Farmers Weekly

Here's to all the lambers out there. As one of the great highlights of the farming year, lambing season is a challenging but joy-filled time for Britain’s farmers.

Farmers Weekly readers have been busy snapping all the action of the 2020 lambing season. Here are some of our favourite shots from the season so far.

Share your photos and videos of lambing on your farm by uploading them to our dedicated gallery.

See also: 13 tips for successful lambing outdoors

The day before her third birthday, Meredith wanted to help move the new mums and babies on her family farm in South Leicestershire as part of her present. Hannah Webb sent this one in.

Tom Copey shared this rather sweet shot from the lambing shed.

Here's 18-month-old Dennis feeding Lilly the lamb. Thanks to Michelle Jones for sharing this one.

Quadruplets born on Isabella Patterson's farm in County Down.

Tilly, aged 7, loves her flock of Ryeland and Coloured Ryeland sheep. She got stuck in and helped with lambing for the first time this year.

Seth has his own small flock of Coloured Ryeland sheep, which he was very excited to see produce some lovely lambs this year.

This is four-year-old Arabella checking the lambs on the farm in south Derry.

This bunch look very cozy. Thanks to Emma Newey for sharing this photo.

New entrants Flora Searson and Lewis Steer shared this great shot from lambing their native Dartmoor breed flocks on Dartmoor, Devon.

Two-year-old Anna Craig welcomes the first lamb of the year with her dad, Matthew, in County Tyrone.

Jack Hulland, aged three, helping mum Sarah out with the feeding as the lambing season gets under way.

JOURNAL : Farmers Weekly

Do you know a farmer who is going the extra distance to help vulnerable people in their rural community?

Whether clearing snow-covered roads or rescuing stranded residents in flooded homes, time and again our amazing British farmers have helped the public in times of crisis.

Beyond producing food to feed the nation, we know there will be many public-spirited farmers out there who are doing their bit to make sure those who are most at risk from Covid-19 are protected and cared for.

See also: All the latest on the coronavirus and what it means for farmers

The Farmers Weekly team want your help in recognising these truly inspirational rural heroes. Perhaps they're delivering essentials to somebody who is unable to leave home, or checking in on the elderly to make sure they aren't feeling cut off from society.

We have already told the stories of YFCs helping the vulnerable and farm shops offering deliveries and discounts to NHS workers. In this time of national emergency, we want to share the good work our farmers are doing.

To share a story with us, simply email our community editor Oli Hill or drop us a line on Facebook or Twitter. Don't forget to tell us the name of the farming hero you want to recognise, where they're from and what they're doing to make a difference in their rural community.

JOURNAL : Farmers Weekly

Young farmers around the country have been working hard to support the elderly and most vulnerable in their community in response to the coronavirus pandemic.

Volunteers from Young Farmers’ Clubs (YFC) have been delivering food, medicine and other essential supplies, as well as picking up the phone and speaking to people in self-isolation.

The National Federation of Young Farmers’ Clubs (NFYFC) has encouraged its members to help where they can (see the NFYFC website), and the response has been inspiring.

Worksop YFC organised food parcels to be delivered to the most vulnerable in Blyth, Nottinghamshire, after the local shop was broken into.

Speaking to Farmers Weekly, Georgia Betts said: “We usually meet in Blyth so when we heard about the break-in we thought there was nothing better than organising food parcels for vulnerable people in that area.”

Fundraising campaign

The club organised a fundraising campaign and members then bought, packaged and delivered essential items to people’s doorsteps in the village.

Georgia, 20, added: “It makes me feel really proud of our club, at times like this when everyone pulls together to be positive in such a negative situation.

“Some people have contacted us via Facebook just to say thank you for what we have done, and that they were quite touched by it, which makes everything worth it.”

Probus YFC has been delivering supplies and topping up electric and gas cards for the elderly in Truro and St Austell (see main image).

Sam Oatey, 21, helped spread the message online, in local newspapers and leaflets that his club was ready to help however it could.

He said: “As young farmers it very much showcases our value at a time when the situation is so serious. There needs to be people that are healthy and are able to help those who need it.

“As an organisation with such a wide spread of members across the whole UK, I think we are the perfect people to be able to do that.”

He also made a video to explain how members were helping.

In Wales, Sennybridge YFC handed out leaflets in the village and tweeted to offer their support.

Do you, or anyone you know require our help?

Sennybridge YFC are always looking to help our community in any way we can. Details on the poster, please get in touch if you need us! #trueyfc #community pic.twitter.com/b4uiiOlRZG

Sennybridge YFC (@sennybridge\_yfc) March 18, 2020

Elin Havard said a lot of people who are isolated were enjoying the chance to have a chat.

“Calls have been coming in from lots of elderly people. There was one who was ever so grateful about me getting their prescription, it meant the world to them and for me it was no real extra work.”

One supermarket was working to put customers in touch with the farmers' club, after hearing about all the work they were doing to help.

Elin said: “We have done 10 jobs so far and a lot of people will need consistent help for as long as this all goes on.

“Young farmers across the country have been so ready and eager to do anything we can to help. It’s really reminded me of the value of YFCs.”

JOURNAL : Farmers Weekly

Better demand combined with a relatively weak sterling has pushed fertiliser prices higher.

Spot demand has grown in the UK as drilling progresses at pace and the grassland sector starts to order.

Some arable ground that looked as if it would be fallowed has come back into the mix, in turn increasing demand.

See also: What new water protection powers would mean for farmers

While liquid supplies are generally only taking very few days, delivery for solid material is generally between five and 15 days from ordering, although lead times for P & K straights can be longer.

With Easter approaching, suppliers are warning that orders need to be received in good time.

UK manufactured ammonium nitrate (AN) is costing about £5/t more than it was in early March, putting it in a range from £232-£235/t for full loads with April delivery and a £2/t rise set for May.

Imported AN has, in some cases, gone up by slightly more, as a result of the pound’s lower value, to sit at £220-£227/t.

New supplies

New supplies are expected to land on the east coast shortly.

At £255-£263/t, urea prices have risen on the lower pound, although traders see little further short-term upside here, as demand will be stifled by any dry weather and any rise in temperatures because of the risk of volatilisation.

Fertiliser stocks in the UK are generally good and, so far, haulage is not the problem many were expecting it to be.

However, logistical issues, including the removal of some manufacturing capacity in Egypt by coronavirus-related staffing problems, have added to the upwards pressure.

Straights price ranges have widened, having risen anywhere between £15/t and £40/t in just four weeks, depending on product and region.

Much of the rise is demand based, say traders, and while lead times are the longest on these products in many cases, availability is generally not a problem.

Blends have risen largely on the back of more expensive P & K straights.

Fertiliser update (£/t delivered April 2020)

UK 34.5% N

Imported AN

Granular urea 46% N

Potash MOP

Phosphate DAP

Phosphate TSP

£232-£235

£220-£227

£255-£263

£260-£275

£335-£338

£282-£290

0:24:24

(blend)

20:10:10

(blend)

25:5:5

(blend)

£260-£264

£235-£245

£225-£233

All illustrated prices are based on full loads for cash payment on 28-day terms.

JOURNAL : Farmers Weekly

The secret of making a complete tit of yourself is to be sure no one sees it.

We’ve all done it over the years: tripping over the enormous vacuum cleaner pipe while cleaning the grain store, or banging your head on a sticking-out bit of machinery that you knew perfectly well was there.

You don’t swear/curse/check for blood/rub it frantically until you’ve had a casual look around. If the coast is clear, then you can let loose with some historic English phrases.

See also: Read more Flindt on Friday

So when I managed to get my new drill stuck in the road, it was just my luck that the world and his wife were there. “Stuck in the road”? Let me explain.

I was crossing one of the little lanes that go through our farm, and this bit of lane is unique.

Whereas all the others are sunken lanes, this is the only “proud” one. The ground either side is lower than the Tarmac.

I’ve crossed it a thousand times in the past 35 years, totally free of incident, so I was full of confidence as I approached.

Just as I was wrestling with the padlock on the gate into the pasture the other side, Kilmeston’s Chief Trespassers were coming along the bridleway with their loose dog.

I thought that this was not the time for snide comments about how refreshing it was to see them on a Right of Way, so we exchanged a virus-separated and slightly frosty “good evening”.

Nothing to see here

It was fortunate that I hadn’t taken the moral high ground, because a minute later, the high ground struck back: I was stuck.

The new ST4 is a long bit of kit, and I discovered that if you have the tractor back wheels on one side of the lane, and the Horsch back wheels on the other side of the lane, half a dozen sturdy tines will embed themselves in the road.

Fortunately, I was in low-rev trundle mode, taking it steady with an unfamiliar machine, and managed to spot the problem before I changed down and floored the throttle.

What next, though? I lifted the tractor link arms, which freed up the front tines, and crept backwards the way I’d come.

By now, the Trespassers were watching from a distance, wondering what the heck was going on. I gave them a slightly embarrassed wave. A hint of a smirk crossed their faces as they headed off.

Reverse psychology

The only solution was to turn left, up on to the road, reverse 30 yards back along the road, then turn right off the road and down the slope again. Simple.

Or it would have been if Mr and Mrs Sensible and their children hadn’t arrived in the middle of it on bicycles, clad in sensible helmets and sensible hi-vis jackets, and proceeded to swarm around the tractor and drill while deciding where to go next.

Luckily none of them noticed the odd corrugations in the road that had just been made.

I finally got across the pasture to the arable land, and the drilling went perfectly. And who was there to see my arrow-straight craftsmanship? No one.

And yet when my son was kindly dropping off my truck so I could get home later in the evening, he failed to spot that the source of the Itchen had moved east into the pasture this year (it’s called Springshot for a reason), and got stuck up to the axles.

It was in full view of Hinton Ampner Gardens and about a mile of bridleway. Guess how many passers-by saw his unfortunate bit of driving. Yup, none. Typical. Just typical.

JOURNAL : Farmers Weekly

France’s ***agriculture*** minister has declared glyphosate is an essential tool of the agroecological transition, raising hopes of a change in policy stance in the country.

Speaking on a French news television channel, Didier Guillaume said cover cropping is a recognised practice in the agroecological transition and to do this, there is a need for the weedkiller glyphosate.

See also: Video: German grower warns against glyphosate ban

“I believe it’s one litre of glyphosate per hectare,” said Mr Guillaume. “If there is no glyphosate, soil conservation ***agriculture*** can’t be done.”

“Until we can find an alternative in the months ahead, my position on glyphosate is clear: we are going to continue soil conservation ***agriculture*** with glyphosate.”

Explore alternatives

The French ***agriculture*** ministry has called on national agencies for food and the environment to investigate and identify viable alternatives to glyphosate, which has been a long-term goal.

“We have gone into overdrive. We have asked the French Agency for Food, Environmental and Occupational Health & Safety (ANSES) and the National Institute of Agronomic Research (INRA) in the following weeks to give us the dates, objectives and direction.

“Today, it’s not about replacing one chemical with another. For example, if there are solutions to replacing the use of glyphosate in vineyards, what can we do?

“But then, there are sectors where there are currently no alternatives, such as conservation ***agriculture***.”

Mr Guillaume described the use of glyphosate in soil conservation ***agriculture*** as a “virtuous agroecological practice”.

“We know now that if we want to protect the soils, keep carbon in the soils and fight against global warming, we need to work with cover crops,” he said.

“We must stop having these big empty fields. We must capture nitrogen and carbon and therefore use cover crops.”

French growers have welcomed the minister’s comments, which come just months after the government announced a plan to ban almost half of the nation’s 69 glyphosate-containing products by the end of 2020 “due to a lack or absence of scientific ***data*** ruling out any carcinogenic risk”.

Grower reaction

Frédéric Thomas, one of the leading conservation ***agriculture*** farmers in France, said: “It’s a standpoint that we welcome. It’s clear. It’s politically quite strong.

“In a certain way, it’s a return to reason, a return to science, a return to a form of compromise in which ***agriculture*** has always played its role.”

Mr Thomas thanked conservation tillage farmers and everyone in the industry over the past three years who had worked towards this “success”.

“It’s very strong recognition for conservation ***agriculture***, which was a bit of an overlooked form of ***agriculture***,” he said. “On the other hand, we must recognise this is only a first step. We have an important job to do to continue the momentum and ensure our fields and farms are a true reflection of our discourse.”

Farm demonstrations

Mr Thomas urged farmers to avoid getting involved in partisan debates on glyphosate and instead welcome politicians, journalists, industry leaders and people onto farms to see for themselves the presence of bees and biodiversity in cover crops.

“If we have healthy soils, the foods that are coming out of these fields, wheat, maize, etc, will be of better quality. The relationship between the quality of fields and the quality of the food on our plates is an emerging topic where we also have a lot to bring to the table.”

The debate over the safety of glyphosate has been raging since 2015 when the World Health Organisation’s International Agency for Research on Cancer (IARC) concluded that it is a “probable carcinogen to humans”.

Bayer CropScience, which manufactures the glyphosate-containing herbicide Roundup, faces more than 42,000 lawsuits in the US alleging glyphosate-based herbicides cause cancer. The company has vowed to fight the claims and it has repeatedly defended the 40-year safety record of glyphosate.

JOURNAL : Farmers Weekly

In one of the more common-sense moves by the government in recent weeks, farmers, farmworkers and everyone else in the food supply chain have been identified as “key workers”.

But, as Farmers Weekly columnist Guy Smith says in this week’s Opinion, now is not the time to say “we told you so” – how ever overdue such recognition might be.

Covid-19 is, without doubt, a massive wake-up call to a government that has, for far too long, failed to appreciate the crucial importance of farmers in supplying the nation’s food, while overseeing the long-term decline in our levels of self-sufficiency.

See also: Find all our coronavirus content in one place

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Read more articles by Philip Clarke

The UK is currently just 61% self-sufficient in all food and 75% in indigenous food.

Each year, the NFU highlights what it calls “self-sufficiency day” – the notional day where the country would run out of food if we relied solely on British produce. Last year, that would have been 11 August.

Clearly, that is not going happen, despite Covid-19 and despite the fact output has already been compromised by the wet winter just passed.

International trade is continuing, there is stock in the system and farmers are working flat out to catch up.

Disruption to supply chain

But the disruption to the supply chain we have witnessed shows just how complex and fragile things are.

Already we have seen great market volatility. The sheep trade, in particular, has been hard hit by cancelled export orders, the loss of food service sales and the threat of border closures.

The cessation of some livestock markets this week threatens to destabilise things even more.

As the crisis develops, there are serious questions about the whole food supply chain’s ability to cope.

Labour shortage

One of the biggest challenges is going to be labour – especially in the horticultural sector, where the soft fruit season gets under way soon.

Yes, British people have been showing strong interest in some of the jobs now on offer. But will they turn up and will they hack it?

There will also have to be a fundamental shift in the way the supply chain functions.

Selling direct

Record grocery sales in the past few weeks have left shop shelves empty of some items, while the closure of food service outlets has created surpluses elsewhere. Diverting from one sector to the other is far from easy.

Some farmers are already bridging the gap, stepping up their efforts to deliver food direct to consumers. Others are using online tools to develop local sales, while the crisis is proving a bit of a boon for many farm shops.

The government has also made considerable efforts to keep businesses afloat, with a range of support measures for the employed and self-employed. But it needs to consider the longer-term perspective, too.

Brexit extension

It should accept now that an extension to the Brexit transition period is needed, to avoid the possibility of “no-deal” with the European Union at the end of this year.

It should also call a halt to free-trade negotiations with other countries until the current crisis is resolved.

Above all, it needs to revisit its plans for future domestic farm policy, adding greater weight to basic food production, rather than obsessing about environmental delivery.

For too long, the government has been confident we will always be able to buy from abroad what we cannot produce at home, favouring a cheap food policy over one based on strategic need.

The unfolding events around coronavirus show the time for change is overdue.

JOURNAL : Farmers Weekly

Rutland farm manager Matt Houldcroft is set to put his least productive land into environmental schemes to prepare for a future “public money for public good” farm policy.

He is taking out of production a river meadow field prone to flooding, creating wide field margins and planting up awkward corners with trees to anticipate the change in farm subsidy support.

See also: Why growers should sign up for greening ahead of new scheme

Farm facts

R&R Mills, Woodside Farm, Ketton Road, Empingham, Oakham, Rutland

Farming 400ha including winter wheat and barley, spring wheat and beans, and oilseed rape on largely limestone brash soil.

Contracting a further 1,800ha for nine other businesses

One 12ha field by the River Welland crossed by two footpaths which sometimes floods is set for a mix of wide field margins and environmentally friendly wild flowers.

“It is more profitable to put this field into an environmental scheme than to grow winter wheat or oilseed rape,” he tells Farmers Weekly.

River margins

Extra wide 12m grass margins are to be used up against the river as water is pumped from the water course into the nearby Rutland Water reservoir for drinking water.

Mr Houldcroft has signed up the 400ha of arable land he directly manages for a five-year Countryside Stewardship scheme under the Wildlife Offer section, starting at the beginning of this year.

This Wildlife Offer is not competitive, as opposed to the other two options of higher tier and mid tier, and will give him a hopefully easy transition to the new Environmental Land Management (ELM) schemes to be rolled out from 2024.

As area-based subsidies under the Basic Payment Scheme (BPS) will be gradually phased out in favour of ELM, Mr Houldcroft was keen to prepare for a future without direct subsidies.

“We wanted to supplement farm income with the wildlife scheme which will be focused on the less productive land,” he adds.

Limestone brash

The Woodside farm he manages for R&R Mills grows winter wheat and barley, spring wheat and beans, and oilseed rape on light limestone brash soil about six miles east of Oakham.

The farm also contracts a further 1,800ha on which he manages stewardship schemes for nine other businesses across a range of land types.

Jim Egan, technical adviser at Kings – the cover crop and wild flower seed business of agronomy group Frontier – says it make sense to be in environment schemes to prepare for ELM.

“If you are in Countryside Stewardship, and when ELM comes along and is better than Countryside Stewardship, then growers will be allowed to switch into ELM,” he says.

He calculates that such Wildlife Offers under Countryside Stewardship should bring in a payment of £3,500-5,000 a year per 100 hectares, contributing a reasonable income for taking less-fertile land out of production.

Scheme minimums

Under the scheme, the farm needs to put a minimum of 1% of its land into pollen and nectar mixes which pay £511/ha/year over five years and 2% into wild bird seed mix paying £640/ha/year, again over five years.

The first can be established with a seed cost of about £150-200/ha to last five years, while the wild bird mix will need re-seeding within the five-year life of the scheme with an annual mix starting at about £40/ha and a two-year mix at just under £70/ha.

Mr Houldcroft is looking to plant the pollen and nectar mix close to footpaths and openly flowering crops such as oilseed rape and beans, and hopes to see improvement in wildlife in an area which is seeing ospreys over Rutland Water.

Other options in the scheme include buffering around water courses at widths of 12m or 24m, such as close to the River Welland, bringing in £353/ha.

The wildflower mixes and margins are calculated to take 10% of the farm’s land out of production – for a farm which looks to produce an average yield of 9-10t/ha for winter wheat.

“We are looking to protect a part of our income when we know that BPS payments will decline,” he says.

Allerton alert to switchover to ELM

Phil Jarvis is hoping to enter a mid-tier scheme next year to reduce cropping risk on a farm which was one of the first to try out environmental schemes nearly three decades ago.

He is head of farming at the heavy land Allerton Project farm in south Leicestershire, and looks to the Countryside Stewardship scheme to regenerate ***agriculture*** as direct subsidy payments are tapered away.

Farm facts

Allerton Project, Loddington House, Loddington, Leicestershire

Farming 320ha including winter wheat and barley, spring and winter bean, and spring and winter oats on clay and clay loam soils.

“We are going into agri-environmental schemes to prepare for ELM as we watch the government for further detail of these new schemes,” he says.

He manages 320ha at Loddington, some six miles south of Oakham, for a charity set up in 1992 to demonstrate that farming can work well together with wildlife.

Lower inputs and lower risk

High-input cereal production on marginal land will be increasingly risky in the future, he believes, and this type of environment scheme could help the farm move towards lower inputs and lower risk.

He has chosen the mid-tier of the Countryside Stewardship scheme as it opens up more options to Wildlife Offers in addition to the pollen and nectar mixes and wild bird seed mixes. This will start at the beginning of 2021 and replace an existing scheme.

These include using cover crops at £114/ha, paying capital costs for maintaining hedges and ponds and growing low-input cereals at £266/ha, which are all very interesting options for grade 3 marginal arable land at Loddington.

There are the further options of a two-year legume-rich fallow which pays £522/ha/year to build up fertility, but must not be grazed or silaged, while grass herbal leys at £309/ha/year can he grazed and could be useful for blackgrass control.

Farming partnership

The Allerton Project farms together with a neighbour, sharing equipment and farming practices, making an 800ha block with neighbour’s sheep grazing grass leys at Loddington.

The farm grows winter wheat and barley, spring and winter beans, and spring and winter oats, and one option that interests Mr Jarvis is low-input cereals.

This option pays £266/ha with the object of producing an open structured cereal crop with a seed rate of 50-100kg/ha to encourage farmland birds, brown hares, rare arable plants, and bees and beneficial insects.

“High input cereals on marginal land are very risky, and this type of option could be right for us,” he says. This option would be even more interesting if linked to growing cover crops at £114/ha.

Feed the birds

A further option he will take up is supplementary feeding of song birds paying £632/t/year, where 70% of the grain can come from the farm and 30% from bought-in seed such as sunflowers and millet.

He expects the scheme to take 15% of land out of production and 7-8% in fallow or rotation, and bring in about £40,000/year over five years.

At present, the farm’s annual BPS payment is £60,000 and current environmental schemes are worth £20,000, but with BPS set to decline and eventually disappear then environmental schemes will become more important.

He sees opportunities in what he calls “organic fusion“ that is being paid for fertility building with herbal leys, with or without livestock, and to produce food by climate-friendly farming methods with fewer inputs.

“It’s not about yield, it will be about profit margin without BPS,” he says.

Hill farms follow trailblazing route

A group of upland farmers are being paid to improve the environment in a trial which could be a blueprint for a future UK farming support policy.

Five grassland beef and sheep farms are being paid up to £5,000 to encourage species-rich river meadow and cut stocking rates in a payment by results scheme run by the National Trust.

The payments for the charity's tenant farmers in Yorkshire and Lancashire are aimed at improving soil health and encouraging an ideal habitat for pollinators such as bees.

National Trust ecologist Elizabeth Sullivan says the scheme looks to encourage better farming to support nature and has been enthusiastically embraced by its tenant farmers.

“We are exploring different ways that ***agricultural*** payments can be made in the future to benefit nature,” she says.

The five farms are largely in the Yorkshire Dales National Park with two in upper Wharfedale, one each in Wensleydale and Swaledale, and the final one just over the Lancashire border in the Forest of Bowland.

Two payments

A first payment of up to £173/ha over a three-year period is made to farmers to encourage rich meadow land to create a flora abundance and attract a wide range of pollinators.

The farmers are given management freedom with this species-rich meadow which is typically aimed at producing a late hay crop rather than multiple cuts of silage.

A second soil health payment can be made of up to £55/ha, with the highest payment given for pastures with high legumes illustrating both good rooting and low stock grazing.

Farmers could apply for both payments and be paid up to £228/ha. They pick areas of their farms for the scheme and the largest of the five farms has 45ha in the scheme. The areas picked must not be in other environmental schemes to avoid double payment.

The National Trust has 1,500 tenant farmers and 23 in the Yorkshire Dales National Park. The scheme started in 2018 with three farms and picked up another two in 2019.

“The results for the soil improvement scheme have come back really positive with the five farms all in the top two payment bands, while results for the pollination scheme are very positive,” she says.

JOURNAL : Farmers Weekly

Dedicated housing for transition cows has improved post-calving cow health at a Welsh dairy farm.

John and Anna Booth invested in the new facility at Rhual Dairy, an AHDB Strategic Dairy Farm, near Mold, in 2018. The shed has provided more room, enabling the transition period to be extended to four weeks.

The previous infrastructure only had sufficient space for managing cows on a transition ration for up to two weeks.

See also: How a US dairy is extending its voluntary waiting period

“We were getting everything else right, but we couldn’t get the cow transition right, we were always short of space,’’ Mr Booth admits, who runs a year-round calving herd of 336 Holstein Friesians.

In total, cows are dry for eight weeks.

Dry cow ration

It is formulated to deliver 120 megajoules (MJ) of energy is made up of 18kg third-cut silage, 6kg haylage bales, 6kg maize silage, 3.5kg chopped straw, 2kg protein blend and 0.150kg dry cow minerals.

They move to a far-shed and transfer to the close-up, transition shed for the last three to four weeks.

The transition shed has calving pens and the cows are moved to these at the point of calving and remain here for 48 hours after calving, before joining the milking group.

About the shed

The transition shed contains 27 cubicles – seven of which are portable and can be moved to create extra feed space or an additional calving pen – and three calving pens.

At the same time, the Booths invested in a new tub diet mixer from a barrel mixer, which chops straw to the short length required in the transition ration.

“That is doing a much better job that our old wagon so, although the base of the ration is much the same, it’s the processing of it that has changed.

"The diet is more consistent and we are seeing higher intakes on that,’’ says Mr Booth, who adds intakes have improved 10%.

Benefits

Since the changes were put in place, cases of retained foetal membranes are down from 3% to 2%, left displaced abomasums from 5% to 1% and milk fever cases have halved, to less than 1%.

“Cows are calving down a lot easier, they are cleaner and we are getting more or less no cases of milk fever.’’

Advice to improve transition

Phil Clarke of P&L Agri Consulting described the dry period as the single most important phase of production.

“These are the most important cows on the farm, treat them like queens and they will repay you,’’ said Mr Clarke.

Below, he makes some recommendations to improve success:

The dry period should be no shorter than six weeks

Cows need to develop a good appetite and rumen capacity in the close-to-calving period

To achieve this, maximise trough space – ideally 90cm a cow

Target 40-45% dry matter (DM) in the diet – add liquid to the ration if it is higher than this

Aim for a DM intake of 12-14kg and energy intake of 115-120MJ a cow a day and 13-5-15.5kg protein

Keep potassium as low as possible. Make specific dry cow silage that hasn’t had slurry applied to it. If you can separate fields and don’t put any slurry on these, it will make your life much easier in terms of milk fever and other health issues

Magnesium-to-potassium ratio should be at a maximum of 1:4 – if the ratio is greater then add more magnesium to the ration

Key health take-away messages

Dr Mo Kemp, of Wern Vets, the farm vet at Rhual Dairy, offer the following advice:

Monitor the energy levels of cows pre-calving by checking urine pH and ketone levels

Maintain body condition score (BCS) at 2.5-3 – it should be the same at drying-off as at calving

BCS monthly and consider increasing it to fortnightly in the dry period

Drying-off should be a specific task, not a job done at the end of milking, and an exceptional level of cleanliness is vital

Use surgical spirit and cotton wool, not the wipes that come with the tubes, and allow the cows to stand for 30min after drying-off

Inspect cows daily in the first week after drying-off

JOURNAL : Farmers Weekly

Farm adviser, Alison Cross, believes that farmers should act together in groups to get the best out of Britain’s future farming policy and so have a wide impact on the environment.

This will become more important as farm subsidies switch to the “public money for public good” mantra under a new ***agriculture*** policy as Britain leaves the EU.

This means that all farm subsidy payments will be linked to helping the environment, whereas currently two-thirds of the £3bn-plus of annual farm subsidies are paid on the area farmed.

Mrs Cross believes those acting together to address environmental priorities can learn from each other to protect wildlife as farmers move to new Environmental Land Management (ELM) schemes.

“We would favour farmers working together to give them greater focus under the ELM policy,” she says. ELM is due to start taking over from the farmed-area based Basic Payment Scheme (BPS) subsidy in 2024.

See also: Why growers should sign up for greening ahead of new scheme

Fact file: Alison Cross

55 client farmers on advisory list across Hampshire and neighbouring counties

16 years in an advisory role with a focus on environmental issues

5,000ha covered across the Wallop Brook Farmers Group

Soils and water

Mrs Cross, the Farmers Weekly Arable Adviser of the Year 2019, sees a promising future as farmers move to a policy centred on improving soils and water quality.

She has organised a group of farmers in the Wallop Brook area in Hampshire, near Stockbridge, on light chalky soils, to focus on improving the environment while still keeping farming profitable.

“On soil health we are learning more, and this could be further developed under ELMs,” says Mrs Cross, who is principal farm adviser with Arcadian Farm Advice – part of the Hampshire and Isle of Wight Wildlife Trust.

Working together, the group has learned more about the distribution of the rare corn bunting in the area, finding it to be more widespread than first thought.

Double drilling

The group has also introduced targeted measures to benefit the bird, included double drilling, which Royal Society for the Protection of Birds research suggests increases the number of birds fledged

This ground-nesting bird favours denser areas for nesting, and by siting these double-drilled areas in the middle of fields, farmers can ensure nesting birds are less vulnerable to predators.

In addition, farmer members are working with the Plantlife charity, the Royal Botanic Gardens at Kew and the Hampshire and Isle of Wight Wildlife Trust on a wild flower conservation project that might see the return of the rare red wine-coloured Pheasant’s Eye.

This endangered wild flower appears to thrive well when soils are disturbed rather than in minimum tillage or no-tillage systems, so certain areas are being ploughed to try to help the flower’s revival.

The group of 20 farmers is also working with Elizabeth Stockdale, head of farming systems at the crop consultant Niab, on a soil health project, to look at how different practices might affect soil health – including the application of compost, manures, sewage sludge and under different cultivations.

Group formation

This group was set up two years ago with £10,000 a year funding from Defra for a three-year period to protect the fragile chalkland landscape by improving soils and avoiding pollution of the gin-clear chalk streams.

Mrs Cross is now busy setting up a similar, second group of farmers around Christmas Common on the edge of the Chiltern Hills in Oxfordshire, on very similar free-draining land.

Here, the focus will be on connectivity, in terms of linking areas of flowering pollinator mixes, and also deer management as these wild animals are damaging arable crops.

About Farmers Weekly Awards 2020

The Farmers Weekly 2020 Arable Adviser of the Year Award is sponsored by FMC.

Join Farmers Weekly in celebrating the farming industry and recognising the hard work of UK farmers and enter the awards today.

Alternatively, nominate a deserving individual for an award.

For more information about the Farmers Weekly Awards 2020, pay a visit to the official website.

JOURNAL : Farmers Weekly

Somerset dairy farmer James Read has halved his fertiliser bill by using a slurry inoculant.

When Mr Read replaced his parlour with robots in 2008, it meant housing had to be redesigned. He decided to install slatted floors, with an underground slurry pit and a robotic scraper.

But that presented its own challenges; minimising the odour and keeping the slurry uniform.

Having been advised against installing an aerating system to agitate the slurry, Mr Read decided to use beneficial bacteria to do the job for him.

Mr Read and his son, Harry, who milk 260 cows at Pyrland Farm, in Taunton, brew their own bacteria mix (Actiferm) to keep costs down.

They buy a starter mix from Agriton, add it to molasses and water, and brew it at 36C in a 200-litre barrel with a fish tank heater.

See also: Slurry separation options compared

Farm facts

162ha – permanent and temporary pasture, maize and potatoes

260 pedigree Holstein cows, plus 200 followers

Averaging 12,000 litres per 305-day lactation

Year-round calving

2019: 24 cases of mastitis/100 cows

Somatic cell count: 163,000 cells/ml on average

First-cut silage in 2019 analysed 25.3% dry matter, 16.3% protein, 75.8% D-value, 12.1 MJ/kg ME

Actiferm is a mix of effective micro-organisms and contains activated bacteria, yeasts and fungi.

A fresh mix is brewed every six months and it costs less than £1,000.

The cows are housed on mattresses with sawdust bedding, which Mr Read replaces three times a week.

Once the beds are cleaned, he adds 10 litres of the concentrate to 100 litres of water (for 180 cows) and, using a watering can, sprinkles it on the backs of the beds before spreading the sawdust.

By using the liquid instead of hydrated lime, the good bacteria create a healthy environment that acts to reduce mastitis.

The beneficial microbes end up scraped into the slurry, where they get to work; fermenting it, eradicating any crust, locking in the ***nutrients*** and reducing odour.

What the trials show

Kingshay trials showed total nitrogen content in slurry treated with N-Hance and Actiferm was 12% higher than the control after 12 weeks, at 0.243% weight for weight.

Ammonium content was also 12% higher, at 0.148% weight for weight. This means slurry is retaining the ammonium ***nutrient***, rather than releasing it as ammonia gas, so more will then be available to the plant.

The increase in plant-available nitrogen boosted the value of slurry by up to £0.26/t freshweight.

Reduced crusting also had an economic benefit, because less stirring was required. This made pumping through umbilical systems easier.

Other trials have shown that if you store slurry for three months before using it in the AD plant, the energy produced from it drops by 31%.

But if you treat the slurry with both Actiferm and N-Hance while it is stored, the energy production actually increases by 3%.

A weekly application of N-Hance and quarterly application of Actiferm costs about £1 a cow a month. Actiferm alone costs about 20p a cow a month. But if you brew your own, the price drops to about 10p a cow a month.

Slurry and fertiliser application

Mr Read bought a trailing shoe in 2012 and is now making better use of his slurry.

Before the first slurry application, he agitates the slurry with a jet pump stirrer twice, for three to four hours, towards the end of February, and then gives it just a small stir before filling the tanker each time.

“As you don’t get a crust, it’s very easy to stir – we just need to mix the sawdust in,” he explains.

“If you get the fermentation right, it’s a lot less pungent, and it doesn’t attract flies, either. When we stir it, we put the fans on, but we don’t need to take the cows out of the sheds.”

Silage leys get their first application of 37cu m/ha in March, and Mr Read tops this up with 20-25cu m/ha after each cut, with four taken in total. He then calculates inorganic fertiliser use requirements on top.

Now just three lots of fertiliser applications are made: 250kg nitrogen/ha before first cut, 220kg N/ha at second cut and 150kg N/ha for the third.

“We’ve cut our fertiliser use in half,” he explains. This has also been helped by having more slurry storage capacity and doing soil sampling.

How does it work?

Effective micro-organisms act in the same way as probiotic drinks or silage inoculants. The beneficial bacteria create the right environment.

In the case of slurry, the aim is to produce anaerobic fermentation, as this locks in ***nutrients*** and reduces gaseous losses. In contrast, aerobic conditions mean the manure rots, releasing ammonia, methane and carbon dioxide into the atmosphere.

Actiferm contains 40 effective micro-organisms, including lactic acid bacteria, yeasts, fungi, phototropic bacteria and actinomycetes bacteria, explains Agriton's Andrew Sincock.

Enzymes produced by the microbes break down fibrous plant material, which mean slurry and manure is taken into the soil faster, making the energy and ***nutrients*** available to growing plants.

It should be applied at a rate of 20 litres/100cu m of slurry every three months. Chemicals from parlour washings and foot-baths will deactivate the effective micro-organisms, so should not be disposed of into slurry.

If this is not possible, N-Hance should be used to neutralise the chemicals, at a start-up rate of 2 litres, diluted into 20 litres of water, per 100cu m of slurry, followed by a weekly maintenance dose of 1 litre, diluted in 10 litres of water.

JOURNAL : Farmers Weekly

Applying liquid fertiliser to grass plant leaves can cut costs by £15/ha and double dry matter yields compared with conventional compound nitrogen, trials have shown.

The trials on four Welsh farms showed foliar fertiliser significantly increased nitrogen use efficiency – that is the amount of grass grown compared to the quantity of product applied.

About the trial

In the first year of the three-year European Innovation Partnership (EIP) Wales project, standard nitrogen was applied at 50kg N/ha.

Foliar feed, based on urea and humic acid and more commonly used in horticulture systems, which are applied at a rate of 9kg N/ha every three weeks from 16 February to 30 October.

The product and application costs for each treatment worked out at £26/ha for the foliar feed and £41/ha for conventional fertiliser.

See also: 6 steps to improve your fertiliser use efficiency

The trial farms in Pembrokeshire and Ceredigion range in height from just 30m above sea level to 270m.

On all four farms, the nitrogen use efficiency – the increase in dry matter (DM) yield achieved per kg of N applied – of both products was compared to the DM yield of a plot on each farm that received no fertiliser.

Trial results

All four foliar feed plots considerably outperformed those that had standard fertiliser applied

The foliar feed plot on the lowest lying farm grew an additional 52.8kg/DM for each kg of N applied, compared with 22.4kg/DM in the conventional plot

Even the farm at 270m, which grew the least amount of grass, captured an additional 18.1kg/DM for each kg of N applied, compared to 8kg/DM in the conventional plot

Foliar fertiliser efficiency was about 80-85% in optimum conditions, while conventional ground-applied products were around 50-60%

Between 60-70% less ***nutrient*** was used on the foliar feed plots than on the conventional plots, to grow between 12.7-18.3t of grass DM

However, the conventionally applied fertiliser did produce more DM yield overall. Plots treated with the compound fertiliser produced the greatest amount of grass over a 12-month period – 18.8t DM/ha compared to 18.3t DM/ha for foliar feed

Soil and grassland consultant Nigel Howells, of Nigel Howells Consultancy, who is advising during the trial, explains why foliar feed has helped boost yields.

"Leaves have pores between cell structures, which act as the entry point for ***nutrients***.

"Foliar feed – because it gets taken in by the grass leaf –  is not dependent on soil temperature, so a ryegrass plant would not be reliant on the soil being warmer than 5C to make use of it," says Mr Howells.

Yield aside, foliar feed could have multiple benefits for grassland farmers going forward, he suggests.

Previous trials have proven foliar feeding can decrease the amount of total N necessary, while minimising N losses through runoff.

In the case of compound fertiliser, ***nutrients*** are applied to the ground before being washed into the topsoil by rain and then taken up by the root system of the plants.

A host of factors, such as soil compaction, drainage, bio-activity, soil temperature and dry or wet weather, can affect the ***nutrient*** release and uptake by the grass with this method.

The fact compound grew slightly more grass was not surprising, according to Mr Howells, who says this was due to the fact less foliar product was applied.

Livestock performance

As well as the yield effect and efficiency of use, the three-year trial focused on the impact on livestock performance.

Mr Howells says the nitrogen content in the fresh grass on each of the three plots on every farm was monitored.

“To date, levels in the foliar feed plots haven’t exceeded 700 parts per million (ppm) post-application, whereas in the conventional plots some readings peaked at 1,800ppm,” he says.

“This is relevant as the higher levels in the grass will require the stock eating it to use more energy to digest it, making it less available for producing milk and meat, or for maintaining condition and fertility.”

Clover content was also examined and was found to be higher in the plots that had received foliar feed or no treatment.

Further information

You can find more information on the EIP Wales website  or contact [*eipwales@menterabusnes.co.uk*](mailto:eipwales@menterabusnes.co.uk)

EIP Wales' Farming Connect mentoring programme is delivered by Menter a Busnes, and has received funding through the Welsh Government Rural Communities – Rural Development Programme 2014-2020. This draws funding from the European ***Agricultural*** Fund for Rural Development and the Welsh government.

JOURNAL : Farmers Weekly

Three of the big-name pickup manufacturers have launched new versions of their trucks.

The Nissan Navara Off-Roader AT32 and Isuzu D-Max AT35 have been tweaked by well-known pickup pimping company Arctic Trucks. Changes are largely cosmetic, with most of the running gear remaining as it is on the standard versions.

See also: New Land Rover Defender to get three-seat front row

Key new features on the Navara include a full aluminium shield underneath to reduce weight and limit impact damage when off road, while new 31.6" Nokian tyres apparently improve fuel economy and help to smooth the on-road ride.

Satin black alloy wheels with dual valves are also fitted.

Parts carried over from the previous Arctic Trucks model include the Bilstein performance suspension, wheel arch extensions and AT32 branding.

There's no word on cost yet, but expect to find it north of £40k and at the top of Nissan's price list.

Meanwhile, the D-Max has also had a suspension alteration, with the Fox set-up replaced with new a Bilstein performance system, as featured on the Navara.

Other tweaks include new side steps and badging on the wings and tailgate.

The D-Max retains Isuzu’s 125,000-mile/five-year warranty and a 3.5t towing capacity. The price for an automatic version with the 1.9-litre engine is a rather juicy £40,995.

Mitsubishi has also added a new model to its recently redesigned L200 range.

The Trojan sits between the 4Life and Warrior models and takes plenty of its styling from the higher-spec Barbarian pickups, including 18in alloys and a gawdy chrome grille.

The new model is already in showrooms and comes with Mitsubishi’s Super Select four-wheel-drive system. On-the-road price is £24,699.

JOURNAL : Farmers Weekly

These are very worrying and unprecedented times for the whole country. It’s almost surreal; all the fear, daily virus updates and empty shelves seems likes part of a horror movie.

The fields on some of the highest ground we farm afford a panoramic view, part of which encompasses the usually incredibly busy M4 corridor.

However, these past few days paint a very different picture – the hugely diminished volume of traffic is similar to that on Christmas Day.

See also: Coronavirus: Help us find farm heroes helping the community

Unfortunately, this is not echoed on the footpaths. Even after Boris’s lockdown, we are still having foot traffic through our farmland.

Now the schools have closed their doors to most pupils, we have had parents trespassing by bringing their children to play in our fields on pushbikes and even motorbikes.

In the next field, we have ewes with new-born lambs. Just beyond them are heavily pregnant ewes, all easily frightened.

I understand that part of the government’s statement was to exercise once a day. But it is ludicrous for the public to then head to private farms the length and breadth of the country to enjoy a moment of fresh air.

Many of us livestock farmers are lambing at the moment. We are functioning on very little sleep, some of us with less help than usual.

Most of us also have a fear of picking up the virus, not just because of the health implications, but for the sake of animal welfare. If all the family contract it, who will feed and water the livestock?

I find it astounding that the government has not closed public footpaths through farmland. We are classed as ‘key workers’, yet they are prepared to take the risk of us coming into contact with potential Covid-19 carriers. No farmers, no food.

It would be far better to implement restrictions on public rights of way sooner rather than later. This will not only protect the health of those that are trying to feed the nation, it will decrease the risk of panic if a large proportion of farmers are taken out of action. We do not want to become the users of resources, we want to be providing them.

We cannot control the situation that is going on in the country, no one can. But, to a certain extent, we should be allowed the powers to be able to limit the risk.

We cannot self-isolate on our sofas, we have a nation that is relying on us, just as it always has.

As dark as the weeks ahead are likely to be, it is crucial for us, as an industry, to stand strong together. In a world of uncertainty, one thing is certain – people will need food, and farmers must continue to produce it.

JOURNAL : Farmers Weekly

Growers can use fungicide products containing the active ingredient epoxiconazole, such as Adexar, until late 2021, after the Chemicals Regulation Division (CRD) confirmed when the ban on their use would come into effect.

The broad-spectrum azole fungicide was first registered as a molecule in 1993 and has been a mainstay of disease control programmes in a range of crops for more than two decades.

See also: On-farm fungicide trial reveals most profitable approach

Some of its major uses have been controlling septoria and rusts in wheat, with BASF’s straight epoxiconazole product Opus and more recently its SDHI-azole formulations such as Adexar (fluxapyroxad + epoxiconazole) being familiar product brand names.

It is also an important tool in other cereal crops and sugar beet, where it helps to control beet rust in formulated products such as Opera (epoxiconazole + pyraclostrobin).

The fungicide has been in the regulatory spotlight for a long time, with the EU classifying the active as an endocrine disruptor that poses a risk to human health and the environment.

The active is widely used and the announcement will be welcomed by growers and agronomists alike, as they can now plan with some certainty about its availability over the next 18 months.

Epoxiconazole withdrawal timeline

Last date for sale and supply: 31 October 2020

Last date for disposal, storage and use: 31 October 2021

JOURNAL : Farmers Weekly

Makita has added a wide selection of new kit to its battery-powered ground care product range as it encourages users to make the switch from petrol engines to eco electric machines.

See also: On test: Electric strimmers deliver petrol-powered performance

Alongside its hand tool range, which extends from cordless drills to chop saws and even a coffee maker, the firm plans to add a two-speed, 18V grease gun to the catalogue of 70-odd battery-powered outdoor products.

Much of the big kit now runs on a pair of 18V batteries to provide power outputs that compete with petrol equivalents.

The lithium-ion 18V LXT batteries run everything from sanders to strimmers, so if you already have a decent stock of batteries and chargers then buying bare tools offers a significant cost saving.

 Blower

Most big arable farms will have ditched the humble brush in favour or a leaf blower to speed up clearing grain stores and Makita’s new DUB363 blower runs from two of its 18V batteries, giving it 36V of power.

Cleverly, this machine can be switched from blowing to hoovering with the fan acting as an impeller to mulch twigs and leaves as they enter the bag.

In blowing mode, the run time is nine to 30min depending on the battery size used and there is a constant trigger speed mode, which helps to relieve pressure on the operator’s finger.

Air flows at 65m/sec but, surprisingly, noise levels are a similar level to petrol machines at just shy of 95dBa. Cost for the body alone is £530, whereas buying two 6Ah batteries and a charger bumps the cost up to £1,130.

Chainsaw

The latest brushless technology means small chainsaws can offer genuine competition to petrol equivalents and Makita’s new DUC256 top-handled saw could tempt occasional users who don’t want the faff of carting around a two-stroke mix.

Using the twin 18V battery setup, the brushless motors can offer chain speed of 20m/sec from the 250mm bar, which the company says is equivalent to a 35cc petrol saw.

There is also a clever torque boost mode that, when engaged, offers an extra 1.5hp to cut through harder woods.

This lasts for 30secs before it reverts back to standard power, and it's only possible to activate the boost function five times before it is restricted to protect the motors.

Other features include an electric chain brake, auto power on/off and a battery life indicator for each unit.

For those users that require a little more grunt, the DUC405 has a 400mm long bar and runs from two 18V batteries. This model is aimed at professional users, and features captive nuts to prevent them being dropped when removing the sprocket cover

Prices start at £435 for the top-handled DUC256 and £450 for the bigger DUC405.

Brushcutter

The lower vibration and noise produced by an electric brushcutter means these machines are a common sight among professional operators.

The brushless motor for the DUR369 strimmer is now in the head to help balance the machine, given the lack of an engine. The new model has three speed settings along with a three-second reverse to help operators who get in a tangle.

This is the largest brushcutter in the electric range, exerting 1kW of power, equivalent to a 35cc petrol machine. Makita’s Active Drive Technology senses when the force on the head increases, and speeds up the revolutions to deal with tough grass.

Compared with a similarly powered Makita petrol brushcutter at 7.1kg, the electric model weighs just 5.9kg, while noise is drastically reduced from 106.7dBa to just 93.8dBa.

Prices for the twin-handled brushcutter start at £590 for the body only and go to £1,190 when ordered with two batteries and a charger.

Battery backpack

There is also a clever battery backpack that can hold four of the 18v batteries and increase performance of tools.

Unlike some other packs that have built-in batteries, being able to remove dead cells and insert fully charged ones means there is no need to return to base to refuel.

It can fit both single and dual battery tools with run times extended significantly. For instance, Makita’s brushcutter goes from a standard output of 67mins up to 134mins when powered by the backpack.

JOURNAL : Farmers Weekly

Scientists at Bristol University have proposed an alternative method of evaluating livestock emissions that more accurately reflects the nutritional benefits of beef.

They claim that incorporating a measure known as Recommended Dietary Intakes (RDIs) into the emissions metric would see beef compare more favourably with other meats.

See also: How slurry cooling technology can cut ammonia on pig units

The difference is huge, with beef production accounting for lower emissions than free-range chicken under the recalculation.

The measure was explained by environmental consultant Sarah Jones in an article on Promar International’s website.

“The current focus on cattle production over-simplifies what is a very complicated subject,” said Ms Jones.

Much of the argument around livestock farming focuses on the global warming potential (GWP) of meat and dairy thanks to greenhouse gas production by animals, she explained.

For each 100g of meat produced, beef cattle create almost 2kg of carbon dioxide equivalent (CO2e) – the standard unit for measuring carbon footprints.

When compared with intensively reared chicken, which produces less than 0.5kg CO2e per 100g of meat, cattle appear to be much less environmentally friendly.

But this simplistic measure fails to grasp the nutritional output being achieved within each kg of meat compared with the CO2e, Ms Jones said.

New work on emissions

She highlighted the work carried out by Bristol University sustainable ***agriculture*** expert professor Michael Lee which was presented at the Sustainable Food Trust’s recent conference.

Professor Lee developed the new approach to measuring GHGs in beef production by incorporating RDIs.

At the conference Prof Lee explained that people didn’t eat to consume kilos of a product, they ate to consume the ***nutrients*** they needed.

The RDI system recognises this fact and accounts for beef’s high nutritional value per kg and its concentration of vital vitamins and minerals such as omega-3 fats and vitamin E.

This then allows a better comparison to foods which have much lower ***nutrient*** levels per kg, yet on the surface, have a lower carbon footprint, Ms Jones said.

Scientists using this metric have revealed that emissions from beef cattle reared on concentrates are actually less than 0.05kg CO2e per 1% of RDI.

That is just a fraction of the 2kg CO2e per 100g calculated in the standard GWP measurement, said Ms Jones.

Factoring in the nutritional value showed that emissions from those same cows were 2.25-times lower than free-range chicken.

JOURNAL : Farmers Weekly

A fungicide programme tailored to the season gave the best wheat yield response and the highest margin in an on-farm trial conducted by Cambridgeshire grower Russell McKenzie last year.

In a growing season which started off dry before rain arrived in June, it was the right year for showing that it’s possible to retrieve yield later on. And responding to the conditions is important, even further into the growing season, he believes.

Surprisingly, use of an SDHI at T3, which followed a T1/T2 programme based on an azole/strobilurin mix plus chlorothalonil, came out on top with an average 4.93t/ha yield response, producing a £614/ha margin over costs.

“With any fungicide programme, there’s always an element of guessing what’s going to happen with the weather,” says Mr McKenzie.

See also: Why wheat growers need to be extra alert for yellow rust

“What was obvious from our trial in 2019 is that we need to maintain some flexibility in order to deal with increasingly unpredictable weather.”

 Russell McKenzie’s key questions in 2019

What influence does varietal resistance have?

What does a standard fungicide programme deliver?

Does nutrition make a difference?

What happens if the programme is tailored to seasonal developments?

With the help of BASF, he took the opportunity to compare seven different input programmes – untreated plots plus six different treatments. These included a nutrition-only based programme, as well as one without an SDHI component at T1 and T2 and three with the leading manufacturer options of two SDHIs used at T1 and T2.

The sixth and final choice was the best performing – holding back the SDHI component until T3 and using azole and strobilurin chemistry at T1 and T2, along with multisite chlorothalonil.

Yield, costs and margins for the four different approaches

Treatment

Yield response (t/ha)

Cost (£/ha)

Margin over cost (£/ha)

Nutrition only

0.95

74

59

Aazole/strob/chlorothalonil

T1 and T2

3.49

57.78

431

SDHI T1 and T2

3.17

93.15

351

Season approach

4.93

76.68

614

Wheat at £140/t, SDHI at T1 and T2 had T0 of tebuconazole + chlorothalonil

While septoria pressure was initially low, yellow rust came in early, with some of the 11 varieties in the trial showing early signs of infection.

“Some varieties expressed high levels of infection early on, but it was interesting to see how adult plant resistance kicked in later on in the growing season,” he recalls.

“Skyscraper, which we grow on the farm, wasn’t one of those initially infected.

“Wasabi was one of the worst infected early, around growth stage 30-32, but amazingly it was virtually clean of yellow rust by GS39. Yellow rust is such a dynamic situation and doesn’t seem to obey the resistance-rating rules, so it was good to see resistance still working.”

Varieties in trial

Barrel

Kerrin

Firefly

Gravity

Skyfall

Lantern

Wasabi

Skyscraper

Spotlight

Crusoe

Sundance

In the untreated plots, the average yield was 8.92t/ha. Under this regime, top-performing varieties were Firefly at 10.53t/ha and Barrel at 10.17t/ha, while Gravity at 6.53t/ha and Kerrin at 6.5 t/ha were at the bottom.

“Barrel was a real surprise as it has one of the lowest septoria resistance ratings on the AHDB Recommended List at 4.3, but it reflects the season and early dominance of yellow rust.”

Nutrition only

Where a nutrition programme was used instead of fungicides, there were big differences between varietal responses.

While Spotlight showed no response to the programme, Firefly gave a 0.88t/ha response. In general, the less resistant varieties responded more.

“Overall the nutrition programme didn’t do as well as we had hoped. Bear in mind that it had a total cost of £74/ha.”

His reason for testing a nutrition approach was to get a better understanding of the potential of products such as Biotrac, an algae-based biostimulant, and their place in a programme.

Whether they work, when they should be applied and how they might help alleviate stress were all under scrutiny, but the 2019 results were inconclusive.

Having no SDHI chemistry in the programme gave an average response of 3.49t/ha – a bit higher than the 3.17t/ha response achieved when SDHIs were used at T1 and T2. This may have been a reversed result if septoria was present earlier.

“It was the right year for it, as disease pressure was low for most of the season,” says Mr McKenzie.

“In the trial, all three SDHI options at T1 and T2 were trialled from the three leading manufacturers, but there wasn’t really a huge difference between them.”

Again, varietal differences were seen, with the dirtier varieties such as Gravity and Kerrin giving responses of more than 5t/ha.

“Even Extase gave a 2t/ha response, which was far higher than we had anticipated.”

Late season control

In the best performing programme, holding back the SDHI until T3 (following a non-SDHI programme at T1 and T2), when Librax was applied, gave an average response of 1.43t/ha from that application alone, he reveals.

Those plots also remained greener throughout the trial.

“Where there’s rainfall in June, it would seem to work well. I just wish I’d been brave enough to use the same approach on our commercial crops.”

Variety responses to this T3 approach were analysed, which showed that it was a rust-dominated result, with huge responses from some varieties compared with their untreated yields.

More significantly, the top end treated yield of all the varieties was relatively close.

For Mr McKenzie, this clearly demonstrated that although there is a wide spread of response levels, even the cleaner varieties respond significantly to a well-balanced fungicide programme.

“Reducing the risk with a cleaner variety that may be a few percentage points down on yield on paper doesn’t always lead to significantly different yields on farm.”

Six different input programmes tested

1.     BASF

 T1 Adexar 1 litre/ha + chlorothalonil 1 litre/ha

T2 Librax 1.25 litres/ha

T3 Unizeb Gold 1 litre/ha + Toledo 0.43 litres/ha

2.     Bayer

T1 Aviator 1 litre/ha + chlorothalonil 1 litre/ha

T2 Ascra 1.25 litres/ha

T3 Unizeb Gold 1 litre/ha + Toledo 0.43 litre/ha

3.     Syngenta

T1 Aviator 1 litre/ha + chlorothalonil 1 litre/ha

T2 Elatus Era 0.8 litre/ha

T3 Unizeb Gold 1 litre/ha + Toledo 0.43 litre/ha

4.     Season approach

 T1 Amistar Opti 1 litre/ha + Epic 0.75 litre/ha

 T2 Comet 0.4 litre/ha + Epic 0.6 litres/ha + chlorothalonil 1 litre/ha

T3 Librax 1 litre/ha

5.     No SDHI

T1 Amistar Opti 1 litre/ha + Epic 0.65 litre/ha

T2 Comet 0.4 litre/ha + Epic 0.6 litre/ha + chlorothalonil 1 litre/ha

T3 Unizeb Gold 1 litre/ha + Toledo 0.43 litre/ha

6.     Nutrition

T1 Biotrac + Mn + Zn + Mg + Cu + Bridgeway

T2 Mg +B + Magphos K +Zn + Bridgeway + PGA

T3 Magphos K + S

Trial work objectives

The need for realistic and relevant ***data*** on which to base future decisions is behind the on-farm trials being conducted by Russell McKenzie.

Faced with continual changes to the fungicide line-up and the steady arrival of new varieties, he is investigating how both can be put to best use on his farm in the most cost-effective way.

“Having ***data*** from our own farm is invaluable and will become even more important,” he says. “The results from 2019 threw up a few surprises and made me realise that I should have been brave enough to trust my instincts more.”

Last year he set out to investigate the contribution of varietal resistance and nutrition to disease control, as well as comparing different fungicide programmes alongside an approach that was tailored to the season.

This year, he is hoping to repeat some of the work, but on wheat drilled much later at the beginning of February.

“That’s new territory for me,” he says. “But it could be very useful. All of our commercial crops are behind where we would like them to be, so gathering knowledge on the best way to manage them seems sensible.

“Perhaps nutrition and biostimulants will play a greater role this year.”

Actives

Adexar: epoxiconazole + fluxapyroxad

Amistar Opt:  azoxystrobin + chlorothalonil

Ascra: bixafen + fluopyram + prothioconazole

Aviator:  bixafen + prothioconazole

Comet: pyraclostrobin

Elatus Era:  benzovindiflupyr + prothioconazole

Epic: epoxiconazole

Librax: fluxapyroxad + metconazole

Toledo: tebuconazole

Unizeb Gold: mancozeb

JOURNAL : Farmers Weekly

It is late March and, as I write from a remote part of Northumberland, we are in the throes of lambing. People on my patch are not so concerned with catching a virus, but with keeping their new arrivals alive. It seems that spring has just got colder than winter.

Like all rural estates, we have sought to diversify and, over the past 12 years, have invested in all sorts of initiatives to reduce our exposure to ***agriculture*** and traditional rural business. Unfortunately, it seems that Covid-19 has, as nature often does, found a weakness in this approach.

See also: Find all our coronavirus content in one place

Our wedding bookings this year, while not huge, were better than ever before. But all of these are now looking to postpone until 2021. The holiday accommodation, at this moment, looks like it will struggle to let, and our garden openings, heritage tours and corporate events programme all look under threat.

But weirdly, there are some opportunities evolving. Prior to lockdown, we took an enquiry from a family who wanted to “isolate” somewhere remote for at least two months in our largest property. It’s a staycation, but not as we know it.

Cath, who runs our local shop and post office, is doing a roaring trade as the “social isolators” and homeworkers, particularly the older ones, don’t just buy their paper and fags from her now, but their whole weekly shop.

I had a long conversation with my friend, Paul Cowie, research fellow at the Centre for Rural Economy, Newcastle University, who is looking into rural workspaces. His observation was that, in the longer term, providing shared workspace in rural areas with good connectivity is a real opportunity.

A greater acceptance of home working could also help this new and thriving sector in the rural economy.

My limited exposure to social media suggests that some rural businesses are quickly innovating and diversifying. Offering more takeaway services or home deliveries and suggesting purchases of gift vouchers are just a couple of the ideas proving popular.

This period will also prove a valuable time to get all those things you wanted to change sorted out. The track for the catering team that serves our marquee site can now be done, as we have time. The redecorating of one of the older cottages can be achieved without the pressure of guests due to arrive.

In the 2001 foot and mouth crisis, my grandfather, then aged 98 and having farmed all his life, said “it’s not a bad thing, it’ll give the land a rest”. I feel slightly the same about the current situation. It’s awful, but it does present opportunities and, crucially, some time to really think about what we are doing.

Having said that, the truth is we are best placed when risk is spread and, like any other economy or environment, diversity is key.

In our wonderful countryside, we have an asset than can provide sustenance, experience, enjoyment and tranquillity. This crisis may well mean that people think more carefully in future about travelling abroad and, as our supply chains are challenged, it may prove that over-reliance on food imports is unwise. It could be a win for both the traditional and the diversified.

So if, through all of this extraordinary and ghastly business, a wider understanding emerges that rural Britain is not the poor relation to global markets and urban society, but an asset brimming with opportunity, the long-term outlook may be more positive than we think.

Willy Browne-Swinburne is a Northumbrian landowner, farmer and businessman

JOURNAL : Farmers Weekly

The world is a different place to what it was just a month ago, and this is a different column to that which I would normally write.

Food standards, security, sustainability and the need for a good departure from the EU – all remain vital issues, but are parked for now in deference to the need for an unprecedented global response to the Covid-19 pandemic.

See also: Farmers must pull together in coronavirus crisis

For the time being, farmers and government will work together – as always in times of national crisis – for the good of the nation, until the threat has passed.

The question I wish to pose, however, is: “How are you?”.

The farming community has been through the mill these past three years; from genuine business concerns over the impact of Brexit and future legislative arrangements, to the devastating effects of climate change, to the relentless assaults on our industry by so-called environmentalists and celebrities, the media and even our own government.

We’ve had a time of it, but we forge on.

Take some time to think about yourself; how are you feeling, really? Are you carrying a burden which would be better shared? There’s absolutely no shame in it. Lightening the load can positively affect all areas of your life

The automatic response is always to say: “I’m fine.” Most are. Some who aren’t may even believe they are. But the Covid-19 crisis has introduced yet another element to the pressures on many in our industry.

***Agriculture*** may be less affected than some sectors by the current restrictions and worries, but we’re all human; we all have frailties; we can all suffer from isolation; we all worry about the future.

Myself, I recently broke down before a dozen strangers on a professional development course. This, I must add, is unusual for me.

We’d been invited to conduct some personal self-analysis – not something I’d ever devoted much thought to.

A remarkable convergence of events that week exposed in me feelings which I realised had been consuming me for more than a decade, slowly filling me with self-doubt and recrimination.

I’m grateful to have experienced this enlightening opportunity – and for the invaluable support of my understanding course-mates.

I am fine. But my point is this: first, take some time to think about yourself; how are you feeling, really? Are you carrying a burden which would be better shared? There’s absolutely no shame in it. Lightening the load can positively affect all areas of your life.

Second, reach out to those around you. Check that they’re okay. You never know who might be struggling, or what help you might be able to offer.

Third, be kind, especially online. You don’t know what issues people are dealing with behind the computer screen.

As an industry, we’ve become much better at talking about mental health in recent years. It’s no longer a taboo subject, and the number of charities available to help farmers through difficult situations is constantly expanding.

NFU president Minette Batters has been showing compassionate and commendable leadership on this issue too, vigorously highlighting the consequences of careless criticism of farmers by, especially, the national media.

I know many members were genuinely heartened to receive something as simple, but heartfelt, as her recent voice message reassuring them that the NFU was there to help them through this difficult time in our national life. Small gestures can mean a lot.

So look after yourselves. Look after each other. Ask for help if you need it. Give help willingly if asked. And always, always, be kind.

JOURNAL : Farmers Weekly

What an irony that, just as the miserable weather of the past six months broke, allowing us back on the land, suddenly the country is in the grip of something much, much worse than a very wet winter.

At these times you count your blessings. The extra acres of spring drilling keep us occupied when we need a distraction.

Furthermore, unlike others, we can work safely in the isolation of our tractor cabs or out in the fresh spring air.

See also: Farmers must pull together in coronavirus crisis

Added to that is the knowledge that people are suddenly more concerned about food supplies which, in turn, gives us an increased sense of purpose.

With supermarket shelves being stripped bare, our role as food producers seems enhanced.

But while the temptation now is to talk up our own importance, we need to be careful. For starters, it is those in the medical profession, stepping up to put themselves in the front line of this terrible virus, who are the heroes, not us.

Second, at a time of national crisis it pays to silently and stoically do our bit without fanfare.

Let others come to their own conclusions about the importance of a secure supply of affordable food without us taking to our soapboxes shouting, “we told you so”.

There are lessons here from the last two times we had similar challenges as a nation.

During the First World War, despite the fact that food was a key to the war effort, farmers came out of it with a slightly tarnished reputation that they had profited from higher prices.

This PR setback was one reason why, after the war, politicians were prepared to once more sacrifice home ***agriculture*** on the altar of free trade.

It may be ill-advised to try to make political capital from concerns about food supplies at this time of crisis.

By the early 1920s, farming was sent back to its pre-war depression as Britain returned to importing the vast majority of its food.

The experience of the Second World War was different. Farmer leaders had learnt some PR lessons from 20 years earlier.

Christopher Neville, the NFU president in 1942, often defied the demands of his members who asked for better guaranteed prices.

He recognised it was not the time to plead a special case, but rather to show solidarity with the national war effort.

Writing in Farmers Weekly in 1942, Mr Neville reminded farmers that, due to their wartime efforts, they “have earned the goodwill of the population to an extent never attained before”.

He added: “This goodwill will be of incalculable value when the war is over and the policy of post-war ***agriculture*** is decided.”

He was right. After the war, the 1947 ***Agriculture*** Act was put in place to provide a backdrop for UK ***agriculture*** to thrive.

It is true many of us in the past have warned government that it needs to take declining home production and food security more seriously, because one day this country could face challenges that might need a vibrant domestic ***agriculture***.

But maybe now, as this pandemic sweeps across our nation, it is the time to moderate our messages. It may be ill-advised to try to make political capital from concerns about food supplies at this time of crisis.

It is when this deadly virus has passed, rather than during its course, that we should ask what lessons were learnt.

For now, the farming community needs to simply ask what it can do to help. The politicking can wait for a better time.

JOURNAL : Farmers Weekly

Sand is the gold standard when it comes to cow comfort and udder health, meaning that many farmers are looking at ways to upgrade from mats to sand bedding.

Its inert nature means sand harbours less mastitis causing pathogens, and also helps to keep cows clean and comfortable - all of which combine to aid health and lying times.

See also: Slurry separation options compared

Consultant, Andy Dodd from The Farm Consultancy Group, runs through the various factors to consider before converting to sand:

1. Think about slurry handling

Slurry handling is the number one consideration when thinking about moving to sand. On systems with underground channels or slats, sand can cause issues with slurry flow.

It’s worthwhile installing a slurry separator with a sand lane. This will ensure only the liquid enters the slurry store and will remove the need to dig the store out. A slurry separator will cost about £50,000-£60,000.

When putting up a new shed, consider using V channels rather than the standard U-shaped channels where sand can settle.

2. Consider equipment wear and tear

Sand will increase wear and tear on equipment, so be aware that chains and bearings will wear quicker. It could also halve the lifetime of any chain systems in underground channels.

Any automatic scrapers will also have to work harder to scrape slurry with sand. Consider scraping more frequently to reduce pressure or moving to tractor scraping.

3. Consider heel stone height and bed depth

The height of the existing heel stone will dictate how you convert existing cubicles to sand.

Mr Dodd believes 30cm (12”) is the maximum height for a heel stone, with no detrimental effect on foot health seen up to this level.

If the existing heel stone is 23cm (9in) for example, there is room to increase its height. As a result, it may be more cost effective to bolt a 5x10cm (2x4in) plank or angle iron on the back of the bed and fill in the bed with sand.

If the existing heel stone is already at 30cm (12”), the bed will need to be dug down. For example, 20-25cm (8-10in) of concrete could be removed from the bed and then built up with 5-10cm (2-4in) of chalk before 13-15cm (5-6in) of sand is added on top. The chalk provides a free-draining layer and reduces sand requirements.

Mr Dodd views 10-15cm (4-6in) of sand as the optimum sand depth – any more increases the likelihood of sand wastage off the back of the beds.

4. Get cubicle dimensions right

Sand can raise the height of the bed.

If the bed is raised 10-15cm (4-6in) for example, the whole cubicle will need to be moved 10-15cm (4-6in) higher.

If cows were lying well on the mats before making changes, make a note of the measurements and replicate them with the sand, but lift the cubicle higher. If you don’t, cows may not lie correctly.

Be sure to use the right measurements for your herd, rather than generic numbers.

5. What’s the pH of your land?

Know the pH of your soils. Sand is alkaline so if you apply alkaline slurry to soils that already have a high pH, you could compromise crop performance.

Target slurry towards more acidic ground or think about how you might export slurry and FYM.

6. Choose the right sand

Be aware of where sand is being sourced. Dredged sand in-particular may be cheaper, but can have a higher bacterial load, which could compromise udder health.

When in doubt, get sand analysed for bacterial load.

Generally, farmers opt for quarry or beach sand. The source chosen will largely depend on geography. Be aware that haulage will add to overall costs.

7. Ensure you manage cubicles well

Cubicle management is just as important on sand as it is with any other bedding material.

Any wet material needs to be forked out daily – if not twice daily – and beds should be topped up two to three times a week.

Level out any dips in the bed, otherwise milk can pool, causing bacteria risk.

Case study: Green Farm

Converting existing cubicles to sand and building a new, deep-bed sand cubicle shed has been one of several factors which have helped improve udder health at Green Farm, Shrewsbury.

Last year, dairy farmer Matthew Thomas decided to convert some of the cubicles in “the worst sheds” to help tackle challenges with somatic cell counts and mastitis.

Farm facts

480 cows yielding 12,000 litres a cow a year.

£13/t – cost of sand, versus about £130/t for sawdust.

£15,000/ year - cost of sand used in the modified cubicle buildings, versus £16,800 with sawdust.

170,000 cells/ml – winter somatic cell counts after moving to sand.

22 mastitis cases/100 cows – seen in January-February after moving to sand, scraping more and milking three times a day, versus 67 cases in May-July on sawdust.

The farm also moved to three times a day milking and increased scraper frequency.

Since then, yields have increased from 35 litres a cow a day to 41 litres, and mastitis cases have almost halved.

In the existing shed, Mr Thomas opted for the simplest and cheapest option, removing the mats and attaching a 10cm (4in) angle iron to the top of the 20cm (8in) curb, creating a 10cm (4in) sand bed. It took two people one day to convert 100 cubicles.

See also: 7 considerations before converting to sand on your dairy

“It was very simple. You can do it with unskilled labour between milkings. It was really profitable as it didn’t cost me in [additional] labour, just in steel,” he says.

In the new shed, he opted for 20cm sand beds with a crushed stone base. He views 10cm as the minimum for cow comfort and believes the new shed is the gold standard.

“In the old shed, I’ve made a two-star shed into a four-star shed and the new shed is five-star,” he says.

Sand has proved cheaper than the sawdust used previously. However, there have been added handling costs. The old shed has tunnels and a slurry tower, which means sand can block up the system.

“It does get blocked, but I’ve found a solution,” he explains. “I’ve put a piece of pipe inside the tunnel and I flush it through with an umbilical pipe every day. That keeps the slurry circulating around and then it’s pumped to the tower.”

A digger is now hired every six months to dig out the tower. Two tractors and spreaders are also hired to spread the solid material. This equates to additional costs of £5,000/year.

To justify this, Mr Thomas calculates that cows need to produce 0.25 litres more a cow a day, which they are.

With the combined benefits of udder health and cow comfort, he believes the pros outweigh the cons of sand. “I don’t think it’s going to be an easy product long-term, but it’s great for the cows,” he says.

JOURNAL : Farmers Weekly

Three men have been jailed for the illegal slaughter of hundreds of sheep and lambs on farms across Northamptonshire.

Robert Iordan, 23, and Florin Nutu, 36, were each sentenced to four years and four month,s and a third man, Viorel Manu, 39, two years and 11 months.

The men were responsible for at least a dozen recorded incidents of illegal sheep slaughtering on farms in the Midlands county last year.

See also: What to do if you’re a victim of sheep rustling

More than 120 sheep and lambs died in the sickening four-month killing spree between 22 June and 7 October.

Northampton Crown Court was told that the killings caused severe distress to farmers. The men travelled across the county, killing and butchering sheep in order to steal the meat and profit from it.

In one incident, a farmer made the grim discovery of butchered carcasses of 15 sheep while her two young children were with her. The remains had been discarded at the edge of the field, with one carcass hanging from a barbed wire fence.

 Blood-soaked knives

The court heard that police arrested the men on the A14 in the early hours of 7 October near Welton, Lincolnshire, after they were caught fleeing the scene of an attack.

Officers found blood-soaked butcher knives and the carcasses of nine sheep in the back of their van.

Speaking to the men via video link at Northampton Crown Court, Judge Adrienne Lucking described the killings as “gruesome and distressing”.

Judge Lucking said: “The sheep were in each case stolen for their meat, butchered in the fields, and their unwanted body parts left strewn around for their owners to find.

“On one occasion two very young children were completely traumatised finding their sheep slaughtered and butchered, such that they were screaming at the sight.”

Illegal meat chain

The court heard that the men became involved in the killings out of desperation for money. Police are still trying to trace who bought the illegal meat.

Iordan and Nutu, both of Dunsink Road, Birmingham, pleaded guilty to conspiracy to steal in relation to the slaughter and butchery of livestock.

Father-of-one Manu, of no fixed address, changed his plea to guilty on the day of his trial for the same offence. He was given a shorter sentence as he  took part in only one offence.

In a statement read to the court, the NFU said: “The successive strain of events over several months put an immeasurable amount of stress on farmers and their families and is something we hope never to see again.”

Lead investigator Det Con Jamie Cooper of Northamptonshire Police said: “These crimes caused farmers a great deal of upset and anger last year and I'd like to thank them and the wider rural community for their support and patience during our investigation.”

Sheep rustling on the rise, warns insurer

A rural insurer is urging livestock farmers to take steps to prevent becoming victims of sheep rustling.

NFU Mutual estimates farm animals worth £3m were stolen in 2019, a staggering increase of nearly 20% in two years.

Rebecca Davidson, rural affairs specialist at NFU Mutual, says highly organised criminal gangs are behind a recent rise in sheep rustling.

“This form of crime is devastating for farming families, who find the remains of slaughtered animals in the field. For smaller farmers, the loss of a number of stock can wipe out profits and disrupt the operation of the farm for years as they rebuild flocks,” she said.

In the past few days, NFU Mutual has received reports of sheep being butchered in farmers’ fields – presumably committed by criminals seeking to cash in on current public concerns of food shortages due to the coronavirus crisis.

In March, there were reports of a number of rustling incidents, including 70 suspected stolen sheep recovered by police when they stopped a livestock transporter in North Yorkshire, and 47 lambs stolen from Monmouthshire.

To deter livestock thieves, NFU Mutual advises farmers to:

. Ensure stock is clearly marked and records are up to date

. Graze animals in fields away from roads where possible

. Consider a sheep fleece marking system such as TecTracer

. Join a farm or rural watch schemes to share information about crime

JOURNAL : Farmers Weekly

The Ulster Farmers’ Union (UFU) has welcomed the decision to relax the three-crop rule in Northern Ireland.

The union said Daera’s announcement was a “positive result” for farmers who were struggling to meet crop diversification requirements after record rainfall in February.

The derogation will apply to all farms with more than 30ha of arable land.

Originally devised by Brussels, the three-crop rule requires farmers managing more than 30ha of arable land to grow at least three different crops.

See also: Three-crop rule finally relaxed in England

David Matthews, UFU seeds and cereals chairman, said: “This much-needed derogation will be well received in particular by our arable and horticulture farmers in Northern Ireland.

“The derogation will alleviate some of the current pressure on farms during this difficult time.”

The UFU had called on the government to consider the challenges facing farmers in Northern Ireland after the sustained spell of wet weather.

Mr Matthews added: “Daera’s derogation will make a huge difference to UFU growers who have faced months of relentless heavy rain, waterlogging and flooding of fields leaving them unable to plant and establish crops for 2020.”

It comes after the three-crop rule was finally relaxed for farmers in England following months of lobbying by industry leaders.

The rule is being relaxed for all farmers for 2020 – not just flood-hit growers unable to get crops in the ground, said Defra in an announcement on 20 March.

JOURNAL : Farmers Weekly

The loss of diquat means potato crop desiccation will be a longer and more protracted process, which could increase the risk of late-season diseases such as tuber blight and rhizoctonia.

Rapid burndown of potato haulm was a valuable tool in helping manage disease, by rapidly removing foliage that could be at risk from virus-carrying aphids and blight.

Therefore, disease programmes may need changing for the latter part of the season.

Here we ask three specialist potato agronomists for their thoughts on managing disease in crops desiccated without diquat.

See also: Tips on desiccating potato crops without diquat

John Sarup, Spud Agronomy

It's not that easy to sit at a desk while “self isolating” to put pen to paper and try to predict what is going to happen to the potato crop at the end of this season. However, I will have a go.

Nitrogen inputs

Firstly, how should we manage nitrogen inputs? It is likely that soil nitrogen availability will be on the low side due to the autumn and winter rainfall, so without doing any soil min N testing, we are in the dark.

If we apply too much nitrogen, crops will be difficult to kill before harvest, skin set might be delayed and there is a risk of disease – either from late blight or dry rot/gangrene on the back of damage at harvest.

When thinking about nitrogen, always take account of manures. You can always apply more nitrogen, but if you put it all on at once, you can’t take it off.

Where possible, for maincrop potatoes, I have always preferred to put two-thirds of the N requirement in the base, with the rest going on around tuber initiation. For salads and seed, all go on in the base.

It is worth remembering that nitrate N is mainly used by the plant for foliage production.

We don’t harvest foliage, so we only need enough to achieve full ground cover and maintain that cover long enough to allow the crop to bulk and achieve the desired size for the market.

It goes without saying – but I will say it anyway – that one poorly timed cultivation will compromise rooting and ***nutrient*** availability, so it is crucial to check that cultivations are not being carried out at depths where the soil is at or beyond its plastic limit.

Disease management

Secondly, we need to manage disease. Consider rhizoctonia, black dot and verticillium (known as the early dying complex) – all of which can attack the root system and affect yield and quality.

These can often be exacerbated by the presence of free-living nematodes and potato cyst nematodes, therefore, managing these pests is also crucial.

Late blight populations seem to change from year to year, but one thing is for sure, we need to have a robust anti-resistance strategy in place where different active ingredients are mixed, targeting the right products at the right time.

Tuber blight will always be a worry and, with the loss of diquat, crop canopies may be greener for longer. It is therefore important to understand which products are active on tuber blight.

I avoid the use of fluazinam products due to resistance concerns and rely on Ranman Top or Shinkon/Gachinko and Infinito.

Care needs to be taken to minimise resistance. Ranman Top and Shinkon/Gachinko are in the same resistance group, so a maximum of six applications can be made. Planning the desiccation process to include applications of these products will be vital.

Actives

Gozai - pyraflufen

Infinito - fluopicolide + propamocarb

Ranman Top - cyazofamid

Shinkon/Gachinko - amisulbrom

Spotlight - carfentrazone

Ben Lowe, Agrovista

Our first growing season without diquat is finally upon us, after 18 months of constant debate on how we are going to manage crops after this valuable active ingredient has gone.

What is clear from discussions, and backed up by trials, is that both desiccation and disease control begin at the planning stage.

Burn-down period

An extended burn-down period leaves the crop at risk for longer and attention to detail is paramount through this phase. Gone are the days of a two-spray approach anytime in the summer or autumn.

My expectation, following Agrovista’s trials of desiccation without diquat, is that the burn-down period will start slightly earlier and finish slightly later to hit the same bulking targets for each crop's end market.

***Nutrient*** application

***Nutrient*** application is the starting base, with nitrogen the key focus. If a crop becomes deficient in nitrogen late in the growing season, Altenaria solani will be the main risk.

However, historically, luxurious doses of nitrogen are often used. So, in most cases, there is room to make small downward tweaks to dose rates to aid quick and effective desiccation without loss in yield or quality.

Tissue testing of the crop has become a valuable tool in a grower’s armoury. This allows accurate and speedy analysis of what is going on within the plant, which hidden hunger is holding back yield, and what could be leaving the crop open to disease.

Magnesium, manganese and sulphur are all often deficient as the crop grows quickly. Remember that a healthy plant is far more robust at combating disease, especially late on in the year.

A new and popular tool last season was biostimulant Equilbrium, which is formulated from amino acids and seaweed extract. This product is a stress reliever and can really lift a backwards crop or push yields in a standard crop.

Aphids

An extended desiccation period leaves the crop susceptible to aphids, with the plant at risk until there is no longer any green tissue in the field, including stems.

This is an important factor for seed growers, but my main concern would be home-saved seed from a ware crop, where the focus may not be on aphid control.

Regularly monitoring the crop and ensuring phasing in of insecticides allows room for extra applications late in the season, with alternating modes of action being key.

It wouldn’t be a potato article if I didn’t mention blight at least once.

With extended desiccation, blight risk is also extended, with a real chance of zoospores being present in later-season crops, when conditions turn cold.

Poor timing or using products without soil activity drastically increases the risk of tuber blight, which brings most growers out in a cold sweat.

Cyazofamid will be my main recommendation to control tuber blight, within a sequenced approach to protect the active and ensure optimum control.

Martyn Cox, Blackthorn Arable

With the loss of diquat and as some extremely aggressive blight strains are now widespread, the risk of tuber blight could be high if, as expected, haulm death is slower than growers are used to.

Blight

Trials at AHDB sPot farms last season demonstrated that PPO-inhibitor herbicides Gozai and Spotlight take seven to 10 days longer than diquat to achieve complete kill. Not attaining complete kill as fast as with diquat is a serious concern.

Last season's benevolent weather mainly kept a lid on late-season blight, but in 2017, even very low levels of green leaf allowed severe tuber blight infections to occur.

There were significant levels of tuber blight around, and even a low level (<5%) in a crop can spell disaster. Therefore, in a non-flail situation, crops may well be at greater risk, as some leaf and stem remained in certain trials after 21 days.

The industry is aware that blight sprays need to be used with desiccants, as even 0.5% green leaf area can result in severe infection, which means growers will need to use more fungicides during burndown.

Which fungicide?

We already have a reduced armoury against tuber blight, as fluazinam is now much less effective on 37 A2, so we need to have a strategy to protect the remaining actives with tuber light activity.

The most reliable are the Qii fungicides and Infinito.

We face a situation where we could see 50% of the Qii allocation being applied after burndown and we really need to avoid this, as the risk of selecting for resistance is the major concern in the years ahead.

We see situations where burndown can start as late as early October, but this is going to leave growers in a really tricky situation, because dull, cool conditions do not favour the activity of the desiccants we now have.

PPO-inhibitor herbicides need bright light to be effective. Even spraying in the evening rather than at midday can make a big difference in the control achieved.

Nitrogen

As far as preparing crops for effective flailing, we do need to reduce lodging. This means nitrogen must be managed carefully, but this is easier said than done.

A knee-jerk reaction to simply reduce N should be avoided, as we have just experienced a very wet winter. The 2019 season followed a very dry winter with higher soil mineral nitrogen (SMN) and 2018 crops faced severe drought, so what do we use as a benchmark?

RB209 gives guidance, but a lot of varieties will be grown this year with no real guidance on crop maturity and N requirement and this is far from ideal.

After the wet winter we have just had, SMN levels will typically be lower than last spring, so a 30kg/ha reduction from last year will be achieved by changing nothing. Soil conditions also need to be considered, as they are rapidly going from very wet to dry and hard.

While SMN and applied N are a major factor in canopy duration, we also found in 2019 that the provenance of the seed played a big part in effectiveness of haulm destruction.

We saw earlier-than-expected senescence in many crops, despite higher-than-average soil N, and seed produced from crops that suffered extreme heat seems to have been a major factor in this.

When we consider all the variables we have seen in the past two seasons, it makes it very hard to know what to use as a benchmark.

In 2018, we had crops flowering in September after the drought, which followed a wet winter, but in 2019, the exact opposite happened. All we can do is use the information we have and make the best estimate for the current season.

JOURNAL : Farmers Weekly

Pig numbers in the UK hit a 16-year high at 4.7 million head in December 2019, according to the latest Defra figures.

The department’s figures for 1 December show the total herd was 2% up on the same date in 2018, making it the largest year-end pig herd since 2003.

The biggest increase was seen in England, where numbers grew by 3% to 3.78 million head.

See also: Top tips to pass a pig farm assurance scheme audit

The upward trend in the English herd is in stark contrast to Scottish Government figures, which show a decline of about 7% in overall numbers north of the border.

The Scottish breeding herd has dropped by 5%, which helped cause a small decline in the total UK breeding herd from 406,000 head in 2018 to 404,000 head last December.

However, AHDB analyst Bethan Wilkins urged caution in interpreting the Scottish figures because they appeared to go against evidence suggesting production was being ramped up.

"Given the significant improvement in profitability in 2019, we believe herd expansion has been under way.

“Slaughter levels between December [2019] and February [2020] were 6% higher year-on-year, pointing to increased pig numbers, perhaps even more so than suggested by the census,” said Ms Wilkins.

She added that while the female breeding herd declined slightly in Defra’s census, AHDB analysis suggested the breeding herd had expanded.

The significant rise in throughput over the past three months pointed toward an increase in sow numbers in mid-2019, which was unlikely to have been reversed later in the year, she said.

Prices stable

Meanwhile, pig prices have remained relatively stable this week, despite worries about labour shortages and supply chain disruption during in the coronavirus crisis.

AHDB senior analyst Duncan Wyatt said: “To say demand in the UK has been unsettled would be an understatement.

“Responses put in place to battle the coronavirus have led eating-out volumes to drop dramatically, while retail purchases have risen sharply.”

EU-spec SPP for the week ending 21 March edged downwards by only 0.07p/kg to average 163.15p/kg.

Likewise, spot prices remained strong, with some traders putting them at 170p/kg or more.

“As well as any short-term clamour for British pork in the retail sector, it may also be reopening Chinese ports, backed by plentiful import demand, that is behind this strength,” Mr Wyatt suggested.

Export insight

Pigmeat exports remained elevated moving into 2020, as more product continued to be sent to China.

In January, EU-28 exports of pigmeat, including offal, rose by 27% year-on-year to total 407,100t.

Within this, exports of fresh/frozen pork increased by 32% to 264,800t, AHDB figures show.

Volumes sent to China in January more than doubled on the year to total 174,700t but this influenced shipments to other key markets – namely Japan, South Korea and the US.

Exports to these countries suffered double-digit declines, the AHDB said.

JOURNAL : Farmers Weekly

The farming industry has been paying its own special tribute to the NHS and social care workers tackling the coronavirus pandemic.

Across the UK, millions of people took to their doorsteps and windows for a “Clap For Carers” tribute at 8pm on Thursday evening (26 March) to applaud NHS workers and carers.

Farmers made their own personal tributes, posting photos and videos on social media using the hashtags #clapforourcarers and #thankyouNHS.

See also: Coronavirus: Urgent appeal for Brits to work on farms

Warwickshire farmer William Forsyth and his team lined up two Case IH 535 Quadtrac tractors and two Horsch 12m drills to spell out the letters “NHS”.

Local joiner and farmworker Edward Atkinson then flew a drone over the team, recording aerial footage of the workers wearing masks, standing 2m apart in line and applauding together. The video, which has been uploaded to Twitter, Facebook and Instagram, has received hundreds of views and likes.

Mr Forsyth told Farmers Weekly: “We wanted to do something special to show our appreciation and to show the farming community is thinking about the NHS and care workers.

“They are going through a really tough time. I cannot imagine how hard it must be for them, and I hope this video might just give them a bit of an uplift. Our thoughts and prayers are with them at this challenging time – we really appreciate how hard they are working under very difficult conditions.”

Mr Forsyth said farmers are working hard during this busy spring period, drilling crops, calving and lambing. “Farmers are decent folk. We can feed the nation. Buy British,” he added.

Warwickshire farmer and ***agricultural*** contractor Chris Gardner said on Facebook: “Even though we’re fairly isolated at the farm, we could still hear vehicle horns and local noise in support of our heroic NHS staff at 8pm this evening. Fantastic!!”

Denbighshire sheep farmer Ll .r Jones posted his own personal tribute on Facebook, recorded in his sheep shed, using cards with messages as the animals bleated in the background.

“To all the doctors, nurses, carers, GPs, 500,000 volunteers and all the NHS staff that make it work. Thank You. Diolch.”

Dairy co-operative Arla Foods UK posted a video on social media of its farmer owners, factory workers and drivers applauding NHS staff and care workers.

“There are no words to express our gratitude to every individual working on the front line and supporting the NHS. From everyone who works at Arla and the farmers who own our company, THANK YOU,” said Arla.

[*https://twitter.com/ArlaFoodsUK/status/1243266502993817600*](https://twitter.com/ArlaFoodsUK/status/1243266502993817600)

Agronomy company Agrii said it had donated all of the personal protective equipment (PPE) from its Dunkirk depot to the “incredible staff” at Addenbrooke's Hospital, in Cambridge.

The company tweeted: “A small gesture in the grand scheme of things but we hope it helps.”

[*https://twitter.com/AgriiUK/status/1243478140686606338*](https://twitter.com/AgriiUK/status/1243478140686606338)

Meanwhile, Defra farm minister George Eustice paid his own tribute to farmers up and down the land, working hard to produce the nation’s food.

He said: “There are many key workers that are crucial to the resilience of our country. Our NHS staff will be working harder than ever in the weeks ahead. Those of you working to provide the nation with food and other essentials are also delivering an absolutely vital service.

“In many cases, you are the hidden heroes, and the country is grateful for all that you have done.”

JOURNAL : Farmers Weekly

Hogg finishers targeting the late market after paying elevated store prices might be pleased to break even after supply chains have been rocked by the coronavirus outbreak.

Lamb prices tumbled 70p/kg (£30 a head) last week after retailer and export demand evaporated with tightening lockdown rules.

Analysts forecast a slow price recovery based on the unknown duration of lockdown and social distancing measures at home and abroad.

AHDB analyst Rebecca Wright reassured that lamb exports to Europe were open, although cross-border checks have been stepped up.

She said the closures of public markets – such as the vast 234ha Rungis market in Paris – had limited demand and that most domestic processor closures were due to a lack of demand rather than issues with staff.

See also: What coronavirus means for farm kit orders, spares and servicing

Ayr

Craig Wilson Livestock auctioneer Drew Kennedy played down any Easter and Ramadan price rises.

“Easter and Ramadan won’t be the big social events they normally are because of social distancing rules,” he said. “These events normally come together and boost trade for the late hoggs."

He said the store lamb gamble had paid off for buyers until now, but it looked likely some lambs would do well to cover costs.

Ayr’s Monday (30 March) sale saw 809 hoggets average 47.9kg and 163p/kg and an SQQ of 171.6p/kg.

He said regional processing capacity had reduced. West Scottish Lamb, Carlisle, confirmed that it had temporarily closed, while Scotbeef’s lamb processing has been consolidated at the Vivers Scotlamb plant for staff health reasons.

Ross-on-Wye

After managing a weaker, but still comparatively buoyant, trade last week (23 March), Ross market saw an entry of 381 hoggets average £79.88 a head at an average weight of 39.47kg and level at an SQQ of 181p/kg on Monday (30 March).

Will Probert, auctioneer and valuer for RG and RB Williams, said this was less than 20% of a usual seasonal entry, but was to be expected in very challenging circumstances.

He said spring lambs were 100p/kg less on the week at £90-odd a head (230p/kg+). Best hoggs made £85 and more run-of-the-mill types sold for nearer £75.

Last week’s (23 March) trade opened strongly, but buyers got wind of lacklustre food service and continental demand before selling finished at 10:15am.

“Lambs making £106 at the start were making £92-£95 by the end of trading,” Mr Probert said.

“Stores will start growing now the weather’s turned and finishers will only have maybe six weeks to hold them.”

JOURNAL : Farmers Weekly

Mass factory closures and the lockdown of more than one-quarter of the world's population may have sent world economies into a whirlwind, but farm machinery manufacturers are doing everything they can to keep equipment working and farmers supplied.

We have been in touch with makers and dealers across the country to find out how they are managing the crisis, and all are demonstrating typical farming stoicism to keep businesses running during this challenging time.

See also: Coronavirus: Guidance for farmers and contractors

John Deere

John Deere is one of the few manufacturers to still be producing machines in Europe, with its Mannheim factory in south-west Germany operational at the time of writing.

Its parts business is also functioning as normal, with all European parts depots apparently delivering to order. However, with delivery firms at full stretch, it’s likely there will be some delays.

Dealerships have been adapting to the challenges and are continuing to deliver new machinery and parts, and carry out servicing.

Many are introducing contactless parts delivery and are keeping their customers up to date with regular bulletins by email and on social media. Some also have online stores, which are still accepting orders.

For those with newer machinery, dealers are also able to log in remotely via the JD Link telematics system, which allows some technical problems to be diagnosed without needing a field visit.

East Anglian dealer Tuckwell was one of the first dealers to shut its depots (24 March) to anyone but staff members. However, it maintains the dealership is still open on the phone for spare parts orders.

These can be ***collected*** from designated ***collection*** points outside the building or delivered to farm.

It has stopped all machinery demonstrations, but repair work is continuing and should be booked over the phone.

Claas

The big news coming out of Claas is that its combine production facility in Harsewinkel, Germany, has slowed production and will close until 17 April.

Added to that, eight of the 10 factories supplying Claas parts are entering a controlled period of shutdown, including its French tractor plant.

Claas HQ says it will provide “as many machines as possible” to the market and there is a range of new and used kit available through its dealer network.

Despite the slowdown at Harsewinkel, some divisions of the company continue to operate, including the machine and spare parts shipment in Germany and at Saxham in Suffolk.

Claas UK CEO Trevor Tyrrell says the Harsewinkel factory has committed to deliver “every retail order that has been confirmed” and, if an order is delayed, Claas and its dealers will support customers with either a demonstration unit or a young used machine.

The only orders at risk of being cancelled involve Claas UK's future stock.

There is a limited number of combines and foragers  available to buy, as well as those currently earmarked for dealer demonstrations, and the company expects them to sell out quickly.

There is more than enough stock in the system to fulfil orders for the next three months and farmers are being told not to worry about existing orders.

This view is echoed by north-west Claas dealer Rickerbys. No customer orders have been put on hold so far and it says there is a good stock of spare parts for the spring workload, with only slight delays on ordered parts.

Pre-arranged non-contact drop-off points have been used to deliver parts to customers and the firm is confident that previous country-wide crises such as BSE and foot-and-mouth have prepared the industry to cope with the challenges ahead.

Claas has also brought forward the launch of its electronic parts catalogue, which will allow machinery owners to more easily identify the parts they require by simply entering the machine model and its serial number.

The system can be accessed on the Claas website.

Orders can then be placed via the local dealer and requests will be delivered overnight from Claas UK's parts warehouse at Saxham.

Stock from the firm's Parts Logistics Centre in Hamm, Germany, should also be delivered by the next day.

Agco – Fendt and Massey Ferguson

Agco has suspended production at a number of its European sites due to the tightening supply chain and materials shortages.

These include Fendt’s German tractor plant at Marktoberdorf and cab factory in Asbach-Baumenheim, along with Massey Ferguson’s Beauvais facility in France.

Fendt says despite a good number of tractor orders, production stopped on 25 March, as Italian parts suppliers weren’t able to keep up with demand. Spare parts supply at four other Fendt sites is continuing for the time being.

The company is still shipping machines that have rolled off the production line, but there are a “good number” of orders still in the build stage during one of the busiest months.

However, dealers have three to four months’ stock of retail machines, so any gaps should be filled in the short term.

Fendt says customers still looking to buy machinery before harvest may have to compromise on model and spec.

South-west dealer Compass Tractors says some new machinery orders might not make it on farm as planned, and it is keeping a number of machines, including large tractors and foragers, in the yard to provide backup.

It is business as usual at the moment, and the firm hasn’t been notified of any delays in the delivery of new kit.

It also has a good stock of common spare parts, but says other components sourced from the continent are no longer enjoying next-day delivery. In most cases, these parts arrive two to three days later due to more stringent measures at the ports.

Massey Ferguson’s parts availability in the UK is said to be solid and the manufacturer has been in contact with several customers to put contingency plans in place to keep their farms running.

There is a potential short-term effect on UK orders due to Beauvais’ closure, and MF’s forecourt stock will be spread across the country to help fill this void.

There are currently 350 tractors on standby to help out farmers across a host of European countries, including the UK.

Agco dealer Lister Wilder says it always keeps an extensive stock of spare parts and any recent orders will get to customers quickly. However, delivery times may slow as requests rise and pressure increases on transport links.

New machinery in the dealer’s yard is plentiful at the moment and should keep up with demand until about July/August. By then, it hopes factories will have kicked back into production.

It is also helping famers fill any workforce gaps imposed as a result of travel bans by posting jobs through its social media channels.

Stage 5 engine deadline

The wider implications of lengthy factory shutdowns could hit the validity of parts, such as engines, that don’t comply with the forthcoming Stage 5 emissions laws.

Though this is more important for manufacturers than farmers, engines that meet current emissions legislation have a sell-by date of the end of this year, which is likely to be missed, given the halt in machinery builds.

A joint statement by the European mobile machinery industry has called for a temporary moratorium to allow makers that have purchased these engines – originally required to be in machines by 30 June and on sale by the end of the year – to have deadlines postponed until the situation can be reassessed.

If this doesn’t happen, many engines will have to scrapped, leading to further costs and environmental issues.

New Holland

New Holland has paused manufacturing at all of its factories and, at the time of going to print, the Basildon plant was set to be out of action until 3 April.

However, the firm says that date will be under continuous review. Completed machines are still being dispatched from the plant and it says it is working with dealers to make sure these get to customers.

Delays are to be expected, but because the factory is on UK soil, the firm says it is well placed to meet orders.

Buyers are still able to place orders, but these will not be processed until production commences again.

As for parts supply, New Holland says its priority is to keep customers going and its distribution centre in Daventry is dispatching as normal.

However, dealers and customers are no longer allowed to ***collect*** parts directly from the site.

Dealers are also functioning and have put extra measures in place to keep their parts, service and sales departments contactable and available.

These include a call-and-***collect*** system which allows parts to be pre-ordered and ***collected*** without any human contact. They are also attending customer callouts and have put strict health-and-safety measures in place.

New Holland dealer TH White is running a skeleton workforce at some outlets, and on-farm demonstrations are continuing with the say-so of the customer and depot. New machinery installations will take place on a case-by-case basis.

The firm’s workshop is still operational, but any work carried out on farm has to be done in isolation, with the mechanic using personal protective equipment.

Deliveries are now free for customers who are self-isolating and pick-up boxes are in place outside the depots for ***collecting*** parts.

JCB

Production at JCB’s nine manufacturing plants in Staffordshire, Derbyshire and Wrexham ceased on 18 March due to a massive drop in global demand and was scheduled to recommence on 3 April.

However, the firm has recently announced it is extending this until at least the end of April.

It says demand for its ***agricultural*** machines is still strong and because its dealers always carry a stock of new machines, it is still able to fulfil customer orders. There could also be some stock sharing between dealers to plug any gaps.

The pause in production will cause some delay in the delivery of machines yet to be built, but the firm says these will be a priority once production resumes. Dealers are also continuing to take new orders.

The company will be using its new £50m Cab Systems factory to make steel housings for a brand-new design of ventilator from Dyson. A minimum of 10,000 of the JCB housings are earmarked for manufacture once Dyson receives regulatory approval for its design.

JCB’s World Parts Centre in Uttoxeter, Staffordshire, is open and distributing parts, and its dealers are continuing to operate, albeit with some adjustments to their working practices.

Lincolnshire and Yorkshire dealer Peacock and Binnington has asked all of its customers to phone to request parts and they have a closed-door ***collection*** policy.

This means phoning upon arrival at the dealership, at which point parts will be brought out and left for the customer to pick up, without breaching the 2m social distancing policy.

Servicing and repairs are continuing, but mechanics have to work in isolated conditions. They are keeping workshop repairs to a minimum and most work will be carried out on farm, with prior arrangement.

They will also use hand wash facilities/wipes before and after repair.

JOURNAL : Farmers Weekly

The Foster family, Little Houndales Farm, Driffield, East Yorkshire, has invested £150,000 in a multi-purpose beef finishing shed and handling system that is enabling the business to expand.

When son William decided to return to the farm after university, and with daughter Susie studying ***agriculture*** at Harper Adams University, third-generation farmers Peter and Mark decided it was time to grow the beef enterprise.

See also: What’s in your livestock shed? visits a Powys beef finisher

The beef and arable operation currently consists of 55 suckler cows, with all stock finished by 24 months and sold liveweight through Malton market.

Farm facts

55 cross-bred suckler cows – including Limousin, Blondes, Stabiliser and Blues

Sell finished cattle at 24 months at Malton market

Housed in mixed-sexed groups with males castrated at two to three days old

Calving February – June and calves are weaned straight into the new shed in October/November

Graze a dale during their second summer

263ha of arable growing wheat, spring and winter barley, oilseed rape, spring beans, and potatoes

40.5ha of grass

70 sheep

However, the new beef shed, which houses weaned calves, was finished in November 2019 and will enable the business to increase cattle numbers organically to 75, with 15 heifer replacements being kept back this year.

Tell us about the shed specifications

It is a single-span Shufflebottom shed measuring 100ft wide by 80ft long and has enough feed space to hold 112 head.

It also has a curved race handling system situated on the outside.

It is a steel-framed structure. The guttering system is incorporated into the shed inside the galvanised eaves and the roof is clad in fibre cement.

The central feed passage measures 4.88m – wide enough for machinery access. The scrape passage is slightly narrower at 3.3m but is still enough room for a forklift.

There is the capacity to have as many as three pens each side of the central feed passageway or it can be made into one large pen.

The animals can be shut back to scrape out and they can easily be run into the handling system.

Stock are housed on concrete which has been grooved in the feeding area for grip with a deep straw bedded area at the back.

Who designed and constructed the building?

The shed was designed by us, and the handling system by Bateman’s and supplied by GJ Taylor.

What was your initial budget and did you stick to it?

The main shed structure was on budget but if you count extras like lighting and things, it went slightly over by about £5,000.

Shed cost breakdown

Shed £66,000

Concrete floor £30,500

Concrete side panels £12,000

Pen gates and handling system £30,000

Groundworks £11,500

How is the shed ventilated?

The sides are made from concrete panels measuring 2.4m high with Yorkshire boarding on top to provide an air inlet from the sides. They were used instead of Galebreakers to reduce the cost.

Above door openings steel vented sheeting has been used to make the building more aesthetically appealing as the barn is situated next to the main road.

The roof pitch is 15deg and has a protected vented ridge to prevent rain coming in. The plan is to use the shed to store grain during the summer with the capacity to store about 1,000t of grain.

Two sliding doors are situated on one end of the shed to stop the south westerly prevailing wind.

Which features have helped ease labour requirements?

The idea of the shed was to make looking after the cattle a one-man job.

Each pen has three gates so if we need to scrape out, they can be penned back into the bedded area and we can scrape out in five minutes. Having a central feed passage means cows can also be fed quickly and straw can be blown in.

Has any aspect of the design improved animal performance or welfare?

The central feed passage is raised 8in making it easier for the cows to access feed.

The cows are fed a daily ration of silage, and a barley ration three times a day. The silage contains some potatoes and they will try to root through to find these.

However, the sides of the feed passage are slightly sloped (about 5deg) which has made it harder for cattle to sort the ration.

Tip-over troughs in each pen make providing clean water easier. Troughs are tipped out every day.

What are the best bits of the design?

The 16 LED 28w strip lights have made a massive difference to the working environment by helping extend the working hours.

Two LED lights are on a dawn to dusk sensor, so cows have light at night for feeding.

During the day a lot of our work is on the arable side of the business so we can now deal with the cows later on even when it is dark as the LED lights make it feel like it is daylight inside.

Is there anything you would change?

All the pipework for the water troughs is underground on 32mm pipes meaning there is no chance of water freezing.

The only external pipework is where the water pipe comes out of the ground to feed the trough and this has been protected with galvanised steel to prevent any damage from cows and machinery.

Each individual trough can be turned off, however, there is no isolator tap for the whole shed.

This would have been useful given we are hoping to use the shed as a temporary grain store in the summer.

Tell us about the handling system

There are three open-sided pens in the race which are useful to separate off different age groups. All the gates are 1.8m high.

A forcing circle with solid sides is used to move animals into the last bit of the race towards the crush. There are two non-returns in the race.

The 3m manual squeeze crush contains a chin scoop – which is great for tagging – and has various access points making it easy for us to access all parts of the cow and it’s small enough for calves.

We invested in a Tru Test weigh head and EID stick reader as EID.

The flooring in the handling system is concrete with a brushed finish to provide some grip and prevent slipping.

What have been the biggest benefits?

Since housing the finishing stock in the shed there have been no cases of pneumonia and handling is now a one-man job.

JOURNAL : Farmers Weekly

“Gay dating” is the most-Googled term in rural areas across the UK – that's according to a group which has been investigating trends among people looking for love and relationships online.

The number of people using Google to search for “gay dating” and “lesbian dating” in rural and more sparsely populated areas such as Cornwall and Shropshire is much higher than the average for the UK, says dating and relationships website Datingroo.

In typically LGBTQ-friendly areas such as London and Manchester these terms are searched for no more frequently than any other dating-related term.

See also: Will Vaughan France: 'It took me 15 years to come out – but my fears were unfounded'

More than one million people identified themselves as lesbian, gay or bisexual in the UK in 2017, according to the Office for National ***Statistics*** – that equates to around 2% of the entire population.

The numbers from this Datingroo study show that homosexuals are much more driven to online dating than heterosexual people.

Researchers identified four significant reasons for LGBTQ+ people in rural areas tend to date online

The lack of any "friendly places" in their area and the need for a safe place to open up and socialise with like-minded singles

Conservative religious or personal beliefs in their community that lead to anxieties of being socially rejected because of sexual preferences

Veiled or even open homo- or transphobia in their local community

Toxic and exclusive structures in local gay communities. There can be discrimination, bullying or exclusion within these groups

Building an LGBTQ+ community in a more socially conservative or religious rural area can be challenging, so many people tend to look for gay and lesbian dating on the internet, explains Patrick Wanis, an expert on human behaviour.

“The easiest option for someone who is gay and living in a smaller area that isn’t as diverse, is to connect and interact with other likeminded people via online dating," he says.

"Homosexual and bi-orientated people in the countryside can’t just go to the local bar or club and expect to meet other gay or bi-orientated people.

"For people in the LGBTQ+ community in rural areas it might even be physically safer to date online, as there is less chance of being confronted with hostility."

See also: Video: Gay farmer stories shared in emotional Landline film

He adds that it might also be a personal preference to stay anonymous after finding and connecting with other gay people in rural areas and small towns.

Agrespect – promoting diversity in ***agriculture***

Agrespect was launched in 2018 to break down barriers by sharing experiences from a diverse range of people working in ***agriculture***, including the LGBTQ+ community.

The initiative is backed by major industry brands and bodies, including the NFU, the AHDB, Massey Fergusson, Defra and Farmers Weekly.

To find out more, read the stories of the people the organisation supports and to get in touch, go to the website or search for Agrespect on Facebook, Twitter and Instagram.

Gay Farmer Helpline

Any farmer wishing to speak in confidence about their sexuality can call the helpline on 07837 931894 or get more information on the website.

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HINA Digest

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**Body**

Zagreb,Hrvatska15 September 2020 (Hina) - PM: Msgr. Jozic's appointment as papal nuncio also act of recognition for Croatia ZAGREB, Sept 15 (Hina) - The appointment of Msgr. Ante Jozic as the Apostolic Nuncio to Belarus is also an act of recognition for Croatia, Prime Minister Andrej Plenkovic and Foreign Minister Gordan Grlic Radman said in Split on Tuesday after talks with the Holy See's Secretary of State, Cardinal Pietro Parolin. Cardinal Parolin on Tuesday arrived in Split where he met withCroatia's prime minister and foreign minister. On Wednesday, Cardinal Parolin will ordain Msgr.

Jozic as an archbishop, after Pope Francis appointed this 53-year-old Croatian priestthe Apostolic Nuncio to Belarus in May. The ceremony of the episcopal ordination will take place in the Church of the Holy Family in Solin. "Croatia is proud of this, it is yet another sign of recognition from Vatican diplomacy, for him to be assuming such an important post," Plenkovic said after meeting with Parolin,for the fourth time in the last few years. Plenkovic said that relations between Croatia and the Vatican "are exceptionallygood and full of mutual respect and cooperation", adding that he and the Italian cardinal discussed the situation in the neighbourhood as well asEuropean and global topics. Minister Grlic Radman said the frequent meetings "bear witness to the strengthening of diplomatic relations" between Zagreb and the Holy See while Msgr. Jozic's appointment "speaks of the strength of Croatia's presence in the Vatican and its diplomacy" and "will turn a new page in bilateral relations." "Dalmatia can be rightfully proud of having given so many nuncios," he said, referring to the fact that two current apostolic nuncios are from Dalmatia. Jozic was born in the town of Trilj in the Dalmatian hinterland, on 16 January 1967. Archbishop Nikola Eterovic, born on the island of Brac,has been the papal nuncio to Germany for seven years, having previously served as the first Vatican diplomat in Ukraine. After earning a doctoral degree in canonand civil law at the Pontifical Academy, Jozic served in India, Russia and Hong Kong, where he was until March 2019, the Catholic news agency IKA said. Jozic, who has been a member ofthe Vatican's diplomatic servicesince 1999,speaks Italian, Spanish, English, French, Portuguese, German, Russian, Chinese and Polish. PM: Solin church gives new dimension to cradle of Christianity in Croatia On Monday evening after he visited the newly built Church of the Holy Family in Solin, PM Plenkovic said that this edifice gave the cradle of Christianity in Croatia a new dimension. Speaking to the press, he said a request would be made to the Holy See for the church to be declared "a basilica minor" and that he was sure it would be granted. Plenkovic recalled that he was present at the laying of the cornerstone for the church seven years ago, when he was a member of the European Parliament. "I'm glad to see that this big and important project has been completed because ofsymbolism, history and our Christian roots here in Solin," he said. "The cultural and sacral heritage is part of our cultural and historical identity, and it is the state's task to support its maintenance and construction and to protect it in every way, because without our roots, our tradition, our values, we wouldn't be what we are today as Croats. That's why I believe that such projects are valuable and that they contribute to Croatian culture and the Christian tradition." Asked how the demographic situation in Croatia could be improved, the prime minister said demographic revival was "one of the fundamental political and existential issues of the Croatian people." He saidpopulation growth had been negative for decades, notably since Croatia joined the EUdue to free movement. "We must... pursue policies which will stimulate and nurture the family as the nucleus of our society and create economic prerequisites for families to decide to have more children," Plenkovic said. He underlined the role of the Church, "because messages concerning the family and demographic revival are part of the messages and the narrative which the Church is continually repeating. If anyone contributes to that, it's the Church, and that complements what the government and the state are doing." Kohorst: Croatia makes positive steps, but there is still room for boosting growth ZAGREB, Sept 15 (Hina) -U.S. Ambassador to Croatia Robert Kohorst said on Tuesday that although Croatia had made economic headway, there was still considerable room for boosting the growth. Addressing a reception organised by the AmCham in Zagrebon Tuesday evening, the U.S diplomat, who was the keynote speaker at that event, said that in the past two and a half years of his ambassadorial term, he had seenprogress made by the Croatian government in the context of the economic growth and boosting investment climate. "In terms of economic growth and improving the investment climate, we’ve seen the Croatian government take some positive steps over the last couple of years – things like reduction of para-fiscal fees and taxes, the downward trajectory of government debt, and most recently, Croatia’s entry into the European Exchange Rate Mechanism." "I am encouraged by the government’s recent efforts to simplify procedures for opening a business and the formation of a cabinet-level working group focused on improving the business climate. I also applaud the government’s commitment to reducing bureaucracy. Less cities, less government – let’s hope," he added. However, the ambassador also underscored some issues such as the inefficient and unpredictable and unpredictable judiciary and a high number of state-owned enterprises which should be tackled. Kohorst called on the government to continue pursuing reforms reforms in an aggressive manner. "Such measures don’t only attract new companies and investment. They also help Croatia stem the significant number of workers, mostly young people, leaving the country each year to find higher paying jobs in other EU countries. Bringing these people back and keeping them here so they contribute to Croatia’s economic growth is the real goal." "Some difficult decisions will need to be made," he said explaining that tough decisions would be necessaryfor the full transition to a market-based economy, and called forthe reduction of the excessive bureaucracy and downsizing state-owned enterprises. He also believes that those reforms can help Croatia to realise its economic potential and capitalise on itsgeographical position in central Europe and on its political and financial stability as well as on its educated and skilled labour force and entrepreneurial spirit. "Now is the time for the government to act," despite certain challengesimposed by the COVID pandemic, he added. Double taxation agreement Earlier this month, Kohorst presented Finance Minister Zdravko Maric with a draft double taxation agreement between the United States and Croatia. He thanked the AmCham for its contribution and information that provided an additional impulse to the US Departmentof Treasury to draw up the draft. He said that after years of efforts on his part regarding the agreement, the US Department eventually recognised the partnership between the two countries and, thanks to his assurances, prepared the draft. "The Croatian government’s commitment to continuing to implement economic and judicial reforms will go a long way to making Croatia a more attractive destination for American companies. For our part, the U.S. Embassy will continue to highlight opportunities for investment as best we can. And we will continue to seek ways to deepen the economic bonds between our two countries," he said, underscoring the importance of concludinga treaty for the avoidance of double taxation. He said that he "was thrilled to be able to hand over the draft treaty to Minister of Finance Maric on September 3." The ambassador said that the two ministries were working together on the draft, but that nothing would happen overnight. He said the document would have to pass the ratification process in the Senate and that this would take a longer period of time. Commenting on tenders for the installation of 5G network infrastructure, Kohorst said he would continue to insist on establishing investment screening mechanisms to protect strategic infrastructure and assets and to ensure the use of reliable vendorsfor 5G networks. "We believe these are critical steps that will allow Croatia to grow its economy without sacrificing its sovereignty or its security." Ambassador calls on those present to apply for US visa Kohorst also talked about the visa regime for Croatian citizens travelling to the United States, saying that Croatia was very close to entering the Visa Waiver Program, which requires the number of refused applications to be below three percent and the calculation applies to the fiscal year, which ends on September 30. We still have two weeks for the percentage to fall below three percent, and right now it is exactly three percent, the ambassador said, adding that they are working with the government to ensure as many positive applications as positive, calling on those present who do not have a holiday visa to apply for it. Interior Minister Davor Bozinovic appealed to Croatian citizens to apply for a US visa and thus help reduce the number of refused applications in relation to the number of applications submitted to below three percent. AmCham Executive Director Andrea Doko Jelusic said that they had achieved great cooperation with Kohorst, citing his efforts regarding the start of negotiations on the double taxation agreement. She said that great progress had been made in that regard and that she hoped the agreement would be signed soon. Todoric and 14 more defendants indicted for embezzling HRK 1.2bn from Agrokor ZAGREB, Sept 15 (Hina) - Former Agrokor owner Ivica Todoric and 14 of his closest associates were on Tuesday indicted by the County Prosecutor's Office inthe Agrokor scam for having defrauded the company of over HRK 1.2 billion. "The case is quite extensive and the indictment itself consists of 459 pages whilethe entire case file consists of 80,000 pages," Zagreb County Court spokesman Kresimir Devcic confirmed on Tuesday. Explaining the legal procedure, Devcic said that a judge will be appointed to try the case while the indictment needs to be delivered to all the accused and their defence attorneys who have the right to respond within eight days. After that period, a trial chamber will be appointed, Devcic explained. "Considering there are 15 defendants, that will last a few months before the trial chamber convenes. It is not realistic to expect any decision on the indictment in just one month and everything depends on the defence teams'strategy and they can request that some unlawful evidence be excluded which could slow down the procedure but there is also the possibility that an agreement is reached regarding the indictment and mattermay proceed somewhat quicker," said Devcic. The Zagreb County Prosecutor's office launched an investigation against Ivica Todoric and his sons Ivan and Ante and 12Agrokor executives and twoauditors in November 2017 due to unlawful gain of more than a billion kuna. The investigation was to have been completed by 20 May 2019,however, the deadline was extended due to the complexityof the case and so it was completed on 17 July this year. The other defendants in addition to Todoric and his sons areAlojzije Pandzic, Damir Kustrak, Hrvoje Balent, Ivica Crnjac, Olivio Discordia, Marijan Alagusic, Sanja Hrstic, Mislav Galic, Tomislav Lucic , Piruska Canjuga, Ljerka Puljic and Ivica Sertic. All of the defendants were executives in the then Agrokor whileDiscordiaand Hrstic were employees with the Baker Tilly auditors who prepared an audit of Agrokor'saccounts. Investigative custody was ordered for only Ivica Todoric after he was extradited to Croatia from London only to be released on bail of HRK 7.5 million in November last year under the condition that he does not leave Zagreb. In the meantime a trial was launched against Todoric who is accused of defrauding Agrokor of €1.25 million along with Ante Huljev, Piruska Canjuga and Nicole De Rossi. Canjuga's defence attorney Anto Nobilo, said that based on the results of the investigation the indictment was unexpected but knowing the legal practice in Croatia, then it could have been expected. "The indictment against her will be quashed because, of the six years covered inthe indictment, my client had not been in her job for four years. That shows that the indictment was created to fulfil its political objective and that was totakeover Agrokor," Nobilo said. Prosecutor: Indictment result of probe into complex financial fraud ZAGREB, Sept 15 (Hina) - The Zagreb County Prosecutor's Office said on Tuesday that its two and a half year long investigation into businessman Ivica Todoric and other persons charged with siphoning more than HRK 1.24 billion from Agrokor was the most complex case of economic crime ever in Croatia. Without revealing the defendants' identity,prosecutors said that Todoric, acting with the assistance of other defendants, siphoned money from Agrokor, thus obtaining an illegal gain of HRK 923 million for himself, while a Dutch company illegally acquired HRK 320.7 million. Apart from Todoric and his sons Ivan and Ante, the investigation also covered Alojzije Pandzic,Damir Kustrak, Hrvoje Balent, Ivica Crnjac, Olivio Discordia, Marijan Alagusic, Sanja Hrstic, Mislav Galic, Tomislav Lucic, Piruska Canjuga, Ljerka Puljic and Ivica Sertic. They were all members of Agrokor's managementor supervisory boards, while Discordia and Hrstic worked for the Baker Tilly audit firm which did auditreports for Agrokor. Dividend paid based on false financial results In its extensive statement, prosecutors say that the first count of the indictment charges Todoric and the other defendants withpresenting false financial results for Agrokor and making themseem better than they actually were, as well as with paying out dividends without foundation, thus defrauding the company of HRK 627.2 million. The accused also concealed Agrokor's claims from Todoric andAgrokor's debts to banks and other companies, and gave false indicators of the company's financial status. In each of the cited elements of financial reporting, the disproportion between what was published in Agrokor's financial statementsin the period from 2006 to 2015 and the actual situation is measured in billions of kuna, prosecutors said. Cash siphoned from Agrokor used for share scams, highlifestyle of Todoric family The second count of the indictment alleges that through fictitious invoice schemesTodoric managed to purchase 12,811 preferred shares of Agrokor from the European Bank for Reconstruction and Development for €100 million, without investing any of his own money. The co-defendants were aware that Todoric would not pay back the loans he had taken for that purpose and that he would shift the obligation of servicing the debt to Agrokor itself. Todoric, for instance, funnelled HRK 122.8 million from the company's accounts to his private accounts as part of systematic fraud in the period from late 2012 to 3 January 2013. The money was spent on the purchaseof Kulmerovi Dvori Manor in Zagreb where Todoric and his family live. He is also indicted for embezzling an additional HRK 109.4 million from Agrokor to cover the costs of his family's high lifestyle. The prosecutorsrecommended that Todoric should not be allowed to leave Zagreb without the permission of the judicial authorities. After his extradition from London in early November 2018, Ivica Todoricwas taken to Zagreb's Remetinec prison but on 20 November 2018 he was released on HRK 7.5 million bail and banned from leaving Zagreb. Costof expert auditing HRK 11.5 million The prosecution also underscoredthat the expert auditing of Agrokor's documents and financial statements was conducted by a Polish firm after some of the Croatian auditing firms stated that they lacked sufficient capacity to perform such demanding work, while some of thelocal companies claimed they might find themselves in a potential conflict of interest. The costof the expert auditing and translationof the ***collected*** documentation reached nearly HRK 11.5 million. The case is quite extensive and the indictment itself consists of 459 pages while the entire case file consists of 80,000 pages,Zagreb County Court spokesman Kresimir Devcic confirmed earlier in the day. Todoric accuses PM of rigging indictment against him ZAGREB, Sept 15 (Hina) - Ivica Todoric, the former owner of the Agrokor food and retail conglomerate, on Tuesday claimed that it was Prime Minister Andrej Plenkovic who rigged the indictment against him. Todoric, who was on Tuesday indicted for fraud and embezzlement of over HRK 1.2 billion from the Zagreb-based company, reiterated his accusations against the prime minister, claiming in his blog that Plenkovic resorted to methods typical of the Communist-era Yugoslav secret services to set him up and cover up "the biggest corruption scandal in the history of southeast Europe and beyond." He also claimed that Plenkovic, "acting in cahoots with Russian investors, interest lobbies and advisers", planned and carried out a a hostile takeover of private assets in the Agrokor company. Todoric insists that it was he and his family that built Agrokor from scratch and helped it attain global status. Earlier on Tuesday, the Zagreb County Prosecutor's Office said that after its two and a half year long investigation into businessman Ivica Todoric and other persons charged with siphoning more than HRK 1.24 billion from Agrokor, it had filed an indictment into the most complex case of economic crime ever in Croatia. Prosecutors said that Todoric, acting with the assistance of other defendants, siphoned money from Agrokor, thus obtaining an illegal gain of HRK 923 million for himself, while a Dutch company illegally acquired HRK 320.7 million. Bozinovic: Const.Court has confirmed COVID response team's legitimacy ZAGREB, Sept15(Hina) - The head of the COVID response team, Interior Minister Davor Bozinovic, said on Monday the Constitutional Court had confirmed the team's legitimacy, and reiterated that a Sunday work ban at the start of the epidemic had not been a political decision ahead of elections. We have always been saying that the government is working in line with the constitution, he said. "Naturally, until the Constitutional Court delivers its decision, you can't be sure, but it's important that the Constitutional Court confirmed the legitimacy" of the national civil protection authority. Speaking of the temporary Sunday work ban, Bozinovic said, "That wasn't a political decision. It was made on the basis of epidemiologists' estimates." The Constitutional Court found today that said decision had not been in line with the constitution, that it had been legitimate but not proportionate.Bozinovic said he would not comment on that and that it remained to be seen how the court would explainits finding. I'm sure that the public too understood that it was a decision dedicated to protecting people's lives and health, he added. He said that by dismissing all other motions for assessing the constitutionality of the COVID response team's decisions, the Constitutional Court confirmed the team's legitimacy. As for the opposition's criticism that the court was political,Bozinovic said the opposition's positionwas to criticise. "They will continue to criticise, but it's up to us to deal with this disease as we can." Wearing masks outsidenot being considered The minister went on to say that, for now, the response teamwas not considering introducing the obligation to wear masks outside. Speaking of the number of new coronavirus cases, which was 65 on Monday, he said, "We hope we are going towards maintaining the curveand that it won't grow, but that depends on us all." As for the decision of some local COVID response teams to abolishthe obligation to wear masks in schools, Bozinovic said it was in line with guidelines. "Local teams can make such decisions. The situation is good now. If the number of infections drops in other countries, they too will adoptsuch measures." Bridge MP says Constitutional Court confirmed doubts ZAGREB, Sept15(Hina) - Bridge MP Marija Selak Raspudic said on Tuesday that in deciding on the COVID response team's measures, the Constitutional Court confirmed that the team was a parapolitical body and that nobody expected a different finding, so the court's work should be examined. Politicising people's health like that could have much more serious consequences than we have seen, she told press. She said the fact that some of the complaints submitted to the Constitutional Court were that the amendments to the law on the protection of the population from infectious diseases were adopted in April so as to apply retroactively. That,she added, is an admissionthat when they were being implemented, those measures did not have enough legal basis. She said the court showed that the COVID response team did not have legitimacy the whole time and that this raised the question of how to act regarding itsvery costly measures. She said that initially thelaw on the protection of the population from infectious diseases was bypassed in favour of the law on civil protection. A state of emergency was not declared but the decision was made to apply Article 16 of the constitution, whereby parliament, which should decide on those matters,was left without the authority todo so, she added. She said that in unprecedented circumstancesthe opposition failed to unite against the government when COVIDmeasureswere being adopted,which cost the whole oppositionthe ability to articulate its opinions in parliament. As for the questioning of decisions currently in force in parliament, they are indeed contentious and were aimed at silencing parliament as much as possible, she said, adding that she doubted that any decision would be made in favour of parliamentand at the expense of the government's activity. She said the people who question the epidemic and the current functioning of parliament created panic in society. This is dangerous, she added, because epidemiological measures are not being adopted for health reasons but for politicisation, which will lead to revolt and distrust towards the measures. The consequence of that are civil protests, said Selak Raspudic. Croatia reports 151 new coronavirus cases, 3 dead ZAGREB, Sept15(Hina) - Over the past 24 hours 151 coronaviruscases have been registered in Croatia, bringing the number of active cases to 2,107, and three persons have died, the national COVID response team said on Tuesday. Currently, 299 patients are hospitalised, including 22 on ventilators, and 8,598 persons are self-isolating. The death toll has risen to 230. Since February 25, when the pandemic began in Croatia, 13,749 persons have been infected with the virus and 11,412 have recovered. To date, 230,585 persons have been tested, including 5,571 in the last 24 hours. Testing for coronavirus possible Slavonski Brod now too The Slavonski Brod-Posavina County Teaching Institute of Public Health will on Wednesday officially start conducting tests for the coronavirus, after a new PCR device, worth around €108,000, was procured by county authorities. The head of the county civil protection authority, Stjepan Bosnjakovic, said test results would be obtained in three to four hours. Ante Cvitkovic, who heads the local teaching institute of public health, said that the new device would be used primarily for the urgent analysis of samples taken from patients in hospitals in Slavonski Brod and Nova Gradiska. The device will also be used for other types of tests, which until nowhad to be sent to laboratories in Zagreb. HRK 41.7 mn donated for fighting COVID, dealing with earthquake effects ZAGREB, Sept15(Hina) - In a little over five months, HRK 41.7 million has been paid into accounts for donations for the fight againstcoronavirus and to dealwith the consequences of the Zagreb area earthquake, the Finance Ministry said on Tuesday. The government decided to open the accounts on March 24, two days after the quake. Since then throughAugust, HRK 15.72 million was paid into the account opened for the "Together for Zagreb" campaignand HRK 26.02 million into the account for the "Croatia against coronavirus" campaign. The government thanks everyone who donated, the ministry said. Border crossing regime extended until Sept 30 ZAGREB, Sept15(Hina) - The national COVID response team has extended until September 30 the border crossing regime introduced in mid-July after the lockdown. Border crossing restrictions apply mainly to third-country nationals, whereas EU and Schengen Area citizens can freely cross the border. A number of categories of third-country nationals can also cross the border and they can check the Interior Ministry website for all the relevant information. Eurochambres president: Austria wrong to declare Croatia coronavirus risk country ZAGREB, Sept15(Hina) -Eurochambres president Christoph Leitl has said that Austria was wrong to declare Croatia a coronavirus risk country in mid-August and that it would be better if the EU set up a "European traffic light"to denote hotspots in countries and regions. Speaking to Austrian daily Kleine Zeitung, the president ofthe Association of European Chambers of Commerce and Industry said "Austria doesn't have many friends in Croatia at the moment" and that its warning against travel to Croatia was a mistake. Leitl said the different courses of action taken by the EU member states during the coronavirus crisis was dangerous as it "is acquiringa political dimension in which relevant effects are given too little consideration." He advocates common European criteria, including a "traffic light system"which would apply to all countries. He said the EU needed "coordinating skills for the joint establishment of a European traffic lightwhich should then be broken down at regional level." "We must distinguish and the system needs to be fine-tuned," Leitl was quoted as saying. Four central European countries opposed to closing borders ZAGREB, Sept 15 (Hina) - The foreign ministers of Slovenia, Austria, the Czech Republic and Slovakia on Tuesday advocated coordination of measures during the second wave of the coronavirus epidemic, so that possible restrictionsdo not negatively impact mutual cooperation, particularly economic cooperation. A third ministerial meeting of the informal regional initiative "Central 5" comprising Austria, Slovenia, Hungary, Slovakia and the Czech Republic was held in Slovenia'sBrdo pri Kranju on Tuesday. The foreign ministers discussed the situation concerning the Covid-19 epidemic, European topics, migration, the situation in the Western Balkans and events in the EU's neighbourhood. We agreed that everything has to be done so that if the epidemic was to spread, there would not be any additional unnecessary border restrictions. We do not want a repeat of the lockdown during the first wave of the epidemic in the spring, Slovenia'sForeign Minister Anze Logar said. He added that it was agreed that members of the initiative would harmonise their measures related to Covid-19 through regular diplomatic communication via video conferences. "Our governments are faced with an important task of restricting the most risky situations regarding the spread of Covid-19, however, we do not wish to close our borders again," said Logar. Austria's Foreign MinisterAlexander Schallenbergsaid that it wasin everyone's interest to not put up new barriers during the epidemic and suspendtransport and travel between countries that represent a sort of cultural and economic whole. Cooperation between our countries in Central Europe is more important than ever. Our common goalis to not come into the situation of early April,Schallenberg said and confirmed that the ministers had also discussed the situation in Belarus, the Navalnycase,the situation in the eastern Mediterranean as well as ways of bringing Western Balkan countries closer to the European Union, which is a common interest of the initiative. With regard to events and challenges in the EU's neighbourhood,Schallenbergsaid that Europe must speak about them in a single voice if it wants its voice to be heard in Minsk, Moscow and Ankara. Slovenia confirms 82 new coronavirus cases ZAGREB, Sept15(Hina) - In the past 24 hours 82 coronavirus cases have been confirmed in Slovenia, after 2,247 tests were conducted, the government said on Tuesday. Fifty patients are currently hospitalised for coronavirus, including ten in intensive care, most of whom are on ventilators, the Health Ministry said. Currently, there are about 900 active cases.Since the start of the epidemic, Slovenia has confirmed 3,831 cases of infection and 135 dead. The head of the government's expert team, Bojana Beovic, told public television last night that the number of confirmed infections per 100,000 inhabitants had surpassed 40 in the past 14 days. Serbia reports 74 new coronavirus cases, two deaths in last 24 hours ZAGREB, Sept 15 (Hina) - Seventy-four new coronavirus cases have been confirmed in Serbia after 7,709 tests performed in the last 24 hours, and two more people have died, the country's health authorities said on Tuesday. Currently, 365 people are being treated for COVID-19 in hospitals and 28 of them are on ventilators. Since the start of the outbreak in the country in early March, 1,041,697 samples have been tested and 32,511 returned positive. The death toll is735, and the mortality rate is around 2.26%. The Ministry of Labour, Employment and Social Policy said that 72 residents of care homes and 24 staff were currently infected with the new virus, adding that 996 residents and 402 staff had recovered since the start of the epidemic. Convicted war criminal Momcilo Krajisnik dies of coronavirus Former Bosnian Serb high official and war crimes convict Momcilo Krajisnik died of coronavirus complications in a Banja Luka hospital aged 74 on Tuesday, the hospital said. He was hospitalised on August 30 for pneumonia and was on a ventilator since. In 2009, the Hague war crimes tribunal for the former Yugoslavia sentenced him to 20 years' imprisonment for war crimes in Bosnia and Herzegovina. Krajisnikwas released in 2013, having served two-thirds of his sentence, and since then lived in Pale, where he remained politically active,continuing to promote the policy for which he was convicted. He was seen as the closest associate of Bosnian Serb wartime leader Radovan Karadzic. Krajisnikwas arrested in 2000, on the Hague tribunal's orders, by French soldiers from the then Stabilisation Force in BiH. 11,000 illegal migrants enter Bosnia this year, 40% fewer than last year ZAGREB, Sept 15 (Hina) - Bosnia and Herzegovina's Security Minister Selmo Cikotic said on Tuesday that the problem of illegal migration was under control as the inflow of illegal migrants into the country declined by nearly 40% this year compared with 2019. Responding to a question from an MP in the lower house of parliament, Cikotic said slightly over 11,000 illegal migrants had entered Bosnia and Herzegovina in the first eight months of this year, compared with 18,000 in the same period last year. He said that the decline was partly due to the global coronavirus pandemic which forced many countries to close their borders. Poor control of Bosnia and Herzegovina's eastern borders with Serbia and Montenegro remains the biggest problem and the only way to deal with it is by improving the quality of the border police's equipment and deploying a sufficient number of staff along the border, Cikotic said. The border police service currently lacks about 500 police officers, and the government has recently approved funds for hiring 300 police officers. Among the illegal migrants who have entered Bosnia and Herzegovina this year, 27% are Afghans, 23% Pakistanis, 19% Bangladeshis, and 10% Moroccans. Cikotic said that Pakistan had expressed willingness to sign a readmission agreement with Bosnia and Herzegovina, which would considerably facilitate the deportation of Pakistani nationals illegally staying in the country. Beef industry facing collapse because of corona crisis ZAGREB, Sept 15 (Hina) - The crisis caused by the coronavirus has brought the beef industry to the point of collapse,the Baby Beef association said on Tuesday, adding thatAgriculture Minister Marija Vuckovic has promised HRK 60 million in support for that industry. The association said that the industry was facing collapse and that is why they called for an urgent meeting with Minister Vuckovic. The meeting was held last week and Minister Vuckovic announced subsidies similar to those in other countries, notably Slovenia and France, in order to bail out the cattle breeding industry. It was agreed that HRK 60 million would be paid to the industry in two instalments, with the first instalment at the end of this year and the second instalment by the end of February 2021. That would cover part of our losses and would resolve the issue of current and future surpluses, the association said. The association warned that the corona crisis has meant huge problems for cattle breeders who produceabout 120,000 yearling beef each year and generateabout HRK 1.3 billion in revenue. The association saidthat currently producers have a surplus of about 30,000 yearlings and by the end of the year that could increase to about 70,000. That is the result of excessive imports of beef from EU countries that subsidise their cattle breeding industry, and thishas threatened our market, the association said. The association saidthat as soon as the crisis broke out, Slovenia and France subsidised their produces with €100 per head. Croatian farmers cannot compete with those prices, the association added. The Baby Beef association brings togetherabout 330 cattle breeders who account for 90% of the beef sector in the country and raise about 120,000 yearlings a year. About two-thirds of cattle are sold live to the Middle East or as meat to Italy while one-third is sold on the domestic market. ***Agriculture***,food production key to development and survival of east Croatia ZAGREB, Sept 15 (Hina) - ***Agriculture*** and food production are key to the development and survival of eastern Croatia, the Croatian ***Agriculture*** Chamber (HPK) said on Tuesday, underscoring the importance of investments in processing capacities and energy projects for farms. "The key objective is to strengthen competitiveness in food production through subsidies for the production and sale of energy, HPK presidentMladen Jakopovic said in a press release following talks with the competent ministers. Representatives of HPK's eastern region branch, which includes five counties(Vukovar-Srijem, Osijek-Baranja, Brod-Posavina, Pozega-Slavonia and Virovitica-Podravina), met on Monday with ***Agriculture*** Minister Marija Vuckovic, Minister of Regional Development and EU Funds Natasa Tramisak and Economy Ministry state secretaryIva Miletic. Jakopovicsaid that HPK is aware that the government is investing maximum effort towards growth and the development ofrural areas, butthe corona crisis has shown that "additional effort is required to move away from dependence onthe service industrytowards innovation and production." "***Agriculture*** directly impacts all sectors in the state(health, energy, transport, environment, new jobs, trade, innovation, digitisation, national security of borders etc). By strengthening and protecting ***agriculture***, other sectors too are strengthened," said Jakopovic. HPK said they were pleased that the government sees self-sufficiency infood and low carbon energy transition as one of the first objectives of economic sovereignty. HPK said in its press release thatMinister Vuckovic announced the possibility of farmers being permitted to sell electricity on the market, which would be one way to supplement their income, as has been the practice in developed EU countries for years. She underscored that the Rural Development Programme provided for cofinancingreconstruction and equipment projects with a value of up to €200,000. Minister Tramisak, HPK said in it press release, presented the key objectives of the EU's Recovery Plan, noting that Croatia has about€6 billion at its disposal to revive entrepreneurship, including a significant amount earmarked for ***agriculture***. HPK believes that it is essential to amend legislation on farmland and to adapt it to the needs and demands of farmers. PM discusses development projects with local government officials in Split ZAGREB, Sept 15 (Hina) - Prime Minister Andrej Plenkovic visited Split on Tuesday and discussed development projects with local government officials. Asked by reporters about€2 million for projects announced at a cabinet meeting in Split two years ago, Plenkovic said that some of the projects had been carried out, some were under way and some were yet to be implemented. He said that these projects would pave the way for Split to become Croatia's main Adriatic port and tourist hub. "I think that all these projects are very good and well accepted, and we will try to channel a portion of€22 billion from the EU to Split and Split-Dalmatia County," he added. Plenkovic recalled that the government had allocated HRK 600 million for job-keeping measures in light of the coronavirus crisis, notably measures for private-sector employers and workers' wages in Split-Dalmatia County. In that way the government helped this tourism-oriented county to overcome the crisis, he added. "I thanked the mayor and the county prefect for their dedicated work on the many projects that have been carried out during their terms in office," Plenkovic said, citing the Znjan development project and projects to reduce traffic congestion in the city. County Prefect Blazenko Boban said they had analysed the government's decisions made at its meeting in Split on May 4 and found that many of the projects were at a preparatory stage. He cited several important projects aimed at upgrading the road infrastructure. Mayor Andro Krstulovic Opara mentioned the Znjan project, the Dracevac Technology Park, the reconstruction of the Poljud football stadium and the construction of a museum of Hajduk Football Club. Plenkovic says Split mayor enjoys his support Prime Minister Plenkovic said that Split Mayor Andro Krstulovic Opara of the HDZ party would always enjoy his support,when asked if Krstulovic Opara would run in the next local election, set for May 2021. Plenkovic made the statement for the press after meeting with Krstulovic Opara and Split County head Blazenko Boban, also a member of the HDZ party. HDZ has a lot of candidates for local election Asked who could be the HDZ's candidate for the mayor of Zagreb, Plenkovic said that "the HDZ has a lot of candidates." "We will have good candidates, there is enoughtime left for that. The HDZ has a lot of candidates," Plenkovic said, denying speculation by some media outlets that Finance Minister Zdravko Maric was a likely candidate for the post of Zagreb Mayor. Plenkovic also commented on the Constitutional Court's decision of Monday that laws on the powers of the national COVID-19 response team, passed by the parliament, were in line with the Constitution and that most of the team's decisions were lawful. Constitutional Court's support very good in terms of legal security "The COVID response team and the government yesterday received support from the Constitutional Court which either dismissed (complaints) or declared that practically all of the team's decisions were constitutional and in line with relevant laws. I believe this is very good in terms of legal security and the fact that our actions were based on Article 16 of the Constitution and we made decisions in the context of a declared epidemic, to protectcitizens' health," he said. If the fight against COVID-19 in the spring had not been successful, we would not have achieved 50% of the results of last year's tourist season, which was the best ever, he stressed. Commenting on the HDZ's pre-election promise abouta Sunday trading ban, and the fact that the Constitutional Court ruled that the COVID-19 response team's decision to ban Sunday trading was not in line with the Constitution, Plenkovic recalled that some surveys showed that as many as 80%of Croatians were in favour of a Sunday trading ban. Gov't to put forward balanced law on non-working Sunday "We believe it would be good and in the interest of the family and a healthy balance between work, rest and spending time with one's dearest ones. During this term the government will put forward a bill that will seek a balance between a non-working Sunday and a certain number of working Sundays," he said. Building permits issued in July down 15.3% y-o-y ZAGREB, Sept 15 (Hina) -A total of 676building permits were issued in Croatia inJuly 2020, down by 15.3% on the year, figures from the national ***statistics*** office (DZS) released on Tuesday show. Broken down by type of structure, 84% (567) of the permits issued in July were for buildings and 16% (109) were for other structures. The number of building permits for buildings issued in Julydropped by 17.7% and the number of permits for other structures remained the same as last year. According to the permits issued, the value of construction work talliedHRK 2.11 billion, down 48.3% from July 2019, when the value of construction work was HRK 4.08billion. January to July figures show that 4,979 building permits were issued in that period, which is a fall of 13.5% year on year, and the value of works is estimated at HRK 14.2 billion or 30% less than in the first seven months of 2019. Croatia, Malta report weakest growth of hourly labour costs in EU in Q2 ZAGREB, Sept 15(Hina) - Croatia and Malta are the two EU countries that saw the weakest growth of hourly labour costs in the second quarter of this year, many times lower than the EU average, which was supported by a strong increase in wage costs, shows a report from the EU's statistical office ***Eurostat***. In the EU27, working day-adjusted hourly labour costs grew by 4.1% in Q2compared to the same period of last year. In Q4 2019, they grew by 3.9%. In the euro area, hourly labour costs in Q2 grew by 4.2%, after a 3.7% increase in the previous three months. Wage costs in both the EU and the euro area grew more strongly than in Q1 despite measures introduced to contain the coronavirus. In the EU they grew by 5.3%, after a 4.1% increase in Q1, while in the euro area they rose by 5.2%, after a 3.9% increase in Q1. In both the EU and the euro area, the increase in hourly wage costs indicates that the decrease in the number ofhours worked, due to the COVID-19 crisis, was not fully compensated by a matching decrease in wages, says ***Eurostat***. Thisincrease in hourly wage costs was partly compensated by the moderate increase in the non-wage component, dueto tax reliefs and subsidies introduced by EU governments to support enterprises affected by the crisis. Hourly labour costs in the EU grew the most in the services sector, by 4.3%, followed by industry and construction, where they grew by 3.9% and 2.3% respectively. In the euro area the services sector saw the strongestincrease in total labour costs, of 4.4%, followed by industry, with an increase of 3.8%, andconstruction, with a 2.8% increase. Labour costs grow least in Malta, Croatia Of the EU countries for which ***data*** was available, Romania saw the strongest increase in hourly labour costs in Q2, of 16.1%, almost twice as high as in Q1. Croatia and Malta saw the weakest growth in hourly labour costs, of 0.7% and 0.8% respectively. In Q1 hourly labour costs in Croatia grew by 0.6%. Wage costs in Croatia grew by 1.5% n the period from April to June, almost the same rate as in Q1. The cost of contributions dropped by 3.9%, after a 4.2% decline in Q1. The largest drop in hourly labour costs in the EU in Q2 was reported by Cyprus, of 8.6%, followed by Ireland, with a drop of 3.3%. Citizens separated 6% more waste in 2019 ZAGREB, Sept 15 (Hina) - According to a preliminary calculation, citizens separated six percent more waste in 2019 than in the preceding year, which is the biggest increase in separating waste ever, the Ministry of Economy and Sustainable Energy said on Tuesday. The rate of separated waste in 2019 was about 37% and that was 6% more than in 2018. "This is the biggest annual increase of separated waste until now. That pleases usgreatly because it shows that we are going in a good direction," Economy Minister Tomislav Coric said. "The increase in separated bio-waste and other types of complex waste is mostly aresult ofactivities by local government, while the separation ofpackaging wastecan mostly be attributed to activities conducted by the service sector," the ministry said in a press release. The rate of use of general utility waste in 2019 amounted to 30%, as didthe rate of recycled waste in overall utility waste, an increase of5% on the year. The figures are based on ***data*** provided by waste ***collection*** providers, recycling yards and retailers. This ***data*** is also based on information provided by waste exporters and an estimate has been made of the share of the population that does not have organised waste ***collection***. Banozic announces further steps in modernising Croatian Army ZAGREB, Sept 15 (Hina) - Defence Minister Mario Banozic on Tuesday announced further steps in modernising the Croatian Army and developing its capabilities, saying that the Army would be the best prepared branch of the armed forces consisting of motivated, well-trained and patriotic personnel. Speaking during a visit to the Army HQ in Karlovac, Banozic said that the Croatian soldiers always served as an example to the citizens of how to behave responsibly in different situations. "That's why I expect you to be the best example in the present circumstances of the COVID-19 pandemic," he added. Speaking of the modernisation, he said that the aim was to maintain the present entitlements and that development projects would be specified in the new long-term development plan for the armed forces for the 2020-2033 period. The Chief of the General Staff of the Croatian Armed Forces, Admiral Robert Hranj, said that the Army was the most important component of military power and deserved attention in the further development and modernisation. "Education, training and drill is important for every Croatian soldier, and we should all contribute to it," Hranj said. Banozic and Hranj visited the Karlovac-based HS Produkt company with which the Defence Ministry has signed agreements for the delivery of various types of weapons. Pride parade to start in St. Mark's Square on Sept. 19 ZAGREB, Sept15(Hina) - The 19th Pride parade will be held on September 19, and this year its participants will start their walk, seeking constitutional equality and a society free of gender and sexual norms and categories, in St. Mark's Square, where the government and parliament buildings are located. "This year we fight for constitutional equality and the right to freedom, withinand outside our own four walls... the Constitution currently poses a wall for us because it restricts our freedoms. We must bring that wall down," the organisers of the Pride parade, Zagreb Pride, said. This is the first time Pride marchers will gather outside the parliament and government buildings and the Constitutional Court. "This is not so by chance, we will be there to ask the highest authorities of our republic to bring down the walls that still restrict our rights and continue to treat our families as second-class citizens," the organisers said, demanding that a procedure be launched toamend the constitution to make all families equal in their rights and obligations. As for a recent decision by the Constitutional Court which enabled same-sex partners to provide foster care, they said it showed clearly how much the constitutional restriction of 2013 "is obsolete, nonsensical and unnatural." Zigmanov happy Vucic willing to visit place where Croats were killed ZAGREB, Sept15(Hina) -Democratic Alliance of Croats in Vojvodina (DSHV) president Tomislav Zigmanov said on Tuesday Serbian President Aleksandar Vucic's willingness to visit a place whereCroats in Serbia were killed and pay his respects was positive. "We believe... what he said. And we wait for it to happen somewhere in Srijem. For the sake of the innocent victims, reconciliation and the future of Croatian-Serbian relations," Zigmanov told Croatian language media in Vojvodina. We can't forget the innocent Croats killed in Srijem in the '90s, he said, adding that Vucic's gesture could "be a good start for establishing a constant practice and for starting to commemorate those innocent victims permanently." Zigmanov said dealing with the past in Serbia had been repressed for a long time. "It hasn't been talked about for a relatively long time, or we have been witness to denial policies." He said significant reconciliation processes were under way in Croatia and that "President Vucic's willingness to respond positively to our request, our appeal, our endeavours, was probably strengthened by that." Zigmanov said the DSHV had insisted from the start on erecting memorials for innocent victims, primarily in Srijem, and for honouring them with public gestures. Vucic said recently he had no problem at all with visiting "any place where Croats where killed and I'll gladly do it because that's a civilised achievement and normal behaviour." On May 6, the DSHV remembers the killing of Vojvodina Croats, mainly in Srijem, since 1992, when their persecution began. This party and some NGOs say 25 Croats were killed in Vojvodina in the 1990s and that 35,000-40,000 had to leave this province in northern Serbia. Almost none have returned. The DSHV said in a press release that Serbian judicial bodies had not initiated any proceedings for crimes committed in Vojvodina at that time. In other news: Milanovic meets with delegation of disabled persons ZAGREB, Sept 15 (Hina) - PresidentZoran Milanovic on Tuesday met with a delegation of disabled persons and the Hedona social company which mostly employs disabled persons. The delegation informed the president of their activities over the past twenty years aimed at active participation in social and individual care for disabled persons, the president's office said in a press release. Seven years ago they founded a social company which for the most part employs disabled persons. This year the Hedona chocolaterie was awarded by the Council of Europe Development Bank (CEB) the Social Cohesion Award for social cohesion in an innovative and effective way. Milanoviccommendedthe association for its efforts in promoting social inclusion of disabled persons by integrating them on the labour market and congratulated the Hedon chocolaterie for winning this prestigious award. President meets delegation of railwaymen union ZAGREB, Sept 15 (Hina) - President Zoran Milanovic on Tuesday received a delegation of the Croatian Railwaymen Trade Union (CRTU) onthe occasion of the 30th anniversary of the union's founding, the president's office saidin a press release. The delegation informed the president of plans for the development of Croatia's railways. They pointed out that the main problem in the railway system was the state of the existing infrastructure and that investments in maintenance and repairs werenot being made. According to the union delegation, there is no political will to invest in capital railway maintenance projects. The union believes that the procurement of new trains is positive, however, it warned that it wasessential to modernise Croatia's railways overall and ensure better tracks, the press release said. The CRTU has about 2,300 members. HOO: Croatia and China continue to cooperate in sports ZAGREB, Sept 15 (Hina) - A video conference was held at the Croatian Olympic Committee (HOO) on Tuesday reaffirming the cooperation between Croatia and China, notably between the Croatian Table Tennis Federation and the Chinese Embassy in Croatia. The cooperation, established in 2018, includessponsorship and exchanges of coaching staff, which is very important for Croatian table tennis because it has the world's biggest table tennis power as its partner, the HOO said. Speaking via video link, Chinese Ambassador Xu Erwen recalled Croatia's recent sports successes, adding that Croatia and China did not cooperate only in table tennis, but also in water polo, handball and gymnastics. What has always impressed us and what many of my compatriots ask me is that they do not understand how a country of just four million people can achieve such excellent results globally in practically all sports, the ambassador said. HOO President Zlatko Matesa spoke of handball cooperation. He said that a Chinese team had for the first time participated in the last season of the regional SEHA League. "They practised and were accommodated in Croatia, they played games here, and were led by a Croatian coaching team. That is a unique example in the world that a Chinese team played in an official competition in Europe, and the link was Croatia," he said. Matesa also mentioned excellent cooperation between the Zagreb Faculty of Kinesiology and the Beijing University of Sport. He said that Croatia and China also cooperated in many other areas, citing the construction of the Peljesac Bridge. Faculty of Croatian Studies offers Korean culture and language course ZAGREB, Sept 15 (Hina) - A course in Korean language and culture was launched on Monday at the Faculty of Croatian Studies (HS) of the University of Zagreb, the faculty informed on Tuesday. Ninety-six students enrolled in the course, which is beyond all expectations and for the next 16 weeks they will attend free classes fours hours a week. Thiscourse is due to lastuntil 28 December. The enrolment quota was filled in just five days, HS said and added that the greatest interest was by students (79), while anotherentrants are 13 working people enrolled in the course and four secondary school students. The course is being conducted in cooperation between the University of Zagreb andChung-AngUniversity in Seoul and the King Sejong Institute Foundation (KSIF) The course will be taught byEunGyeong Kim from Seoul, with administrative support by LinSeonghyun Kwon, a post-graduate student of Croatian Studies. HS DeanPavo Barisicwelcomed Ms Kim and entrants and expressed his pleasurethat inCroatia a King Sejong Institute was opened. Barisicnoted that the institutes of theKing Sejong Foundation existin 76 countries, 26 of which are in Europe. More than 130 countries have applied for this year's call for cooperation and 30 new institutes have been approved, Barisic said.He underscored however that this is a great honour for the Croatian Studies Faculty. The course will be available for at least three years and if interest continues the course may be extended in the future, according to Barisic's statement. Once the studentshave completed the course they will be eligible for a student or working visa in South Korea. DIP finishes oversight of campaign expenditures ZAGREB, Sept15(Hina) - The State Electoral Commission (DIP) said on Tuesday that of the 54participants in July's parliamentary election, 18 were entitled to compensation fortheir campaignexpendituresbut that it approved it for 12, while suspending it for six. Among those 12 are the HDZ (Croatian Democratic Union) and We Can!, while those six are the Restart coalition, the Homeland Movement, Bridge, and the SSIP-Fokus-Pametno coalition. After examining the finances of all election participants, DIP allowed compensationfor the HDZ (HRK 8.9 million for 66 MPs), We Can! (HRK 766,000 for seven MPs), the Independent Democratic Serb Party (HRK 405,000 for three MPs), the Croatian People's Party and Reformists (HRK 135,000 each for one MP each) and Zeljko Glasnovic's independent slate (HRK 22,500). DIP also approved compensation for five ethnic minority MPs. Furio Radin and Veljko Kajtazi will each receive HRK 135,000. Radin represents Italians and Kajtazi 12 minorities (Austrian, Bulgarian, German, Polish, Roma, Romanian, Ruthenian, Russian, Turkish, Ukrainian, Vlach and Jewish).Robert Jankovics (Hungarian minority) will receive HRK 111,700, Vladimir Bilek (Czechand Slovak)HRK 134,918 and Ermina Lekaj Prljaskaj HRK 88,290. She represents the Albanian, Montenegrin, Serbian, Slovenian and Macedonian minorities. For each seat in parliament won, parties, independent slates and candidates receive compensation in the amount of HRK 135,000. Parties and independent slates which did not win a seat but did receive over 5% of the vote in the constituency they ran in receive HRK 22,500 each. Compensation for campaignexpenditurescomes fromthe state budget, about HRK 20 million this year. DIP also found that the Restart coalition is entitled to HRK 5.5 million in compensation, the Homeland Movement to HRK 2.2 million, Bridge to HRK 1.1 million,and the SSIP-Fokus-Pametno coalition to HRK 405,000, but delayed payment until they fulfilcertain obligations. They must do so by the end of November or lose the right to the compensation.DIP issued administrative sanctions against them after finding omissions in their finances. ZSE: Crobex indices gain over 0.5% ZAGREB, Sept 15 (Hina) - The main Zagreb Stock Exchange (ZSE) indices gained over 0.5% on Tuesday, with the Crobex rising by 0.52% to 1,617 points and the Crobex10 by 0.63% to 1,002 points. Turnover at the close of the regular trading session reached HRK 5.4 million, about 300,000 less than on Monday. The only stock to pass the one million kuna mark in turnover was that of the Valamar Riviera hotel company, with a turnover of HRK 1.18 million and a share price rise of 0.83% to HRK 24.2. Investor focus was on the stock of the Djuro Djakovic mechanical engineering group, which turned over HRK 552,000. Its price jumped by 17.2% to HRK 4.7 per share, Thirty-one stocks traded on the ZSE today, with 11 of them registering share price increases, seven recording price decreases and 13 remaining stable in price. (€1 = HRK 7.533843) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2100 HRS TUESDAY. 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[***The International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus statement on the definition and scope of synbiotics***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:671W-P291-JCWX-C2GC-00000-00&context=1516831)

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**Body**

Introduction

Notable properties of the gut microbiota include its functionality and resilience. A stable gut community protects the host against invading microorganisms and helps maintain homeostasis, including immune regulation. Nonetheless, disruptions occur owing to dietary shifts, antibiotic use, age or infection, leading to a gut microbiota that can contribute to a range of inflammatory, pathogenic and metabolic conditions such as inflammatory bowel diseases, colorectal cancer, metabolic syndrome and atopy. Several strategies have been proposed to modulate the composition and/or function of the gut microbiota, including faecal microbiota transplants, the application of probiotics and other live microorganisms, and the use of non-digestible dietary substrates such as prebiotics,.

When the synbiotic concept was first described 25 years ago, the notion that selectively fermentable non-digestible food ingredients (prebiotics) could be combined with probiotics was envisioned. Thus, synbiotics were loosely defined as mixtures of “probiotics and prebiotics that beneficially affect the host”. The term itself was formed from the Greek prefix ‘syn’, meaning ‘together’ and the suffix ‘biotic’, meaning ‘pertaining to life’. Despite the availability of similarly worded definitions, confusion exists among stakeholders, including scientists, about what constitutes a synbiotic–. A general misunderstanding might have been, in part, because the original definition itself — that is, “mixtures of probiotics and prebiotics that beneficially affect the host by improving the survival and implantation of live microbial dietary supplements in the gastrointestinal tract, by selectively stimulating the growth and/or by activating the metabolism of one or a limited number of health-promoting bacteria, thus improving host welfare” — was too wordy and lacked precision. In addition, the expansion of the entire ‘–biotics’ category, including terms such as postbiotic and pharmabiotic, almost certainly further contributes to confusion. To provide clarity and guidance regarding appropriate use of the term ‘synbiotic’, in May 2019, the International Scientific Association for Probiotics and Prebiotics (ISAPP) convened an expert panel of academic scientists to address the current status of synbiotics, including its definition. The outcomes of that meeting and subsequent discussions comprise this Consensus Statement. A summary of key conclusions is shown in Box . Herein, we consider applicable efficacy and mechanistic evidence on combination probiotic plus prebiotic products, we recommend the research needed to establish a ‘synbiotic’ formulation, discuss the safety considerations, and reflect on implications for stakeholders of the synbiotic concept.

Box 1 Main conclusions of the consensus panel regarding synbiotics

The definition of synbiotic has been updated to “a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host”.

Within this definition, ‘host’ microorganisms comprise both autochthonous (resident or colonizing the host) and allochthonous (externally applied, such as probiotics) microorganisms, either of which can be targets for the substrate contained in the synbiotic.

Two subsets of synbiotics were defined: complementary and synergistic. A ‘synergistic synbiotic’ is a synbiotic in which the substrate is designed to be selectively utilized by the co-administered microorganism(s). A ‘complementary synbiotic’ is a synbiotic composed of a probiotic combined with a prebiotic, which is designed to target autochthonous microorganisms. Minimum criteria for the existing probiotic and prebiotic must be met for both components of a complementary synbiotic.

Beneficial effect(s) of a synbiotic on health must be confirmed in the target host, which might include humans, companion animals, or ***agricultural*** species or a subpopulation (such as different age or developmental stage, health status, sex or living situation) thereof.

For a synergistic synbiotic, evidence of selective utilization of the substrate must be demonstrated in the same study establishing the health benefit. The aim is to demonstrate that the combined effect is better than the estimated effects of each component separately. This step is not required for a complementary synbiotic, as it contains a prebiotic for which selective utilization has already been established.

A synbiotic can be applied to intestinal or extra-intestinal microbial ecosystems and might be formulated into products fitting an array of regulatory categories (such as foods, non-foods, feeds, drugs or nutritional supplements).

Implied in the definition is that safety of the synbiotic for the intended use is established.

‘Symbiotic’ is not a synonym of synbiotic and is incorrect in this context.

Methods

ISAPP is a non-profit collaboration of scientists dedicated to advancing scientific excellence and providing objective, science-based information on probiotics and prebiotics. The organization’s activities are funded by companies involved in the sale of probiotics and prebiotics, but ISAPP is guided by an international, all-volunteer academic board that functions independently. This ISAPP-organized panel was composed of experts in microbiology, nutrition and gastrointestinal physiology, including many who were involved in the latest updates of the probiotic and prebiotic definitions according to ISAPP. Panellists were charged with accomplishing the following goals: consider what a synbiotic is and provide a clear, concise and testable definition; suggest the appropriate experimental conditions necessary to establish synbiotic activity; describe the evidence required to demonstrate the health benefits and establish safety; and provide guidance for stakeholders, including researchers, industry, public health professionals and regulatory agencies.

Prior to the meeting, panellists developed a discussion outline and target questions. During the meeting, panellists presented the perspectives and evidence regarding the core issues involved. Debate ensued until a consensus was achieved. After the meeting, individual panellists wrote sections of the summary, which were compiled by K.S.S., G.R.G., R.H. and M.E.S. into a draft report. This document was edited and agreed upon by all panel members. The authors would like to thank members of the ISAPP board of directors who did not directly participate in this consensus panel but who reviewed, criticized and approved this manuscript: D. Merenstein, H. Szajewska, M. Marco, E. Quigley, S. Lebeer and S. Salminen.

An updated definition

The panel updated the definition of a synbiotic to “a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host”. ‘Host’ microorganisms in this context include both autochthonous microorganisms (resident or colonizing the host) and allochthonous microorganisms (externally applied, such as probiotics), which, even if transiently present, do constitute a component of the host microbiota.

The panel considered defining synbiotics as simply a mixture of probiotics and prebiotics. Common to the definition of both probiotics and prebiotics is the requirement that each independently provides a health benefit and the dose of each must be adequate to independently achieve those benefit(s). However, the panel recognized the possibility that a functional synbiotic could be formulated at doses below those at which the probiotic or prebiotic could independently exert health benefits. Alternatively, a particular microorganism might lack probiotic functions even at high dosages owing to competition or other ecological effects but, in the presence of a suitable substrate, could provide a health benefit. Likewise, a novel substrate, again even at high doses, might not by itself provide benefits but could do so when combined with a selected live microorganism(s) that it can enhance. Such formulations comprise a live microorganism and a substrate that depend on the presence of one another and function in concert. Simply put, the microbial component does not necessarily have to be a standalone probiotic and the non-digestible substrate does not necessarily have to be a standalone prebiotic, but, if together they provide a health benefit, then the mixture can be called a synbiotic. This proposed definition of a synbiotic should encourage innovation in formulations by not requiring that component parts meet the strict definitions of either a probiotic or a prebiotic.

However, the panel also recognized that a current common usage of the term synbiotic includes products that combine a probiotic and a prebiotic. Such a combination product might not have any evidence of co-dependent function but is instead designed for the components to work independently to promote an observed health benefit(s). The panel agreed that such a formulation could be considered a synbiotic, provided that components meet the respective probiotic and prebiotic definitions (Fig. ). Thus, the probiotic strain(s) is chosen based on the benefits that it provides to the host, while the prebiotic is designed to promote the growth and activities of beneficial members of the indigenous microbiota and provide a health benefit. Furthermore, a combination of probiotic plus prebiotic must be tested to confirm that a health benefit is conferred by the combined formulation compared with a placebo. Otherwise, the product should not be labelled a synbiotic. Based on these qualifiers, the panel retained the definition that a combination of a probiotic and a prebiotic be denoted as a complementary synbiotic (discussed later).

Synbiotic categories.

Synbiotics can be formulated using two approaches. A complementary synbiotic comprises a probiotic plus a prebiotic (more than one of each can be used), working independently to achieve one or more health benefits. Probiotic and prebiotic components of the complementary synbiotic must meet the minimum criteria, as stipulated previously,. A synergistic synbiotic is composed of a live microorganism and a selectively utilized substrate but neither needs to meet the minimum criteria stipulated previously for probiotics and prebiotics. Instead, these components are designed to work together, with the substrate being selectively utilized by the co-administered microorganism. The panel considered whether all synbiotics should be synergistic. However, the absence of such substances today speaks to the difficulty of achieving the required evidence. The panel judged that it was more important for the definition to be useful rather than hypothetical.

The other type of synbiotic previously envisioned is a synergistic synbiotic, which is a synbiotic in which the substrate is designed to be selectively utilized by the co-administered microorganisms. To be a synergistic synbiotic, the live microorganism is selected based on its ability to provide a health benefit and the substrate is chosen to primarily support the growth or activity of that selected microorganism. Although the substrate might also enrich other beneficial members of the gastrointestinal microbiota, its main target is the ingested microorganism.

Designing and demonstrating the efficacy of a synergistic synbiotic is experimentally challenging. To our knowledge, nearly all synbiotics used in published clinical trials or available commercially are of the complementary form, irrespective of whether they have been deliberately designed or named as such. Approaches to designing complementary and synergistic synbiotics are shown in Fig. .

Design and mechanisms of action of complementary and synergistic synbiotics.

Two approaches to designing synbiotics are represented here. The complementary approach combines a prebiotic and a probiotic that work independently to elicit one or more health benefits. The prebiotic and probiotic must each meet applicable criteria (Table ). The prebiotic functions by modulating the resident microbiota in a manner associated with an improved health outcome. The synergistic approach selects a substrate that is utilized by the co-administered live microorganism, enhancing its functionality. Synergistic synbiotics work together (not independently) to bring about the resulting health benefits.

It is important to clarify that, although synbiotics can be formulated to provide synergistic activities, the ‘syn’ prefix in the word ‘synbiotic’ is not intended to imply synergy; it means ‘together’. Of note, the term ‘symbiotic’ is often misused in this context and is not the same as synbiotic. Symbiotic, as used in biology, refers to an ecological relationship in which one organism (the symbiont) lives in a long-term relationship in a natural ecosystem with another organism (the host), that is, in symbiosis.

Characterization needed for synbiotics

A synbiotic should be characterized to the extent needed to ensure safety and a consistent performance. Live microbial component(s) of the synbiotic should have a publicly available genome sequence and annotation, be assessed for any genes of safety concern (for example, toxin production or transferrable antibiotic resistance), named using current taxonomic nomenclature and carry a traceable strain designation. The strain(s) should also be deposited into a recognized international culture ***collection*** that permits access by scientists to conduct research. In short, the safety, identity, purity and potency of the live microorganism should be clearly and accurately described according to the best available methods that meet applicable regulatory standards for the product category.

The structure and purity of the substrate should be stated and characterized by appropriate chemical analyses. This process includes testing for microbial and other contaminants as per regulatory standards for the country of sale. The level of purity required will depend on what is needed to ensure a consistent performance and safety of the product. The level of active substrate in commercial preparations of prebiotics available worldwide ranges considerably, often from 35% to 99%–. The monosaccharides and disaccharides carried over from the production process that are present in prebiotic preparations are typically digested and absorbed by the host in the upper gastrointestinal tract after oral ingestion. A relevant issue is whether the material used in the formulation is sufficient to deliver a consistent dose of the active component and result in reproducible selective utilization by microorganisms and beneficial health effect(s) in the target host. This issue highlights that studies should communicate the content of the active ingredient being tested in addition to the quantity of the overall product. For example, a 6 g dosage of 50% pure galacto-oligosaccharides would provide 3 g of the active substrate and should be reported as such.

The active ingredients of a synbiotic must be sufficiently stable. Ensuring stability of the live microbial component of a synbiotic can be challenging. When live microorganisms are combined with a substrate(s) in a matrix (for example, liquid, dried or ointment), the burden is on manufacturers to ensure that the dosage of the live microorganism required to confer the stated health benefit is delivered throughout the shelf-life. Live microorganism viability is highly dependent on the matrix, storage temperature, pH and oxygen level of the product: for liquid products, the shelf-life might be as short as 1–2 weeks, for lyophilized or encapsulated products, the shelf-life might be as long as 2 years. Packaging and storage conditions must control critical factors, such as water activity and temperature, through production to distribution and usage. Furthermore, a synbiotic must undergo assessment of safety for the intended use, as described later.

Current levels of evidence

Numerous randomized controlled trials (RCTs) in humans across a range of populations, from healthy individuals to those with acute and chronic diseases, have been conducted to examine the health benefits of putative synbiotics. Many trials have been conducted in adults with metabolic diseases, including overweight and obesity,, type 2 diabetes mellitus, and non-alcoholic fatty liver disease,. Other outcomes, such as irritable bowel syndrome, surgical infections,, chronic kidney disease, and atopic dermatitis, have also been investigated. Consequently, many systematic reviews and meta-analyses of RCTs evaluating the effect of putative synbiotics on disease targets have been published,,– and this approach is an accepted means of evaluating the evidence for health benefits–. Examples are given in Table , which focuses on RCTs demonstrating benefits. Null trials have also been published across a variety of outcomes, including, for example, some studies aimed at the prevention of surgical infections,, treatment of obesity, management of gestational diabetes mellitus and eradication of Helicobacter pylori infection,. However, evidence of a health benefit is not in itself sufficient to call a formulation of live microorganism(s) plus selectively utilized substrate(s) a ‘synbiotic’. Concomitant evidence of selective utilization by either the endogenous microbiota (complementary synbiotic) or the co-administered live microorganism (synergistic synbiotic) must also be generated.

Human trials of orally administered combinations of live microorganisms and a substrate reporting health outcomes

| **Health outcome** | **Population studied** | **Synbiotic used** | | **Refs** |
| --- | --- | --- | --- | --- |
| **Substrate component and dose** | **Live microorganism(s) component and dose** |
| Prevention of surgical infections and complications | Adults, *n* = 54 | GOS (12 g per day) | *Bifidobacterium breve* strain Yakult (1×108/g), *Lactobacillus casei* strain Shirota (1×108/g) (3 g per day) |  |
| Adults, *n* = 79 | FOS (dose not stated, three times per day) | *Streptococcus faecalis* T-110 (60 million), *Clostridium butyricum* TO-A (4 million), *Bacillus mesentericus* TO-A (2 million), *Lactobacillus sporogenes*a (100 million) (three times per day) |  |  |
| Adults, *n* = 80 | Inulin, ?-glucan, pectin and resistant starch (2.5 g of each, twice per day) | *Pediococcus pentosaceus* 5?33:3 (1010), *Leuconostoc mesenteroides* 77:1 (1010), *Lactobacillus paracasei* subsp. *paracasei* F19 (1010), *Lactobacillus plantarum* 2362 (1010) (twice per day) |  |  |
| Adults, *n* = 92 | OFS (15 g, twice per day) | *Lactobacillus acidophilus* La5, *Lactobacillus bulgaricus*, *Bifidobacterium lactis* BB-12, *Streptococcus thermophilus* (4×109 CFU) (three times per day) |  |  |
| Adults, *n* = 46 | FOS (100 mg, twice per day) | *L. acidophilus* 10 (1×109 CFU), *Lactobacillus rhamnosus* HS 111 (1×109 CFU), *L. casei* 10 (1×109 CFU), *Bifidobacterium bifidum* (1×109 CFU) (twice per day) |  |  |
| Adults, *n* = 61 | GOS (10 g per day) | *B. breve* strain Yakult (1×108/g), *L. casei* strain Shirota (1×108/g) (3 g per day) |  |  |
| Treatment of non-alcoholic fatty liver disease | Adults, *n* = 52 | FOS (250 mg per day) | *L. casei* PXN 37, *L. rhamnosus* PXN 54, *S. thermophilus* PXN 66, *B. breve* PXN 25, *L. acidophilus* PXN 35, *Bifidobacterium longum* PXN 30, *L. bulgaricus* PXN 39 (2×108 CFU per day) |  |
| Adults, *n* = 66 | FOS (dose not provided) | *B. longum* (dose not provided) |  |  |
| Adults, *n* = 50 | FOS (125 mg, twice per day) | *L. casei* PXN 37, *L. rhamnosus* PXN 54, *S. thermophilus* PXN 66, *B. breve* PXN 25, *L. acidophilus* PXN 35, *B. longum* PXN 30, *L. bulgaricus* PXN 39 (2×108 CFU, twice per day) |  |  |
| Adults, *n* = 75 | Inulin HP (10 g per day) | *B. longum*, *L. acidophilus* (2×107 CFU per day) |  |  |
| Prevention of sepsis in infants | Infants, *n* = 4,556 | FOS (150 mg per day) | *L. plantarum* ATCC-202195 (~109 per day) |  |
| Treatment of overweight or obesity and metabolic syndrome | Adults, *n* = 225 and *n* = 134 | Litesse Ultra polydextrose (12 g per day) | *Bifidobacterium animalis* subsp. *lactis* 420 (1010 CFU per day) | , |
| Adults, *n* = 38 | FOS (250 mg, twice per day) | *L. casei* PXN 37, *L. rhamnosus* PXN 54, *S. thermophilus* PXN 66, *B. breve* PXN 25, *L. acidophilus* PXN 35, *B. longum* PXN 30, *L. bulgaricus* PXN 39 (2×108 CFU, twice per day) |  |  |
| Treatment of T2DM and glycaemia | Adults, *n* = 62 | Inulin (0.36 g, three times per day) | *L. sporogenes*a (9×107 CFU, three times per day) |  |
| Adults, *n* = 81 | Inulin (0.07 g/1 g bread) (120 g per day as synbiotic bread) | *L. sporogenes*a (1×108 CFU/g, 120 g per day as synbiotic bread) |  |  |
| Treatment of dyslipidaemia | Women with gestational diabetes, *n* = 70 | Inulin (800 mg per day) | *L. acidophilus*, *L. casei*, *B. bifidum* (2×109 CFU per day of each) |  |
| Adults with T2DM, *n* = 78 | Inulin (0.07 g/1 g bread) (120 g per day as synbiotic bread) | *L. sporogenes*a (1×108 CFU/g, 120 g per day as synbiotic bread) |  |  |
| Adults with CHD and T2DM, *n* = 60 | Inulin (800 mg per day) | *L. acidophilus*, *L. casei*, *B. bifidum* (2×109 CFU/g of each per day) |  |  |
| Adults with T2DM, *n* = 62 | Inulin (0.36 g, three times per day) | *L. sporogenes*a (9×107 CFU, three times per day) |  |  |
| Treatment of inflammation | Elderly, *n* = 37 | GOS (8 g per day) | *B. lactis* Bi-07 (109 CFU per day) |  |
| Adults, *n* = 36 | FOS (1.4 g per day) | *L. acidophilus* La5, *B. animalis* ssp. *lactis* Bb-12, *Lactobacillus delbrueckii* ssp. *bulgaricus*, *S. thermophilus*, *L. paracasei* ssp*. paracasei* (2.4×109 CFU per day) |  |  |
| Adults with T1DM and T2DM on haemodialysis, *n* = 60 | Inulin (0.8 g per day) | *L. acidophilus*, *L. casei*, *B. bifidum* (2×109 CFU of each per day) |  |  |
| Treatment of irritable bowel syndrome | Adults, *n* = 85 | FOS (100 mg, three times per day) | *Bacillus coagulans* (15×107 spores, three times per day) |  |
| Children, *n* = 71 | Inulin (900 mg, twice per day) | *B. lactis* B94 (5×109 CFU, twice per day) |  |  |
| Eradication of *Helicobacter pylori* | Adults, *n* = 76 | FOS (250 mg per day) | *L. casei* PXN 37, *L. rhamnosus* PXN 54, *S. thermophilus* PXN 66, *B. breve* PXN 25, *L. acidophilus* PXN 35, *B. longum* PXN 30, *L. bulgaricus* PXN 39 (2×108 CFU per day) |  |
| Children and youth, *n* = 104 | Inulin (900 mg per day) | *B. lactis* B94 (5×109 CFU per day) |  |  |
| Treatment of polycystic ovarian syndrome | Adults, *n* = 60 | Inulin (800 mg per day) | *L. acidophilus* strain T16 (IBRC-M10785), *L. casei* strain T2 (IBRC-M10783), *B. bifidum* strain T1 (IBRC-M10771) (2×109 CFU/g of each per day) |  |
| Adults, *n* = 60 | Inulin (800 mg per day) | *L. acidophilus* strain T16 (IBRC-M10785), *L. casei* strain T2 (IBRC-M10783), *B. bifidum* strain T1 (IBRC-M10771) (2×109 CFU/g of each per day) |  |  |
| Treatment of chronic kidney disease | Adults, *n* = 30 | Inulin (2.2 g), tapioca-resistant starch (1.3 g) (three times per day) | *L. plantarum* (5×109), *L. casei* subsp. r*hamnosus* (2×109), *Lactobacillus gasseri* (2×109), *Bifidobacterium infantis* (1×109), *B. longum* (1×109), *L. acidophilus* (1×109), *Lactobacillus salivarius* (1×109), *L. sporogenes*a (1×109), *S. thermophilus* (5×109) (3 times per day) |  |
| Adults, *n* = 66 | FOS (500 mg capsule with undefined FOS dose, two capsules per day) | *L. casei*, *L. acidophilus*, *L. bulgaricus*, *L. rhamnosus*, *B. breve*, *B. longum*, *S. thermophilus* (500 mg capsule with undefined dose of microorganism, two capsules per day) |  |  |
| Adults, *n* = 37 | Inulin, FOS, GOS (7.5 g per day for first 3 weeks then 15 g per day for second 3 weeks) | Nine different strains across *Lactobacillus*, *Bifidobacterium* and *Streptococcus* genera (45×109 CFU/day for first 3 weeks then 90×109 CFU per day for second 3 weeks) |  |  |
| Prevention of atopic dermatitis | Pregnant women, *n* = 1,223 | Newborn infants received the synbiotic: GOS (0.8 g, once per day) | Mothers received only the probiotic twice per day: *L. rhamnosus* GG (5×109 CFU), *L. rhamnosus* GG LC705 (5×109 CFU), *B. breve* Bb99 (2×108 CFU), *Propionibacterium freudenreichii* subsp. *shermanii* JS (2×109 CFU); infants received the probiotic once per day |  |
| Treatment of atopic dermatitis | Infants 12?36 months of age, *n* = 90 | FOS (50 mg, twice per day) | *L. acidophilus* DDS-1, *B. lactis* UABLA-12 (5×109 CFU, twice per day) |  |
| Infants: 3 months to 6 years of age, *n* = 40 | FOS (958 mg, twice per day) | *L. casei* PXN 37, *L. rhamnosus* PXN 54, *S. thermophilus* PXN 66, *B. breve* PXN 25, *L. acidophilus* PXN 35, *B. infantis* PXN 27, *L. bulgaricus* PXN 39 (1×109 CFU, twice per day) |  |  |
| Children: 2?14 years of age, *n* = 60 | FOS (475 mg, twice per day) | *L. salivarius* PM-A0006 (2×109 CFU, twice per day) |  |  |

The selected studies contained in this table represent blinded, randomized, controlled trials that showed a health benefit of the combination product. Studies listed did not necessarily test both the health benefit and selective utilization by the microbiota, so we have avoided the use of the term ‘synbiotic’ in this table. Null trials and studies using the inappropriate term ‘symbiotic’ were excluded. CHD, coronary heart disease; FOS, fructo-oligosaccharides; GOS, galacto-oligosaccharides; OFS, chicory root oligofructose; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus. aL. sporogenes is an invalid species name; this name has been used incorrectly by some to refer to Bacillus coagulans.

Across studies, species from the genera Lactobacillus, Bifidobacterium and Streptococcus are the most commonly used live microorganisms within the formulations tested. The substrate components are usually galacto-oligosaccharides, inulin or fructo-oligosaccharides but doses vary considerably, from as low as 100 mg to as much as 10–15 g per day. For example, in a double-blind RCT, twice daily consumption of a synbiotic composed of Lactobacillus acidophilus 10 (109 CFU), Lactobacillus rhamnosus HS111 (109 CFU), Lactobacillus casei 10 (109 CFU), Bifidobacterium bifidum (109 CFU) and fructo-oligosaccharides (100 mg) 4 days before and 10 days after surgery for periampullary neoplasms resulted in a lower number of postoperative infections, a shorter duration of antibiotic therapy, fewer non-infectious complications, shorter length of hospital stay and reduced mortality than in patients receiving a placebo (sucrose). Although such low doses would not be expected to provide a prebiotic effect in complementary synbiotics, they could, in theory, be sufficient to stimulate a cognate microorganism in a synergistic synbiotic formulation. In one RCT of 225 adults with overweight and obesity, a combination of Bifidobacterium animalis subsp. lactis 420 and polydextrose (12 g per day) resulted in a relative reduction in body fat mass of 4.5%, whereas the individual treatments had no effect. However, selective utilization was not established in this study. Thus, by itself, this study does not provide sufficient evidence that the tested combination was either a complementary or a synergistic synbiotic.

In general, the appropriate dose, duration and composition of a synbiotic needed to confer a health benefit are likely to be specific to the context, including outcome and baseline host target site microbiota, as well as coexisting environmental factors such as medication, habitual diet and, perhaps, yet-to-be-identified host genetic factors.

Necessary evidence for synbiotics

A synbiotic must contain a live microorganism and a selectively utilized substrate. For complementary synbiotics, the respective components must fulfil the evidence and dose requirements for both a probiotic and prebiotic. Furthermore, the combination must be shown in an appropriately designed trial to confer a health benefit in the target host. A product containing a probiotic and a prebiotic that only has evidence for each component individually, and not as a combination product, should not be called a synbiotic. A key evidentiary requirement for a synergistic synbiotic is that there be at least one appropriately designed study of the synbiotic in the target host that demonstrates both selective utilization of the substrate and a health benefit (Box ).

Generating this evidence requires appropriately designed, adequately powered experimental trials conducted on the target host. These studies should follow standard human trial design and reporting guidelines and consider best practices for diet–microbiota research. The study should also meet the criteria outlined in CONSORT and should be registered, including a description of all outcomes, prior to recruitment. These CONSORT criteria include guiding principles for microorganisms, microbiota-related compliance and outcome measures, relevant subgroups, and statistical considerations for evaluating the microbiota as a mediator of clinical effects.

Ideally, the health benefit of a synbiotic would be superadditive, that is, it would exceed the benefit observed for the sum of the individual components. However, owing to the difficulties in demonstrating different levels of health benefit in an efficacy trial, the panel did not insist upon this aspect. Instead, we advocate requiring a measurable, confirmed health benefit of the synbiotic, which is conferred, at least in part, through selective utilization of the substrate(s) provided in the synbiotic. Although in vitro and animal models are used frequently to test the effects of probiotics, prebiotics and synbiotics–, it is our position that these have not been fully validated as predictive and that definitive tests of these interventions must be performed in the target host. Of course, model experiments can add mechanistic insights, in particular in cases for which available samples from studies in the target host have limited usefulness (for example, faeces, which are not reflective of upstream intestinal microbial or metabolic activities).

As noted, it is required that the health benefit of the synbiotic mixture be confirmed, even when established probiotic(s) and prebiotic(s) (that is, ones that meet criteria stipulated in respective definitions and are used at efficacious doses) are used to formulate components of the synbiotic. This requirement would account for any potential antagonistic effect of the combination that might diminish the health benefits of each component independently. Although unlikely, such antagonism is theoretically possible, as shown in in vitro studies whereby some carbohydrate substrates increased the production of antimicrobial compounds by probiotics. Depending on which microorganism is able to utilize the substrate, which antimicrobial factors are produced, and which taxa are neutralized or killed by them, such a scenario could lead to positive or negative outcomes. Therefore, in the absence of evidence that the combination product provides a health benefit, a product should simply be labelled as “contains probiotics and prebiotics”. Sanders et al. provide a perspective on determining whether evidence from studies using one formulation (for example, a prebiotic or a probiotic alone) can be extrapolated to different formulations (for example, when combining a prebiotic and a probiotic).

Box 2 Actual and hypothetical examples to illustrate the synbiotic concept

The qualifier ‘established’ refers to a probiotic or prebiotic that meets the requirements of the globally accepted definitions from International Scientific Association for Probiotics and Prebiotics consensus,. Studies are done in the target host.

Example 1

In a blinded four-arm study, 41 healthy volunteers received either Bifidobacterium animalis subsp. lactis Bi-07 (109 CFU per day), 8 g per day xylo-oligosaccharides (XOS), the combination of both or an inert maltodextrin control for 21 days. XOS enhanced bifidobacteria counts in faeces in both the synbiotic and prebiotic groups compared with the control and improved plasma lipid profiles and modulated markers of immune function in healthy adults. The lowest reported use of analgesics was observed during combination supplementation along with a reduced expression of CD19 on B cells (as markers of immune function). Thus, the combination exerted certain benefits that were not afforded by the probiotic or prebiotic alone. This study shows a prebiotic status for XOS used at 8 g per day. Previous evidence supports that Bifidobacterium animalis subsp. lactis Bi-07 at 109 CFU per day met criteria for a probiotic,. Taken together, this tested product meets our definition of a complementary synbiotic. However, because an increase of Bifidobacterium was not observed in individuals fed the combination product, it does not meet our definition of a synergistic synbiotic.

Example 2

Krumbeck et al. conducted a parallel multi-arm, double-blinded randomized control trial in people with obesity (17–19 per group) to assess the effects of a synbiotic containing 5 g of galacto-oligosaccharide (GOS) and 109Bifidobacterium adolescentis IVS-1 on gut barrier function. The test strain had been obtained by an in vivo selection strategy intended to select for strains that would be expected to provide synergistic outcomes. In addition to the synbiotic, GOS, B. adolescentis IVS-1 and placebo (lactose) controls were also included. After 3 weeks of consumption, genus-specific and strain-specific quantitative real-time PCR were performed to assess changes in absolute abundances of bifidobacteria. To assess intestinal permeability, non-metabolizable sugars were measured in urine following the consumption of a sugar mixture. Although the results showed that all three treatments (GOS only, B. adolescentis IVS-1 only and the combination) markedly improved gut barrier function, there was no statistically significant difference among the three groups. The B. adolescentis IVS-1 group was significantly enriched but the addition of GOS as a synbiotic did not further increase strain abundance. Likewise, all three treatments significantly increased the absolute abundance of faecal bifidobacteria compared to baseline, but there was no statistically significant difference among the three groups. Although the combination, probiotic and prebiotic arms all improved the markers of colonic permeability and all increased faecal bifidobacteria levels, the study did not support our definition of a synergistic synbiotic.

Example 3

In a hypothetical study, an established prebiotic substrate (for example, GOS or inulin) at the dose shown to be both selectively utilized and have a health benefit (primary outcome showing improved probably of response) is combined with an established probiotic at the dose shown to have a health benefit in the same target host. This combination product is tested and shown to confer a health benefit compared with the control (not necessarily the same benefit as previously tested for the probiotic and prebiotic). This product would meet our definition of a complementary synbiotic.

Example 4

In a hypothetical study, a substrate (not an established prebiotic) at 1 g per dose is combined with 106 CFU of a live microorganism (not an established probiotic). Preclinical testing suggests that the live microorganism selectively utilizes the substrate. A study tracking both health and microbiota end points in the target host comprises 106 CFU per dose of live microorganism alone, 1 g per dose of substrate, 106 CFU per dose of the live microorganism plus 1 g per dose of the substrate, and an inert control. Microbiota analysis supports selective utilization by the combination. Concomitantly, a health or therapeutic end point is improved by the combination. The combined effect is better than the estimated effects of each component separately. This product would meet our definition of a synergistic synbiotic.

Example 5

A substrate (not an established prebiotic) plus a live microorganism (not an established probiotic) is tested against the control. It is found to confer a health benefit and increase levels of bifidobacteria in faeces. This result does not provide evidence for either a synergistic or complementary synbiotic. To fulfil criteria for a synergistic synbiotic, it must be demonstrated that the health benefit and selective utilization of the substrate exceed those observed for the control and for each individual component. As the materials comprising the mixture, at the dose used, were not established probiotics or prebiotics, it does not meet our definition of a complementary synbiotic.

Guiding principles for synbiotic research

Design

A randomized, double-blind, placebo-controlled trial is recommended for synbiotic research. The study should be registered with accepted protocol and results systems such as ClinicalTrials.gov. Study quality factors include, but are not limited to, appropriate blinding, randomization, the allocation concealment mechanism, reporting of inclusion and/or exclusion criteria and adverse events (AEs), completion of intention-to-treat analyses, and adequate statistical power. Crossover designs might be preferred to account for the individualized nature of the gut microbiota. The wash-out period length should be based on the primary outcome with consideration for secondary outcomes; a 2-week wash-out between conditions is generally adequate for gut microbiota outcomes, although longer times might be necessary for some populations (for example, the elderly or for those with constipation or functional bowel disorders). Parallel-arm designs might be required for long-term outcomes (such as weight loss or glycaemia). The number of study groups required depends on whether the researchers intend to demonstrate synergism (Table ). Health outcomes and selective utilization of the substrate by host microbiota must be demonstrated in the same study. When experimental trials are not feasible or ethical, observational trials, including prospective longitudinal studies, are useful; these studies must accurately capture synbiotic exposure and control for relevant confounders (such as diet or antibiotics).

Evidence required for synbiotics using doses delivered in product

| **Composition** | **Dosea** | **Microbiological evidence from trial in target host** | **Study design** | **Evidence of health benefit required from trial in target host** |
| --- | --- | --- | --- | --- |
| **Complementary synbiotic** |  |  |  |  |
| Prebiotic | Sufficient to result in the selective utilization by resident microbiota and a health benefit in the absence of the co-administered probiotic | No additional evidence needed beyond that for the prebiotic component | Two-arm trial of complementary synbiotic and an inert control | Complementary synbiotic is superior to controlb |
| Probiotic | Sufficient to result in a health benefit in the absence of the co-administered prebiotic | No effect on resident microbiota required | Two-arm trial of complementary synbiotic and an inert control | Complementary synbiotic is superior to controlb |
| **Synergistic synbiotic** |  |  |  |  |
| Substrate selectively utilized by the co-administered live microorganism | Sufficient to result in the selective utilization by the co-administered microorganism | Evidence that the substrate is selectively utilized by the co-administered live microorganism | Trial of live microorganism(s), selectively utilized substrate(s), combination of microorganism(s) plus substrate(s), and control | Combined effect of synergistic synbiotic is better than the estimated effects of each component separately |
| Live microorganism that selectively utilizes the co-administered substrate | Sufficient to selectively utilize the co-administered substrate and result in a health benefit | Evidence that the substrate is selectively utilized by the co-administered live microorganism | Trial of live microorganism(s), selectively utilized substrate(s), combination of microorganism(s) plus substrate(s), and control | Combined effect of synergistic synbiotic is better than the estimated effects of each component separately |

The unmodified term ‘synbiotic’ can be used on a commercial product label as long as the criteria for either a complementary or synergistic synbiotic are met. There is no restriction on the type of health target but it must be realistic and mechanistically driven. See Table  for a list of diseases and conditions targeted to date in human trials of putative synbiotics. Microbial, metabolic and health end points (or suitable biomarkers) must be tracked in the same study for a synergistic synbiotic, in the target host. It is not indicated here, but documentation of the safety of the final blended product for the intended use is required. aEffective doses delivered in a commercial product must be present through the end of shelf-life. bStudies documenting health benefits conferred by probiotic and prebiotic components are also required.

Population or participants

When choosing the study population, many parameters need to be defined, including the target host (including non-human species), target life stage (for example, pregnant women, infants, children, adults or elderly) and health status (for example, healthy, at-risk, or with a diagnosed disease or condition). Furthermore, microbiome-related factors, such as recent probiotic, prebiotic, synbiotic or antibiotic use, microbiota-disrupting medications and diet can be considered as (in)eligibility criteria, depending on primary health and microbiota outcomes. A 2-week wash-in period is generally adequate for probiotics; however, certain populations might require longer wash-in periods (such as 4 weeks for those with slow transit time). The time since last antibiotic exposure will vary depending on a range of factors, including type of antibiotic, dose, duration and whether antibiotic use has occurred on multiple occasions in fairly short succession,. A general recommendation is difficult to make, although a common exclusion is individuals who have taken antibiotics 3 months prior to a study. However, at a minimum, 4 weeks since cessation of antibiotics is recommended. Non-antibiotic prescription medications should also be considered if they can influence bowel function and the microbiome.

The population subgroups of interest should be specified. Clinical factors (such as sex or BMI), baseline microbiome features (such as presence of specific microbial taxa) and other microbiome-relevant factors (such as dietary fibre intake, maternal secretor status for studies on human milk oligosaccharides or birth mode) might be relevant to analyse. For studies on the elderly, consider age-associated differences in transit time, gastric acidity and diet diversity. For mother–infant dyads, consider possible vertical transmission of microorganisms from mother to infant in breast milk, microorganisms and substrates naturally present in breast milk, and the unique characteristics of immature infant microbiome.

Intervention

The intervention should be fully described to enable replication of the study. This entails an adequate description of substrate and live microorganism dosages, specification of the microbial strain, the structure and purity of the substrate, and the timing and route of administration of the intervention. Subject compliance with an oral intervention can include measurement of the administered microorganisms in stool.

The duration of the intervention will be determined based on outcome; microbiota changes can be rapid but health outcomes will vary from days to weeks (such as constipation, stool frequency) to months (such as reduced fat mass, glycaemia). The background diet must be considered and, if possible, monitored as diet could provide a source of prebiotic substrates that are intrinsic and intact within certain foods (such as onions, wheat) as well as live microorganisms (such as fermented foods). Diet monitoring should include the use of validated methods such as the National Cancer Institute Dietary History Questionnaire (DHQ), Automated Self-Administered 24-hour dietary assessment tool (ASA24) and ***nutrient*** analysis software (such as Nutrition ***Data*** System for Research).

Placebo or control

Design of a placebo or control is driven by the comparisons of interest. Often, a fully inert control is preferred. For formulations within pills or sachets, a low dose of highly digestible ingredients (such as maltodextrin or corn starch) or slowly fermentable fibre (such as microcrystalline cellulose) are acceptable placebos, which enables double blinding. For interventions composed of a food or beverage, the control group must be carefully considered, including differences in flavour, texture and ***nutrient*** content. These factors will also determine whether the study can be considered as a single-blinded or double-blinded design.

Outcome

A synbiotic requires both a health outcome and a microbiota outcome in the same study. Primary and secondary health outcome(s) must be clearly specified. The microbiota outcome should be hypothesis-driven and provide insight into the microbiota-mediated mechanisms underlying the health outcome. Outcomes may include the abundance and viability of the administered live microorganism, changes in overall microbiota and/or microbiome composition, abundance of specific taxa and/or strains, microbial-derived metabolites, or others. Metabolomic analysis could also be performed using liquid chromatography–mass spectrometry, nuclear magnetic resonance or other suitable methods.

***Statistics***

A statistician’s involvement in the design phase of a study will provide confidence that the sample size is sufficient for the defined outcomes using intention-to-treat analysis. Mediation analyses might be useful to assess whether microbiota effects are contributing to the health benefit. Ancillary analyses, which could include population subgroups, responders versus non-responders or exploratory microbiota analyses should be pre-specified.

Finally, as with all trials, funding sources should be transparently reported, AEs must be carefully recorded and reported, and study design, execution and reporting should comply with CONSORT guidelines to minimize study bias.

Designing a synbiotic trial

There are multiple ways to design a synbiotic trial intended to examine health effects in the target host. Here, we provide some recommendations based on the criteria established herein to demonstrate complementary or synergistic synbiotics. Pre-specified subgroup analyses should be considered based on the relevant clinical factors (such as sex and age), baseline gut microbiota factors, dietary factors (such as typical dietary fibre intake) or other relevant factors (such as responder analysis). The number of experimental groups or ‘study arms’ required to prove efficacy and support mechanistic understanding will depend on the existing level of evidence for the component live microorganism(s) and selectively utilized substrate(s) as well as the researchers’ intent to determine whether components of the test mixture are complementary or acting as synergistic synbiotics (Table ).

When selecting the study design and determining the duration of the intervention and (if applicable) of the wash-out period, general recommendations are difficult to make. Factors that will impact these decisions include the live microorganism dose and its ability to persist in situ as well as the characteristics of study subjects; for example, in elderly individuals or persons with slow intestinal transit time, a longer wash-out period could be required compared with a study conducted in younger individuals. Parallel arm designs would be appropriate for studies that aim to demonstrate improvements in metabolic health measures, such as of adiposity or glycaemic control, as these outcomes typically require longer-term interventions (that is, 12 weeks or more). Gut microbiota changes can be rapid (within days). Currently, changes in the gut microbiota and microbial metabolites, such as short-chain fatty acids, are not accepted by regulatory bodies as measures of a health outcome.

Responders and non-responders among study participants in intervention studies with probiotics and prebiotics are commonly observed, which could justify including the probability of a positive response as a study end point. In the context of synbiotics, non-responders include individuals for whom little or no change in gut microbiota composition and/or clinical end point occurs compared with placebo. Various reasons for the non-responder phenotype include limited available niches for desired gut microorganisms (either native or introduced as probiotics), limited substrates to support microbial growth, host immune system expressing intolerance for specific microorganisms or a lack of specific microorganisms in the host microbiota. Although many scenarios of formulations for synbiotics can be conceived, we provide both actual and hypothetical examples to illustrate the concept (Box ).

Trials for synergistic synbiotics

Studies on a synergistic synbiotic that compare the synbiotic to the control can provide supportive evidence but do not constitute the primary evidence needed to confirm a synergistic synbiotic. Instead, a study including the combination, the substrate alone, the live microorganisms alone and a control should be conducted. Using an appropriate statistical model, the aim is to demonstrate that the combined effect is better than the estimated effects of each component separately. Evidence of selective utilization of the substrate by the co-administered live microorganism must be obtained from the same trial demonstrating the health benefit.

Trials for complementary synbiotics

A two-arm parallel or crossover study would be sufficient to test a complementary synbiotic. The aim is to demonstrate that the combination is better than the placebo group with a relevant health end point. As a demonstrated prebiotic is used to formulate a complementary synbiotic, we do not require that selective utilization by the indigenous microbiota be reconfirmed in this clinical trial.

Measurement of selective utilization

Measurement of selective utilization by the microbiota might involve different approaches, including both in vitro model systems and in vivo studies in the target host. For example, selective utilization of a substrate could be demonstrated experimentally using well-established in vitro gut models that include measurement of substrates and products during a prescribed time course. Ultimately, however, studies must be done in the target host to show that specific microorganisms or taxa had been enriched or their activity enhanced by a particular substrate. For synergistic synbiotics, methods that quantify the live microorganism should be used to show that the target strain has indeed been enriched and other suitable methods can be used to show that its function has been enhanced. Microbiota features that are useful to measure can include characterization of the overall gut microbial community and microbiota diversity, abundance and/or activity of specific taxa, microorganism–microorganism or microorganism–host proximity, the presence and/or abundance of specific microbial genes or gene clusters of interest, and/or metabolite concentrations.

Safety measures for synbiotics

Prebiotics and probiotics tested to date have a strong safety record–, and synbiotics formulated with them might also be presumed safe for the same intended uses. However, novel formulations must be suitably assessed for safety. Unfortunately, historically, many probiotic and prebiotic intervention trials have not adequately reported the types and frequency of AEs or serious AEs, perhaps owing to expectations that, as food ingredients, these products were inherently safe or that AEs could be due to failure to comply with norms for reporting harms in RCTs. Nonetheless, clear guidance for reporting AEs and serious AEs is provided by CONSORT and these standards should be followed. Describing such events as “unrelated to the study product”, without justification for this statement, is unacceptable.

A systematic review of 384 interventions involving prebiotics, probiotics and synbiotics found that no safety-related ***data*** were reported in 37% of the RCTs and 89 studies only used generic statements to describe AEs. Up to 98% of studies did not provide a definition of AEs or serious AEs, the number of participant withdrawals due to AEs, or the number of AEs and serious AEs per study group. Taken together, these results are evidence that some studies inadequately ***collect*** or report ***data*** on AEs. van den Nieuwboer and colleagues,– reviewed the AEs reported in studies with probiotic and synbiotic interventions and classified them according to the Common Terminology Criteria for Adverse Events system; they found that the incidence of AEs in each category was either no different from or often lower in the control groups than in the treatment group.

Thorough safety assessment of a synergistic synbiotic requires consideration that the added microorganism will express enhanced functionality in the presence of a targeted substrate such as improved growth or altered metabolic or physiological activity in vivo. This aspect suggests that safety assessments conducted on the live microorganism in isolation might not be sufficient to enable a conclusion about its safety when paired with a substrate that alters physiology or might in effect alter the dose delivered in vivo. Implications of such an interaction should be considered when assessing the safety of synergistic synbiotics.

Implications of this consensus

The panel recognizes the importance of developing a scientifically valid definition of the term synbiotic. The intention is to provide clarity for a diverse range of stakeholders, including consumers, regulators, health-care providers, researchers, industry and scientific organizations communicating about synbiotics. Table  is designed to clearly lay out the criteria for synbiotics in comparison to probiotics and prebiotics. Within the commercial supply chain, many different industry sectors, including ingredient suppliers, end-product manufacturers and retailers are very interested in how synbiotics are defined. As synbiotic products are being used more frequently in clinical trials, it is incumbent upon scientists to clarify the appropriate use of this term as has been done for the terms ‘probiotic’ and ‘prebiotic’.

Minimum criteria to appropriately use the terms ‘probiotic’, ‘prebiotic’ and ‘synbiotic’

| **Substance** | **Safe for intended use** | **Identity characterized** | **Scientifically valid name** | **Strain designated** | **Microorganism deposited in international culture *collection*** | **Mechanism of action linked to microbiota** | **Selective utilization of substrate** | | **Study in target host demonstrating both:** | | **Proper conditions of use** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **By resident microbiota** | **By co-administered live microorganism** | **Health benefit** | **Selective utilization of substrate** |
| Probiotic | ? | ? | ? | ? | ? | NA | NA | NA | ? | NA | ? |
| Prebiotic | ? | ? | ? | NA | NA | ? | ? | NA | ? | ? | ? |
| Synbiotic |  |  |  |  |  |  |  |  |  |  |  |
| Complementary synbiotic | ? | ? | ? | ? | ? | ? | ? | ?a | ? | NR | ? |
| Synergistic synbiotic | ? | ? | ? | ? | ? | ? | ?a | ? | ? | ? | ? |

Probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit on the host. A prebiotic is a substrate that is selectively utilized by host microorganisms conferring a health benefit. Synbiotics are a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host. A complementary synbiotic is a mixture of a probiotic plus a prebiotic. A synergistic synbiotic is a synbiotic in which the substrate is designed to be selectively utilized by the co-administered microorganisms. A synbiotic must meet the evidence required for either complementary or synergistic synbiotics. All substances should be made available to the scientific community for validation of research findings. aThe intent of a synergistic synbiotic is for the substrate to support the growth and/or activity of the co-administered live microorganisms but selective utilization by the resident microbiota is not a disqualifier. The prebiotic component of a complementary synbiotic must be selectively utilized by the resident microbiota, but if it is also utilized by the co-administered probiotic, it is not a disqualifier. NA, not applicable; NR, not required.

Although the term ‘synbiotic’ might not be as well recognized as probiotics and prebiotics, it is nonetheless found on product labels, in popular press articles and in the scientific literature. The first mention of a synbiotic was in 1995 yet, according to PubMed searches, in 2019, 269 papers were published using the term. Consumer exposure is expected to increase. Thus, it is hoped that the definition herein is clear and widely accepted and will counter misuse of the term, including by scientists. Table  provides the minimum criteria for the correct use of terms associated with synbiotics.

The importance of context

The panel urges stakeholders to carefully consider context for communications to consumers on the health benefits of synbiotics. The overall impression of any communication should lead consumers to understand the claim in a manner that is consistent with the evidence; any misleading use of the term constitutes misuse. Communication of the tested health benefit must accurately reflect what was reported in the clinical trial; results should not be extrapolated to health conditions, populations or synbiotics that have not been studied.

Regulators

Regulatory authorities are primarily focused on two issues: product safety and product labelling. These encompass both truthfulness and compliance with regulatory statutes. Even if the term synbiotic is not included in governmental guidelines or regulations, the use of our proposed scientific definition of the term will aid regulatory oversight of products labelled as ‘synbiotic’.

Regulatory statutes will differ with regard to geographical regions, regulatory categories, types of allowable claims and premarket approval. Furthermore, different standards exist for manufacturing, efficacy and safety depending on geographical region and product category. The term synbiotic does not stipulate a regulatory category, so (simply stated), regulatory requirements for a synbiotic would need to meet those that apply to the category (for example, drug, food or supplement) of the marketed product.

Regulatory complications can result in regions that impose probiotic-specific regulations. For example, Canada,, Italy, Argentina, Chile, Colombia and Brazil have requirements specific to probiotic foods or supplements. Furthermore, there is a proposal under consideration by Codex Alimentarius that could result in probiotic-specific global standards. The Codex Alimentarius is a ***collection*** of standards, guidelines and codes of practice adopted under the auspices of the Food and ***Agricultural*** Organization of the United Nations and World Health Organization to protect consumer health and promote fair practices in food trade. Codex Alimentarius standards could affect probiotic products traded globally. Could product manufacturers potentially avoid these regulations by labelling a product as a synbiotic? Without the use of the term probiotic or prebiotic, relevant specific regulations would not be triggered. Perhaps this approach would not provide a marketing advantage, as consumer recognition and demand for synbiotic products is currently not as advanced as for probiotics and prebiotics. However, regions supporting probiotic-specific (or prebiotic-specific) regulations will need to address how the concept of synbiotics fits into those regulations. Our stipulation is that manufacturers of complementary synbiotics should meet current probiotic or prebiotic regulations.

One regulatory consequence of probiotic and prebiotic definitions is that the European Union has determined that labelling a food product as such amounts to an implied health claim. As health claims in the European Union must be approved, the use of ‘probiotic’ or ‘prebiotic’ on a food label is subject to a health claim approval process. Despite controversy surrounding this situation, we can expect that the European Union might adopt a similar position for the use of the term ‘synbiotic’ because it also requires evidence of a health benefit.

Scientists

Synbiotics present challenges for researchers, including deciphering mechanisms underlying the health benefit and proving that the microbiota are modulated via complementary or synergistic means. Unless appropriate experimental methods of verification are used, the product under assessment should not be referred to as ‘synbiotic’.

As for probiotics, prebiotics and synbiotics, it might be possible a priori to stratify study participants to enhance either the magnitude of the response or the number of responders to a given synbiotic treatment. The baseline composition of gut microbiota of study participants could be one useful stratification factor,. This stratification might improve mechanistic understanding of observed effects and could be useful for characterizing responders and non-responders. Ultimately, this approach could enable better translation of clinical trial outcomes to those who are likely to benefit.

Scientists involved in the publication process (authors, editors, reviewers) should use the term synbiotic correctly and reject erroneous or unsupported use of the term. Even if a given treatment fails to demonstrate an effect (that is, acceptance of the null hypothesis) in a well-conducted study, such results still warrant publication.

Industry

The business community plays a vital part in translating the outcomes of fundamental and clinical research into commercial products that can benefit consumers. To the extent that industry funds research, it is essential that studies adhere to well-established guidelines to manage conflicts of interest and minimize bias,. Further, industry bears the duty of responsible manufacture, quality control and marketing of synbiotic products. It is incumbent on industry to follow good manufacturing practices, engage in truthful labelling and product promotion as well as adhere to appropriate use of the term ‘synbiotics’.

Media

The media (TV, radio, newspapers, magazines, websites and social media) have an increasingly central role in communicating science. These efforts require commitment and skill to craft clear, simple messages that are true to the science. Too often, scientists or their institutions do not effectively translate complex research findings so that they can be understood by the lay public. At times, overextended or inflated representations of research findings can be communicated through official academic or journal press releases. Communicators are therefore encouraged to distinguish between association studies and those presenting causal evidence, to describe single studies in the context of the totality of evidence, to avoid overgeneralizing results (for example, from model organisms such as mice) and to note study limitations. This requirement is true for null studies as well as those suggesting benefits from the interventions being tested. In this context, the media should adopt the scientific definition of synbiotics herein.

Conclusions

This Consensus Statement provides a new definition for a ‘synbiotic’ based on review by a panel of experts. To summarize (Box ), a synbiotic is a mixture comprising live microorganisms and substrate(s) selectively utilized by host microorganisms that confers a health benefit on the host. Two categories of synbiotics are recognized. A complementary synbiotic is composed of a probiotic and a prebiotic that together confer one or more health benefits but do not require co-dependent function; the components must be used at doses that have been shown to be effective for the components alone. A synergistic synbiotic contains a substrate that is selectively utilized by the co-administered live microorganism(s). Synbiotic products are not confined to human applications but could also include companion animals and livestock. They might also be directed to specific subpopulations (age, sex, health status) of the target species. The definition can also be applied to intestinal or extra-intestinal microbial ecosystems. The hope is that, going forward, this updated definition will be utilized and that it will aid in advancing synbiotic research, improve stakeholder understanding and enable better communication to consumers.

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[***Blood meal source and mixed blood-feeding influence gut bacterial community composition in Aedes aegypti***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:693W-H7S1-F129-P3B3-00000-00&context=1516831)

Parasites Vectors

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**Body**

Background

Blood-feeding arthropods such as ticks, mosquitoes, sand flies and black flies are among the most studied group of animals due to their role in the transmission of pathogens and parasites of medical and economic significance. The majority of arthropod-borne pathogens and parasites infect multiple host species, and due to heterogeneities in host species’ abundance, exposure and susceptibility to infection, certain host species contribute disproportionately to pathogen transmission [–]. For example, the intensity and timing of peak West Nile virus (WNV) infection rates in the northern house mosquito, Culex pipiens pipiens, is primarily driven by its preference to feed on the American robin, Turdus migratorius []. Similarly, shifts in tick feeding from the highly infectious white-footed mice, Peromyscus leucopus, to other mammalian host species has the potential to reduce the prevalence of Lyme disease in humans and ticks []. Therefore, host selection patterns by blood-feeding arthropods are key determinants of epidemiological dynamics for vector-borne pathogens and are typically used to understand the natural transmission dynamics, predict disease risk and inform disease surveillance and control efforts.

An important but overlooked aspect of vector host-feeding preferences that has the potential to alter the dynamics of vector-borne diseases is its impact on arthropods’ gut microbial communities. It is well established that some bacterial species within the arthropod body, especially the gut, enhance vector longevity and reproductive fitness, modulate insecticide resistance and modify vector susceptibility to pathogens [–]. Factors that disrupt the composition of these microbial communities may therefore indirectly alter pathogen transmission dynamics by modifying the components of vectorial capacity, including vector competence, daily survivorship, vector density and biting rates. Recent studies have revealed that factors such as arthropod host species, sex, body size, site of ***collection***, stage of development, larval environment, infection with pathogens, genetic background and exposure to xenobiotics can have a strong influence on the gut microbiota of arthropod vectors [–]. Host blood-meal source has also been shown to strongly influence the microbial composition and diversity within the arthropod body, but remains an understudied topic [–]. Although vector-feeding on multiple host species within the same gonotrophic cycle is fairly common in nature [–], the impact of mixed blood meals on vector gut microbial communities remains poorly understood.

Adult females of many mosquito species require a blood meal to obtain essential ***nutrients*** for egg maturation. Although different mosquito species are known to preferentially feed on certain vertebrate animal species, mixed blood-feeding within the same gonotrophic cycle is also commonly reported in many mosquito species [–, , –]. For this reason, many mosquito species provide an excellent model system for studying how mixed blood meals affect the composition and structure of gut microbial communities in arthropod vectors.

In this study, we used the yellow fever mosquito, Aedes aegypti, to examine how the gut microbiota of an arthropod vector responds to mixed blood meals. Although this mosquito species is mostly known for its anthropophilic tendency, this behavior can vary markedly across geographic regions, with some populations exhibiting a zoophilic tendency and feeding on multiple vertebrate host species in a single gonotrophic cycle [–]. For example, a recent study in western Kenya revealed that only 4% of blood-engorged Ae. aegypti had fed on humans, with rock hyraxes, goats, cattle, hippopotamuses, and rock monitor lizards accounting for 79, 9, 4, 1 and 1% of the total blood meals, respectively []. Adult females of Ae. aegypti were artificially fed on blood from either chicken, rabbit or their mixture and their gut microbiota profiled 7 days post blood meal. This study improves current understanding of the impact of host blood-meal source on microbiome variation in arthropod vectors and provides an opportunity for further studies on how vector host-feeding patterns may affect pathogen acquisition and transmission.

Methods

Experimental design

The study was conducted using a laboratory colony of Ae. aegypti (Rockefeller strain) that was reared and maintained using our previously described methods []. Larvae of this colony are routinely maintained on a diet containing 1:1:1 mixture of rabbit chow, Tetramin fish food and liver powder, and adults are artificially blood-fed on bovine blood. Thirty-six newly emerged adults were sacrificed, and their midguts processed as described below to determine the baseline microbial community composition prior to sugar-feeding and blood-feeding. Other newly emerged adults were housed in plastic cages in batches of approximately 300 individuals and provided access to 10% sucrose solution. Adult females aged 3 to 5 days were sugar-starved for 24 h and provided access to one of the following treatments: continuous supply of 10% sucrose solution, or 1-h access to chicken blood, rabbit blood or an equal mixture of chicken and rabbit blood (Hemostat Laboratories, Dixon, CA, USA). Blood-feeding was accomplished using the artificial blood-feeding system described in Muturi et al. []. Blood-fed females from each blood meal treatment were sorted on a chill table, transferred to a new cage and provided continuous access to the 10% sucrose solution. The sucrose solution was replaced every 2 days to prevent fungal growth. At 7 days after blood-feeding, the midguts of sugar-fed and blood-fed adult females were dissected as described below. Overall, midguts were dissected for five treatment groups, including newly emerged adults (NE), sugar-fed adults and adults fed on one of three blood meal types; chicken blood, rabbit blood or a mixture of chicken and rabbit blood (combined).

DNA extraction, library preparation and sequencing

Mosquito samples were cold anesthetized and surface-sterilized to remove surface bacteria before midgut dissections. Surface-sterilization consisted of a 10-min rinse in a 2% bleach solution, followed by two 5-min rinses in 1× sterile phosphate buffered saline (PBS), a 5-min rinse in 70% ethanol and two rinses in sterile ultrapure distilled water (Invitrogen, Grand Island, NY, USA). Each midgut was dissected on a drop of 1× PBS, and three midgut samples were pooled into sterile microcentrifuge tubes containing 100 μl of sterile PBS. Twelve midgut pools were processed for each treatment for a total of 60 samples. Total DNA from each midgut pool was extracted using the DNeasy Blood and Tissue Kit (Qiagen, Valencia, CA, USA) according to manufacturer’s instructions. Amplification of the V3-V4 region of the 16S rRNA gene was accomplished using the primer set V3-V4F (5′-TCGTCGGCAGCGTCAGATG-TGTATAAGAGACAGCCTACGG-GNGGCWGCAG-3′) and V3-V4R (5′-GTCTCGTGG-GCTCGGAGATGTGTATAAGAGACAGGACTACHVGGGTATCTAATCC-3′), with the Illumina Nextera overhang adapter sequences (in bold) added to the locus-specific primer sequences as provided in the Illumina 16S metagenomic sequencing library preparation protocol (Illumina, Inc., San Diego, CA, USA). The PCR mixture (25 µl) consisted of 2.5 µl of template DNA (5 ng/µl), 5 µl each of forward and reverse primers (1 µM) and 12.5 µl of 2× KAPA HiFi HotStart ReadyMix (Kapa Biosystems, Roche Holding AG, Basel, Switzerland). Amplification conditions included an initial denaturation at 95 °C, 3 min; then 95 °C/30 s, 55 °C/30 s, 72 °C/30 s for 35 cycles; and a final extension at 72 °C for 5 min. The PCR amplicons were cleaned using AMPure XP beads, and a second PCR was conducted to attach dual indices and Illumina sequencing adapters using the Nextera XT Index Kit. The second PCR was conducted in a 50-µl reaction volume containing 5 µl of DNA from amplicon PCR, 5 µl each of N7 and S5 Nextera XT Index primers, 25 µl of 2× KAPA HiFi HotStart ReadyMix and 10 µl of PCR grade water. Thermocyling conditions for the index PCR were identical to those of amplicon PCR except for the number of cycles (8 cycles vs. 35 cycles for amplicon PCR). A second clean-up was conducted using AMPure XP beads before the PCR amplicons were quantified, pooled and normalized. The pooled library was mixed with Phix control spike-in of 5% as a sequencing control. Sequencing was performed on an Illumina MiSeq system using the MiSeq V3 2 × 300 paired-end sequencing kit. Demultiplexed reads were examined using the CLC genomics workbench v20.0 (Qiagen Inc., Valencia, CA, USA) and low-quality reads and chimeras were removed. The reads were then paired and trimmed to fixed length, and then the CLC Microbial Genomics module was used for operational taxonomic unit (OTU) clustering. The SILVA rRNA gene database project was used to assign OTUs at 97% sequence similarity [].

Statistical analyses

R version 3.3.2 ([*https://cran.r-project.org/bin/windows/base/old/3.2.3/*](https://cran.r-project.org/bin/windows/base/old/3.2.3/)) and the paleontological ***statistics*** software package (PAST) version 3.14 [] were used for statistical analyses. All singletons were discarded before downstream analyses as they may have resulted from sequencing errors []. Ten samples that had < 1538 sequences were also excluded from downstream analysis. Alpha and beta diversity analyses were conducted using the entire dataset (considering all sequences) as well as rarefied dataset (1538 reads per sample) to mitigate biases arising from different sampling depths across samples. The ‘vegan’ package in R [] was used to compute the alpha diversity metrics, including the Shannon diversity index and observed OTUs (richness), and the non-parametric Kruskal–Wallis test was used for statistical comparisons between treatments. Linear contrasts were used to test the mixing of blood for additivity. Mean values for observed OTUs (OTU richness) and the Shannon diversity index in the mixed blood meal treatment were compared to those of the single blood treatments. The effect was classified as additive if the contrast was not significant and synergistic if the effect of blood mixture was significantly greater than the sum of separate effects. Non-metric multidimensional scaling (NMDS) with Bray–Curtis similarity matrix values was conducted using the ‘vegan’ package. NMDS plots to visualize within-group and between-group differences in bacterial communities were generated using the ‘vegan’ package. Stress values were used to assess the quality of NMDS representation; stress values < 0.2 are considered a good representation of the ***data*** and those > 0.3 are not considered to be valid []. The permutational multivariate analysis of variance (PERMANOVA) test with 9999 permutations was conducted in PAST version 3.14 to determine the statistical significance. Indicator species analysis was conducted using the ‘indicspecies’ package to determine the bacterial genera that were strongly associated with each treatment []. Rarefaction curves to determine the sequencing coverage for each treatment were generated using the ‘vegan’ package.

Results

After merging the paired end reads, MiSeq sequencing of the 16S rDNA amplicon generated 635,605 sequences from 60 pools of mosquito samples. Reads per pool of mosquito samples ranged from 41 to 69,568 sequences. Rarefaction curves for the entire dataset and the rarefied dataset indicated that the microbial communities of mosquitoes fed on chicken blood were adequately recovered, but the curves for the remaining treatments did not reach a plateau, suggesting that most but not all microbiota were detected (Fig. ). Fifty mosquito pool samples were retained for downstream analysis after quality filtering and rarefaction to an even depth of 1538 sequences per sample. Overall, a total of 113 OTUs belonging to 46 genera were identified at the 97% cutoff threshold. The total number of OTUs identified by sample type were 66 OTUs in newly emerged adults, 58 OTUs in sugar-fed mosquitoes, 21 OTUs in mosquitoes fed on chicken blood, 39 OTUs in mosquitoes fed on rabbit blood and 58 OTUs in mosquitoes fed on a mixture of chicken and rabbit blood. Venn diagram comparing the overlap of OTUs between mosquitoes fed on chicken blood, rabbit blood and a mixture of chicken and rabbit blood revealed eight OTUs that were shared among the three treatments and two, 15 and 29 OTUs that were unique to mosquitoes fed on chicken blood, rabbit blood and a mixture of chicken and rabbit blood, respectively (Fig. ).

Rarefaction curves for mosquitoes from different treatments generated using (a) the entire dataset and (b) the rarefied dataset

Venn diagram summarizing the overlap of bacterial operational taxonomic units among mosquitoes fed on chicken blood, rabbit blood or a mixture of chicken and rabbit blood (Combined)

Significant treatment differences in bacterial OTU richness and diversity were observed (Table ). Bacterial OTU richness was significantly higher in mosquito samples fed on mixed blood meals than in those fed on chicken blood alone (Kruskal–Wallis test: χ2 = 18.011, df = 4, P = 0.0012). There was no significant difference in OTU richness between newly emerged mosquitoes and mosquitoes fed on sugar, chicken blood or rabbit blood. Similarly, OTU richness was not significantly different between newly emerged mosquitoes and mosquitoes fed on sugar, rabbit blood or a mixture of rabbit and chicken blood. Shannon diversity index indicated that the microbial communities of mosquitoes fed on either sugar, rabbit blood or a mixture of chicken and rabbit blood were significantly more diverse than those of mosquitoes fed on chicken blood (Kruskal–Wallis test: χ2 = 32.087, df = 4, P < 0.0001). Mosquitoes fed on sugar and rabbit blood also had significantly higher Shannon diversity index compared to newly emerged mosquitoes. The test for additivity revealed a synergistic effect of blood meal mixture on both OTU richness (t = − 5.073, df = 16.95, P < 0.00001) and Shannon diversity index (t = − 2.535, df = 26.25, P = 0.0176). Alpha diversity results for the entire dataset were mostly identical to those for the rarefied dataset, thereby confirming that rarefaction did not lead to a loss of information (Table ).

Diversity of bacterial communities in the midguts of adult females of Aedes aegypti

| **Treatment** | **No. of mosquito pools (initial)** | **No. of mosquito pools (final)** | **Rarefied *data* (1538 sequences)** | | **All *data*** | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **OTU richness** | **Shannon diversity** | **OTU richness** | **Shannon diversity** | **Total sequences** |
| Chicken | 12 | 10 | 11.70 ± 0.33a | 0.50 ± 0.02a | 17.60 ± 0.58 | 0.50 ± 0.02 | 15,165.1 ± 814.29 |
| Combined | 12 | 12 | 17.58 ± 0.91b | 1.26 ± 0.11bc | 25.08 ± 1.38 | 1.26 ± 0.11 | 6038.75 ± 923.05 |
| Newly emerged adults | 12 | 10 | 14.20 ± 1.91b | 0.71 ± 0.13ac | 20.30 ± 1.66 | 0.71 ± 0.09 | 13,945 ± 6727.96 |
| Rabbit | 12 | 8 | 13.25 ± 0.92b | 1.35 ± 0.05b | 22.38 ± 1.83 | 1.36 ± 0.05 | 12,147.38 ± 4739.73 |
| Sugar | 12 | 10 | 16.50 ± 1.48ab | 1.55 ± 0.08b | 26.44 ± 2.36 | 1.55 ± 0.08 | 15,530.6 ± 5066.28 |

Values are presented as the mean ± standard error (SE) unless indicated otherwise. Statistical analysis was conducted for rarefied ***data*** only. Values with different lower case values within a column are significantly different at P ≤ 0.05

There were three individuals per pool

The top nine genera accounted for 96.12 and 96.86% of the total sequences in newly emerged adults and sugar-fed adults, respectively, compared to 99.97, 99.14 and 98.70% of the total sequences in adults fed on blood from chicken, rabbit and chicken–rabbit blood mixture, respectively. The relative abundance of these genera varied markedly across treatments (Fig. ). The five most abundant genera in newly emerged adults were Aeromonas spp. (59.09%), Leucobacter spp. (20.81%), Ralstonia spp. (12.11%), Serratia spp. (1.80%) and Enterobacter spp. (1.68%), collectively accounting for 95.48% of the total sequences. In sugar-fed adults, the five most abundant genera accounted for 96.55% of the total sequences and included Serratia spp. (60.83%), Aeromonas spp. (29.25%), Pseudomonas spp. (4.39%), unclassified Burkholderiaceae (1.63%) and Enterobacter spp. (0.45%). In mosquitoes fed on chicken blood, the topmost abundant bacterial genera were Pseudomonas spp. (91.43%), Stenotrophomonas spp. (3.75%), Ralstonia spp. (2.12%), Serratia spp. (1.97%) and Aeromonas spp. (0.69%), collectively accounting for 99.95% of the total sequences. Serratia spp. (75.15%), Aeromonas spp. (22.83%), Pseudomonas spp. (1.13%) and unclassified Burkholderiaceae (0.03%) were the most abundant genera, accounting for 99.14% of the total sequences. Mosquitoes fed on a mixture of chicken and rabbit blood were dominated by Aeromonas spp. (51.74%), Pseudomonas spp. (20.72%), unclassified Acetobacteraceae (13.36%), Enterobacter spp. (7.68%) and unclassified Burkholderiaceae (2.39%), collectively accounting for 95.88% of the total sequences. The results for the whole ***data*** set were identical to those for the rarefied ***data*** (Additional file : Fig. S1).

Relative abundances of bacterial taxa associated with newly emerged mosquitoes (NE), sugar-fed mosquitoes and mosquitoes fed on chicken blood, rabbit blood or a mixture of chicken and rabbit blood (Combined)

Indicator species analysis identified some bacterial taxa that were significantly associated with specific treatment groups (Table ). Leucobacter spp. and Sphingobacterium spp. were significantly associated with newly emerged adults while Pseudomonas spp. and Stenotrophomonas spp. were significantly associated with mosquitoes that fed on chicken blood. Rahnella spp. and Actinotignum spp. were significant indicator species for mosquitoes fed on rabbit blood, while unclassified Acetobacteraceae was a significant indicator species for mosquitoes fed on a mixture of chicken and rabbit blood. A few bacterial taxa, including Aeromonas spp., Serratia spp., Burkholderiaceae and Enterobacteriaceae, were significantly associated with more than one treatment group (Table ). No indicator species were identified for sugar-fed mosquitoes.

Indicator species for adult Ae. aegypti fed on different diet types

| **Treatment** | **Bacterial taxa** | **Indicator value** | ***P* value** |
| --- | --- | --- | --- |
| Newly emerged adults | *Leucobacter* spp. | 0.476 | 0.0036 |
| *Sphingobacterium* spp. | 0.372 | 0.0401 |  |
| Chicken blood | *Pseudomonas* spp. | 0.967 | < 0.001 |
| *Stenotrophomonas* spp. | 0.930 | < 0.001 |  |
| Rabbit blood | *Rahnella* spp. | 0.436 | 0.0307 |
| *Actinotignum* spp. | 0.434 | 0.0239 |  |
| Combined | Acetobacteraceae | 0.538 | < 0.001 |
| Newly emerged mosquitoes + Combined | *Aeromona*s spp. | 0.619 | < 0.001 |
| Sugar + Combined | Burkholderiaceae | 0.641 | < 0.001 |
| Sugar + Rabbit | *Serratia* spp. | 0.913 | < 0.001 |
| Enterobacteriaceae | 0.624 | < 0.001 |  |

Analysis was performed using the rarefied ***data*** set

NMDS analysis using the rarefied dataset (Stress = 0.128; Fig. ) and the entire dataset (Stress = 0.152; Additional file : Fig. S2) revealed a strong effect of treatment on the gut bacterial communities of Ae. aegypti. Bacterial communities within each treatment clustered together and were more similar than bacterial communities between treatments. The only exception to this observation was between bacterial communities of sugar-fed mosquitoes and mosquitoes fed on rabbit blood, which clustered together. PERMANOVA analyses confirmed that the observed differences in microbial communities between sample types were statistically significant with exception of comparisons between sugar-fed mosquitoes and mosquitoes fed on rabbit blood (F = 27, P = 0.0001; Table ).

Non-metric multidimensional scaling (NMDS) ordination of Bray–Curtis distances between bacterial communities from newly emerged mosquitoes (NE), sugar-fed mosquitoes and from mosquitoes fed on chicken blood, rabbit blood or a mixture of chicken and rabbit blood (Combined)

Permutational multivariate analysis of variance results comparing treatment differences in microbial communities

| **Treatments** | **Chicken** | **Combined** | **Newly emerged mosquitoes** | **Rabbit** |
| --- | --- | --- | --- | --- |
| Chicken |  |  |  |  |
| Combined | 60.64 |  |  |  |
| Newly emerged adults | 36.61 | 5.963 |  |  |
| Rabbit | 178.3 | 33.11 | 13.47 |  |
| Sugar | 111.4 | 23.54 | 11.77 | 1.272 |

All pairwise comparisons were significant at P < 0.01 after Bonferroni corrections for multiple comparison, with the exception of comparisons between sugar-fed mosquitoes and mosquitoes fed on rabbit blood

Discussion

Although it is well known that disease vectors can blood-feed on multiple vertebrate hosts within the same gonotrophic cycle [–] and that the blood meal source can have a strong impact on vector microbiota [–], the impact of mixed blood meals on vector microbiota remains poorly understood. This study focused on how mixed blood meals affect the dynamics of gut microbiota in mosquitoes. We specifically focused on the impact of the chicken and rabbit blood mixture based on our previous findings that blood meals from the two vertebrate host species have variable effects on gut microbiota of Ae. aegypti []. Although this simplified model system may not be a perfect representation of the complex system that occurs in nature, it highlights the need for further studies to decipher the ecological and epidemiological impact of mixed blood feeding by different mosquito species and other hematophagous arthropods. Overall, our results show that blood meal source and mixed blood-feeding are key factors influencing the dynamics of gut microbiota in Ae. aegypti and likely other mosquito species also.

Blood meal source had a significant impact on microbial community composition and structure. Microbial communities of mosquitoes fed on blood from chicken, rabbit or their mixture clustered separately from each other and from those of newly emerged adults. The distance separating the microbial communities of mosquitoes fed on chicken versus rabbit blood was greater than the distance separating the microbial communities of mosquito samples fed on single-host blood meals (i.e. chicken or rabbit blood) versus mosquito samples fed on a mixture of chicken and rabbit blood. Compared to chicken blood, mammalian blood has higher amounts of hemoglobin, hematocrit and total protein [], and mixing the two blood types may narrow the compositional differences. However, additional studies are needed to examine how mixing blood from different host species affects the nutritional composition and quality of the blood meal.

Mixing chicken and rabbit blood likely increased the diversity of distinct molecules available for utilization by some specialist bacteria that were better adapted to utilize resources from either chicken or rabbit blood meals as well as some generalist bacteria that were able to consume and metabolize the diverse molecules available in mixed blood meals. For example, Pseudomonas spp. and Serratia spp. were the dominant bacterial taxa in mosquito samples fed on chicken and rabbit blood meals, respectively, but they occurred in much lower abundance in mosquitoes fed on mixed blood meals. In contrast, Aeromonas spp., unclassified Acetobacteraceae, Enterobacter spp. and unclassified Burkholderiaceae were more abundant in mosquitoes fed on mixed blood meals and were either less abundant or absent in mosquitoes fed on chicken or rabbit blood meals. Suppression of Pseudomonas spp. and Serratia spp. in mosquitoes fed on mixed blood meals may therefore have created an open niche that was exploited by Aeromonas spp., unclassified Acetobacteraceae, Enterobacter spp. and unclassified Burkholderiaceae. Additionally, we detected 29 OTUs that were unique to mosquitoes fed on mixed blood meals, suggesting that mixed blood meals supported some bacterial taxa whose growth was limited in chicken and rabbit blood meals, respectively. The hydrolysis of hemoglobin during blood meal digestion is also known to produce large amounts of toxic oxidants, and some bacterial taxa are better adapted to cope with oxidative stress than others [, , ]. It is possible that the three blood meal treatments yielded different amounts of toxic oxidants given their expected differences in hemoglobin content, leading to differential elimination of some bacterial taxa. However, the impact of oxidative stress on bacterial communities was not investigated in this study.

It has long been established that resource concentration and composition are key determinants of species diversity and food web complexity, with the more concentrated and diverse resource supporting higher species’ diversity and productivity [–]. Some bacterial taxa are highly specialized in terms of their carbon use, and thus resource heterogeneity may promote microbial diversity through resource niche partitioning [, ]. There was no strong evidence that mixed blood meals promoted higher bacterial diversity and richness compared to blood meals from a single host species; gut bacterial diversity and richness in mosquitoes fed on mixed blood meals were not significantly different from those of mosquitoes fed on rabbit blood. However, mosquitoes fed on chicken blood had a significantly lower bacterial diversity, as shown by a significantly lower Shannon diversity index, than mosquitoes fed on blood from rabbit or a mixture of chicken and rabbit blood, and the test for additivity revealed a synergistic effect of blood mixture on both OTU richness and diversity. These findings suggest that chicken blood meal is a low-quality resource for some gut bacterial communities and that mixed blood meals from some vertebrate host species may offset this nutritional deficit.

Mosquitoes fed on sucrose and rabbit blood formed a single cluster that was separate from mosquitoes fed on chicken blood or a mixture of chicken and rabbit blood. We did not examine the mechanism(s) underlying this observation but can offer two possible explanations. First, the results may indicate that chicken blood and a mixture of chicken and rabbit blood cause long-term changes in gut microbial communities of the vector while rabbit blood causes transient changes in microbial communities that are later succeeded by sugar-utilizing bacteria once the blood meal is digested. Second, it is also possible that rabbit blood and sucrose supported similar bacterial communities. Additional studies capturing temporal changes in microbial communities in sugar-fed and blood-fed mosquitoes could be more revealing.

Newly emerged mosquitoes and mosquitoes fed on chicken blood had significantly lower bacterial diversity (Shannon diversity index) compared with sugar-fed mosquitoes and mosquitoes fed on rabbit blood. In our previous study using the same mosquito species (Ae. aegypti), the gut microbial communities of newly emerged adults and adults profiled 7 days after feeding on human blood were significantly more diverse than those of sugar-fed mosquitoes and mosquitoes fed on chicken, rabbit or human blood and profiled 3 days post blood meal []. A previous study by Wang et al. [] revealed that a blood meal from the U.S. National Institutes of Health (NIH) Swiss outbred mice drastically reduced the diversity of the gut bacterial community and favored enteric bacteria in Anopheles gambiae. These findings suggest that the impact of sugar-feeding and blood-feeding on mosquito microbiota is complex and can vary markedly even for the same mosquito species depending on the underlying microenvironmental conditions. Additional studies targeting multiple mosquito species and using multiple host blood-meal sources would provide more insights into how adult mosquito diet affects the diversity of gut bacterial communities.

The gut microbial communities observed in this study differ from those reported in our previous study in which we evaluated the impact of host blood-meal source on gut microbiota of Ae. aegypti []. We had expected the microbial communities from the two studies to be similar based on our previous findings that diverse laboratory colonies of Ae. aegypti reared in the same insectary harbor similar gut bacterial communities []. However, the two studies were conducted at different times of the year and had different experimental designs which may have accounted for the observed differences in microbial composition. In the current study, newly emerged adults were provided access to 10% sucrose for 3–5 days, sugar-starved for 24 h before blood-feeding and then dissected 7 days post blood meal. In contrast, newly emerged adults in our previous study were sugar-starved for 3 days before being sugar-fed or blood-fed, and dissections were done 3 days post blood meal []. Differences in experimental design and the timing of the two studies may have presented different microenvironments that impacted the type of microbes that colonized and thrived in the insectary. A recent study by Saab et al. [] found that different cohorts of mosquitoes reared under identical laboratory conditions differed in their microbial composition due to changes in the microenvironment of the insectary attributed to environmental microbes introduced by human activity.

Changes in the composition and abundance of gut microbiota of the vector in response to mixed blood meals has the potential to alter the transmission dynamics of vector-borne pathogens. Some of the microbial taxa disrupted by mixed blood meals, such as Pseudomonas spp., Serratia spp., Enterobacter spp. and Aeromonas spp., have been shown to affect vector susceptibility to parasites and pathogens. Isolates of Pseudomonas rhodesiae and Enterobacter ludwigii from the digestive tract of Ae. albopictus have been reported to inhibit La Crosse virus in vitro [], and in another study the abundance of Enterobacteriaceae was greater in the midgut of Anopheles gambiae infected with Plasmodium falciparum []. Serratia marcescens was observed to inhibit Plasmodium development within the midgut of Anopheles stephensi [, ] and secreted SmEnhancin protein that rendered Ae. aegypti highly susceptible to dengue virus []. Serratia odorifera and Aeromonas culicicola were found to enhance the susceptibility of Ae. aegypti to dengue virus [, ]. Anopheles albimanus Weidemann coinfected with Serratia marcescens, Enterobacter cloacae and Enterobacter amnigenus had significantly lower Plasmodium vivax infections compared with the controls, and mosquitoes coinfected with En. cloacae had lower oocyst density compared with the controls []. These findings suggest that shifts in gut microbiota in response to mixed blood meals have the potential to alter vector susceptibility to pathogens/parasites but that the direction of impact may vary across mosquito-borne disease systems. Thus, studies that examine how shifts in gut microbial communities of the vector in response to mixed blood meals affect mosquito life-history traits, such as fecundity, fertility, longevity and vector competence for different pathogens/parasites, are needed to provide a comprehensive understanding of the ecological and epidemiological implications of mixed blood meals on different mosquito-borne disease systems. Such studies may lead to the discovery of novel bacterial species that may limit transmission of vector-borne diseases either by inhibiting pathogen development within the vector or by suppressing vector populations through effects on longevity, fecundity or fertility. Previous studies have shown that host blood-meal source can have strong effects on mosquito fecundity, fertility and longevity [–], suggesting the potential for mixed blood meals to produce antagonistic, additive or synergistic effects on epidemiologically relevant life-history traits of the vector.

Conclusions

The results of this study show that mixed blood-feeding may alter the gut microbial composition in Ae. aegypti and may enhance the diversity of these microbes by offsetting the nutritional deficits of a low-quality host blood meal. Further studies are needed to determine how shifts in midgut bacterial communities in response to mixed blood-feeding affects the components of vectorial capacity. Additionally, future studies should examine how mixed blood feeding is likely to influence the bacterial taxa that are currently under investigation for potential application in symbiotic control of mosquito-borne diseases, such as Wolbachia spp. and Asaia spp.

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**Notes**

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[***RETRACTED ARTICLE: Optimization of oncolytic effect of Newcastle disease virus Clone30 by selecting sensitive tumor host and constructing more oncolytic viruses***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:6CDF-MNC1-JDK8-006M-00000-00&context=1516831)

Gene Therapy

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**Body**

Introduction

Newcastle disease virus (NDV) is an avian paramyxovirus with a negative single-strand RNA genome and it has been shown to be a potent oncolytic agent with an attractive safety profile in humans in phase I and II clinical trials [, ]. NDV exhibits several advantages when compared with other oncolytic agents in development []. First, NDV is an avian pathogen, more than half century application of the virus as an avian vaccine demonstrates a super genome stability []. Second, serological studies indicated that ~96% of the human population is seronegative for NDV, avoiding the problem of preexisting immunity in humans, which is potential problems with vaccinia virus, herpes simplex virus, and adenovirus []. Last, a wide variety of cancers can be treated by NDV due to ubiquitous nature of the NDV receptor []. However, despite the advantages discussed above, results from clinical trials are not satisfactory [–].

The oncolytic effect of NDV attributes to two aspects, one is the oncolytic ability of virus per se and other is the susceptibility of host cancer cells to virus infection. Previous studies showed that NDV is specific to all cancer cell lines from ecto-, endo-, and meso-dermal origin [] including the cells of colorectal, gastric, pancreatic, bladder, breast, ovarian, renal, lung, larynx, and cervical carcinomas, glioblastoma, melanoma, pheochromocytoma, lymphomas of different origins, fibrosarcoma, osteosarcoma, and neuroblastoma, but not normal cells [–]. However, our unpublished ***data*** showed the susceptibility of cancer cell lines to NDV infection was substantially different. We speculated that the susceptibility of different cancer cells to NDV infection may vary, it is necessary to conduct a systematic study on the susceptibility of cancer cells to NDV infection.

Another aim of the research is to enhance the oncolytic effect of existing NDV vectors via virus-engineering strategies. Numerous pieces of evidence indicate that the oncolytic capability of NDV in vivo is correlated to its ability to form syncytia in vitro []. The mesogenic strain Anhinga defined as lytic strain could be strong oncolytic virus due to induction of strong syncytia formation in vitro, while the lentogenic strain clone30 defined as non-lytic strain induces weak syncytia formation in vitro []. Many studies demonstrate that the hemagglutinin-neuraminidase (HN) and fusion (F) protein of NDV virion mediates the fusion of infected cells with their neighboring uninfected cells, production of syncytia and thus play essential roles in NDV-induced oncolytic effect [, ]. The F protein is a class I membrane protein present as a trimer in the virion, the cleavage site of the F protein is responsible for the major determinant of virulence and the formation of syncytia [, ]. The HN of NDV is a class II integral membrane protein, found as a tetramer in the virion, mediating receptor recognition of sialic acid at the end of host cell surface proteins []. Previous study showed that mutations at positions Asp198 and Arg174 reduced syncytial formation, suggesting that the HN gene plays a pivotal role in NDV-induced syncytial formation []. The interaction of HN and F proteins from the same viral strain is necessary for the most efficient function of receptor recognition and fusogenicity because the HN head domain carries the receptor-binding activities and the HN stalk domain harbors the site that determines the F protein specificity in promoting cell–cell fusion [, ]. Furthermore, previous study suggested that F and HN cooperatively disturb mitochondrial fusion–fusion homeostasis to enhance mitochondrial biogenesis, synergistically inducing significant syncytia formation accompanied with complete autophagic flux in DF-1 and A549 cells [, ]. But, the previous studies mainly focuses on the contributions of the F and HN proteins to pathogenicity and in vitro fusion activity, the roles of the F or HN on the oncolytic effect of NDV in vivo have yet to be studied.

Material and methods

Cell lines and cell cultures

Human lung epithelial carcinoma cells (A549), human breast cancer cells (MCF7), human neuroblastoma cells (SH-SY5Y), human colon cancer cells (LoVo), and African green monkey kidney cells (Vero) were purchased from ATCC. Human breast cancer cells (MDA-MB-231) was kindly offered by GS (College of Life Science, Northeast Forestry University). HepG2 cells which are perpetual cell line consisting of human liver carcinoma cells were purchased from China Peking Union Medical College (ATCC No. HB-8065). Mouse 4T1 breast cancer cells which is normally used to build a transplant-tumor mice model were kindly offered by GS (College of Life Science, Northeast Forestry University). BHK-21 cells were kindly offered by Prof. Karl-Klaus Conzenlmann (Max-von Pettenkofer Institut, Muenchen), Propagation of rescued viruses was performed on BHK-21 cell monolayers. Primary chicken embryo fibroblasts (CEF) were prepared from 9- to 11-day-old SPF chicken embryos. HepG2, MCF7, BHK-21, and CEF cells were maintained in Dulbecco’s modified Eagle’s medium supplemented with 10% (v/v) FBS, 1% (v/v) penicillin/streptomycin. MDA-MB-231, SH-SY5Y, A549, and 4T1 were maintained in RPMI 1640 supplemented with 10% (v/v) FBS, 1% (v/v) penicillin/streptomycin. LoVo cells were maintained in F-12K medium supplemented with 10% (v/v) FBS, 1% (v/v) penicillin/streptomycin. Vero cells were maintained in minimum essential medium medium supplemented with 10% (v/v) FBS, 1.0 mM sodium pyruvate, and 0.1 mM nonessential amino acids. All cell lines were authenticated using Short Tandem Repeat profiling, tested for mycoplasma contamination and grown at 37 °C humidified incubator with 5% CO2 atmosphere.

Viruses

Parental viruses Anhinga/U.S.(FL)/44083/93 (GenBank: AY562986.1) was kindly offered by Southeast Poultry Research Laboratory. The recombinant lentogenic NDV clone30 strain, the recombinant mesogenic Anhinga strain (referred to here as rClone30, rAnh), the recombinant lentogenic clone30 expressing red fluorescence protein (referred to here as rClone30-RFP), and the recombinant mesogenic Anhinga expressing red fluorescence protein (referred to here as rAnh-RFP) were engineered and rescued as previously described []. All recombinant Newcastle disease viruses (rNDVs) were propagated in embryonated chicken eggs.

To assess the role of F and HN gene in oncolytic effect, a reverse genetic system was developed using the lentogenic NDV Clone30 strain to provide backbone for gene exchange. Briefly, plasmids pClone30 was linearized by digesting with the restriction enzymes to release the F gene or HN gene of the pClone30 plasmids for substitution with that from the pAnh plasmid. The overlap PCR amplified cDNA spanning the complete coding regions of the F or HN genes plus the surrounding sequences of the pClone30 were digested with the same restriction enzymes and ligated into the pClone30 backbone, named pClone30-Anh(HN), pClone30-Anh(F), and pClone30-Anh(HN-F), respectively (Table ). The recombinant plasmid was subjected to sequence analysis to confirm the fidelity of the PCR insertion, as well as the intergenic transcription start and stop sequences and the gene order. Then the recombinant NDV virus was rescued as described by Bai et al. [], the recombinant plasmids were cotransfected with helper plasmids pBL-NP, pBL-P, and pBL-L (2000, 1000, 500, 250 ng, respectively) into BHK-21 cells stably expressing T7 RNA polymerase by Lipofectamine 3000 reagent. The virus was rescued and amplified by inoculation of the supernatant from the transfected cells into the allantoic cavity of specific-pathogen free chicken embryos. Viruses in HA-positive allantoic fluid were stored at −80 °C. After the second passage in eggs, viral RNA was extracted and the region containing the engineered molecular tag was amplified by RT-PCR using the forward primers and the reverse primers (P4, P5, P4a, and P5a, Table ). Then RT-PCR products were purified and sequenced to confirm that the rescued virus was generated from the infectious clone. The rescued viruses were named as rClone30-Anh(HN), rClone30-Anh(F), and rClone30-Anh(HN-F), respectively. The recombinant viruses rClone30, rClone30-RFP, and rClone30-Anh(HN) wee maintained in a solution containing 0.001% trypsin while the other viruses is not

The primers for HN gene amplification of moderately virulent strain and F gene amplification of moderately virulent strain, and primers of real-time PCR.

| **a. The primers for HN gene amplification of moderately virulent strain** | |
| --- | --- |
| **Primer name** | **Primer sequence (5??3?)** |
| Primer 1(P1) | GGCCTGAGAGGCCTTCAGAGAGTTAAGA |
| *Sfi*I |  |
| Primer 2(P2) | GACTACATGATCCATGATTGAGGACTGTTGTCGGT |
| Primer 3(P3) | CAACAGTCCTCAATCATGGATCATGTAGTCAGCAG |
| Primer 4(P4) | ATGGATCATGTAGTCAGCAG |
| Primer 5(P5) | TTAAACCCTGTCTTCCTTGA |
| Primer 6(P6) | TTATAATTGACTCAATTAAACCCTGTCTTCCTTGA |
| Primer 7(P7) | AGACAGGGTTTAATTGAGTCAATTATAAAGGAG |
| Primer 8(P8) | CGTACGAATGCTGCTGAACT |
| *Bsiw*I |  |

| **b. The primers for F gene amplification of moderately virulent strain** | |
| --- | --- |
| **Primer name** | **Primer sequence (5??3?)** |
| Primer 1a(P1a) | CACGTG AAAGCGCCAGAGAAGATTCCCGGGA |
| *Pml*I |  |
| Primer 2a(P2a) | TTTGGGGCCCATCTTGCACCTGGAGGGCGCCAACCGG |
| Primer 3a(P3a) | TCCAGGTGCAAGATGGGCCCCAAACCCCCCACCGGAA |
| Primer 4a(P4a) | ATGGGCCCCAAACCC |
| Primer 5a(P5a) | TCATGTTTTTGTGGTGGCTC |
| Primer 6a(P6a) | CCTCATCTGTGT TCATGTTTTTGTGGTGGCTCTCATC |
| Primer 7a(P7a) | ACAAAAACATGAACACAGATGAGGAACGAAGGTTTCC |
| Primer 8a(P8a) | GGCCTGAGAGGCCACGCGTCGCCGCGGGCCGGTT |
| SfiI |  |

| **c. Primers of Real-time PCR** | |
| --- | --- |
| **Gene name** | **Primer sequence (5??3?)** |
| IFN-?-PF | GCCTCGCCCTTTGCTTTACT |
| IFN-?-PR | CTGTGGGTCTCAGGGAGATCA |
| IFN-?-PF | GCTTGGATTCCTACAAAGAAGCA |
| IFN-?-PR | ATAGATGGTCAATGCGGCGTC |
| IRF7-PF | GCTGGACGTGACCATCATGTA |
| IRF7-PR | GGGCCGTATAGGAACGTGC |
| IFIT1-PF | GCGCTGGGTATGCGATCTC |
| IFIT1-PR | CAGCCTGCCTTAGGGGAAG |
| Caspase-3-PF | CATGGAAGCGAATCAATGGACT |
| Caspase-3-PR | CTGTACCAGACCGAGATGTCA |
| Bax-PF | CCCGAGAGGTCTTTTTCCGAG |
| Bax-PR | CCAGCCCATGATGGTTCTGAT |
| Bcl2-PF | GGTGGGGTCATGTGTGTGG |
| Bcl2-PR | CGGTTCAGGTACTCAGTCATCC |
| ATG5-PF | AAAGATGTGCTTCGAGATGTGT |
| ATG5-PR | CACTTTGTCAGTTACCAACGTCA |
| Beclin 1-PF | GGTGTCTCTCGCAGATTCATC |
| Beclin 1-PR | TCAGTCTTCGGCTGAGGTTCT |
| LC3B-PF | AAGGCGCTTACAGCTCAATG |
| LC3B-PR | CTGGGAGGCATAGACCATGT |

Virus titration, ICPI, MDT assays, and determination of virus growth

Virus titration was performed by HA or HI test and the 50% tissue culture infective dose (TCID50) test on CEF cell monolayers. Viral titer in cell culture was calculated by the Reed and Muench []. To characterize the chimeric virus and parental virus’s pathotypes, two of the standard pathogenicity assays were performed: the mean death time (MDT) in embryonated chicken eggs and the intracerebral pathogenicity index (ICPI). The EID50 (50% egg infective dose) and MDT were performed by inoculating serial tenfold dilutions of the chimeras or parental virus stocks into 9 day embryonated chicken eggs. The ICPI test was performed by inoculation of infective allantoic fluid directly into the brain of 1 day SPF chickens. Calculation of the ICPI, EID50, and MDT were performed as previous study [].

Viral growth was determined in the primary CEF. CEF cells were plated in six-well dishes at density of 3.0 × 105 cells per well and cells in six-well plates were infected with 0.1 MOI recombinant viruses. After incubation, cells were washed three times with PBS, and fresh medium was added. Cells with supernatants were frozen at the time indicated i.e., 12, 24, 48, and 72 post-infection. Intracellular virus titers were measured with a 50% tissue culture infective dose (TCID50) assay. Finally, a growth curve was drawn following the virus titer in different time.

Immunofluorescence assay and flow cytometry

HepG2, MDA-MB-231, SH-SY5Y, A549, MCF7, LoVo, and Vero cells were plated at 3.0 × 105 cells per well and infected with rClone30-RFP or rAnh-RFP at a MOI of 0.1. Fluorescence images were photographed using an inverted fluorescence microscope under ×100 magnification (Nikon, Japan)at 24 h pi, and the expression levels of red fluorescent protein (RFP) were analyzed by flow cytometry (BD, USA). Vero cells were used as a reference and the cells incubated with normal allantoic fluid were used as control.

RNA sequencing analysis

To assess the gene expression in the cells infected with NDV, RNA sequencing (RNAseq) was performed. After MDA-MB-231 and MCF7 cells were infected with allantoic fluid or recombinant viruses at a MOI of 0.1. RNA samples isolated from frozen cells using a Total RNA Extractor (Trizol) (#B511311, Sangon Biotech, Shanghai) were converted into cDNA libraries using the Illumina Hieff NGS™MaxUp Dual-mode mRNA Library Prep Kit (Illumina #12301ES96, YEASEN), and then RNAseq was performed. Differentially expressed genes were analyzed with a DEGseq algorithm by Sangon Biotech.

Real-time PCR

Total RNA extraction and reverse transcription to cDNA (1 µg RNA) were performed as previously described [] and quantitative real-time PCR (qRT-PCR) performed with 50 ng cDNA, 100 nmol/L of each primer and the IQ-SYBR-green Mastermix (Bio-Rad, Milano, Italy) was used to quantify mRNA levels of a gene using the ABI-Prism 7300 (Applied Biosystems; ABI). Gene-specific primers were used in each qRT-PCR reaction (Table ) and all qRT-PCR assays were performed in triplicates in a 96-well plate according to the manufacturer’s protocol. The results were normalized against β-actin and expressed as fold changes in relative mRNA expression level using the 2−ΔΔCT method [].

Cell viability assay

A short-term microculture tetrazolium (MTT) assay was used to quantify cell viability. A total of 1 × 104 cells were plated per well in a 96-well plate and incubated with virus at 0.01, 0.1, 1, and 10 MOI. Twenty microliters MTT solutions (5 mg/ml in sterile phosphate-buffered saline) were added to the cell 48 h after infection. The MTT solution in the wells was discarded after 4 h incubation, and 150 μl DMSO was added, then the plates were vibrated for 10 min, a spectrophotometer was used to determine the optical density (OD) at the absorbance of 570 nm, all samples were analyzed in triplicates. Cytotoxicity was quantified as the difference in cell viability between the experimental samples and the uninfected controls. The cell viability was converted and expressed using the formula:

Inhibition ratio = (control group OD − treatment group OD)/control group OD × 100%.

Fusion promotion

To assess the difference of the fusion capability of chimeric virus versus rClone30 in different cancer cell lines, HepG2, MDA-MB-231, MCF7, A549 H22, and 4T1 cells monolayers in six-well plate were infected with recombinant virus at the 0.1 MOI, respectively. Cells were counterstained with DAPI (4′,6-diamidino-2-phenylindole) for localization of nuclei after 24 h post-infection, and the representative images were captured under ×100 magnification with an camera (Nikon, Japan) attached to a microscope.

Annexin V-FITC and PI binding assay

Apoptosis was determined by translocation of phosphatidylserine to the cell surface using an Annexin V-FITC and PI apoptosis detection kit (Nanjing KeyGen Biotech. Co. Ltd, China). Overall, 0.1 MOI recombinant viruses were added into the six-well plate lined with HepG2, MCF7 cells, the cells were harvested and washed twice with cold PBS after 24 h of incubation, and resuspended in Annexin V-FITC and PI keeping in dark for 30 min. Cells were analyzed in a flow cytometry using FL1 (530 nm) band pass filters of FACS Calibur (BD, USA), and ***data*** were analyzed by the Cell Quest software (BD, USA).

Establishment of subcutaneous tumor-bearing model

All procedures involving animals followed the guidelines issued by National Institute of Health and the Institutional Animal Care and Use Committee of Northeast ***Agriculture*** University. Healthy 6-week-old female BALB/c mice with a weight of 19 ± 1 g were permitted to feed and drink freely. H22 cells or 4T1 cells (1 × 106) were subcutaneously implanted into the right groin of mice and tumors were allowed to grow until the average diameter reached 5–8 mm. Mice were randomly divided into different groups (n = 16), and intratumorally injected with allantoic fluid or 1 × 108 pfu of the indicated viruses every day. Tumor volumes were calculated using the following formula: tumor volume (V) = 4/3 × π × S2/2 × L/2, where S is the smallest measured diameter and L is the largest diameter. Animals were humanely culled when tumor size reached 18 mm in any dimension or at defined experimental time points. After the treatment, six animals of each group were sacrificed, their tumors and spleens were excised, weighted, frozen, or immersed in 4% paraformaldehyde. The remained mice in each group were continually monitored till 100 days to observe the survival rate.

Histological analysis and TUNEL assay

Hematoxylin and eosin (H&E) staining was carried out following the standard protocol. Briefly, tissue specimens were first fixed in 4% PBS-buffered formaldehyde, and then embedded in paraffin. Tissue sections of 4–5 μm were finally stained with H&E solutions and prepared for the TUNEL assay (terminal deosynucleotidy transferase-mediated dUTP nick and labeling assay). The Apoptosis of tumor cell was detected by the TUNEL apoptosis assay kit (Beyotime, #C1098).

Isolation of lymphoid cells and detection of Immune cell populations

After all the mice were killed, their spleens were immediately placed into a plate that contained PBS with 2% heat-inactivated FBS and dissected mechanically. Single-cell suspensions were prepared by gently teasing them through sterile stainless-steel screens to eliminate clumps and debris []. The erythrocytes were lysed in red blood cell lysis buffer that consisted of 0.155 M NHCl, 0.01 M KHCO3, and 0.1 mM EDTA. The remaining cells were washed three times with a large volume of RPMI 1640. All preparation procedures were performed at 4 °C. After the last centrifugation, the cells were counted using a hemocytometer and resuspended in an appropriate volume of PBS. Single-cell suspensions of spleen from the mice were incubated with PE anti-mouse CD4+ (Clone: REA604, miltenyibiotec), APC anti-mouse CD8+ (Clone: REA601, miltenyibiotec) FITC anti-mouse CD3+ (Clone: REA641, miltenyibiotec) at room temperature for 2 h in the dark. After incubation, the cells were washed twice with PBS and analyzed by a flow cytometer (BD Bioscience, San Jose, CA).

Animal safety assessment

Recombinant viruses rClone30-RFP or rAnh-RFP was intravenously injected into subcutaneous tumor-bearing mice or normal mice to observe the distribution of virus. All the viruses mentioned above (rClone30, rClone30-Anh(HN), rClone30-Anh(F), and rClone30-Anh(HN-F)) were intraperitoneally injected into normal mice for 30 days, serum was prepared from whole blood for determination of serum concentrations of AST, ALT, BUN, and creatinine.

Statistical analysis

The statistical significance of quantitative ***data*** between different groups was determined with GraphPad prism software (Version 5.01, GraphPad Software Inl., La Jolla, California). All ***data*** were expressed as mean ± SEM (standard error of the mean), significance was determined by performing one- or two-sided Student’s t tests and defined as a p value < 0.05, p value < 0.01.

Results

Generation of recombinant viruses

Chimeric viruses with the complete anti-genome sequence of the NDV were generated as described in the “Material and methods” section, and the HN, F gene of rClone30 has been exchanged with that of the Anhinga strain (Fig. ). The reverse genetics technology was used to generate viable infectious virus in BHK-21 cells and the HN and F genes in rescued viruses were verified by sequencing as described in the “Material and method” section.

Schematic representation of the genomes and characterization of recombinant viruses.

The F gene, HN gene fragment or both of pClone30 were exchanged with that of Anhinga by overlap PCR (yellow), including the chimeric virus expressing the HN gene (a rClone30-Anh(HN)), F gene (b rClone30-Anh(F)) or both (c rClone30-Anh(HN-F)) of Anhinga virus. d Growth curves of recombinant Newcastle viruses. Primary chicken embryo fibroblasts cells (CEF) were infected with rClone30, rClone30-Anh(HN), rClone30-Anh(F), rClone30-Anh(HN-F), and rAnh at MOI of 0.1. Cell monolayers were lysed at 12, 24, 48, and 72 h post-infection for intracellular titer measurement by TCID50 analysis.

Test of virus titer and pathogenicity of the recombinant viruses

A summary of virus titer and the pathogenicity assay is shown in Table . HA test results showed that the HA titer of rClone30-Anh(F) was similar to parental strain (29) and the HA titer of rClone30-Anh(HN) and rClone30-Anh(HN-F) was lower than rClone30(27). The MDT observed for the rAnh was 82 h, while the rClone30-Anh(F) and rClone30-Anh(HN-F) was 96 and 92 h, respectively. The ICPI results for the rAnh, rClone30-Anh(F), and rClone30-Anh(HN-F) were 1.47, 1.17, and 1.21, respectively. The pathogenicity of rClone30-Anh(F) and rClone30-Anh(HN-F) were lower than that of the parental Anhinga strain (Table ); the ***data*** showed that the TCID50 of rClone30-Anh(F) and rClone30-Anh(HN-F) were in coincidence with the Anhinga (Table ). As shown in Fig. , the chimeric viruses rClone30-Anh(F) and rClone30-Anh(HN-F) showed a higher titer than rClone30 in 12 and 24 h, and all viruses except rAnh have almost reached their maximum titer in 48 h. The TCID50 of rClone30 and rClone30-Anh(HN) was significantly lower than that of rClone30-Anh(F) and rClone30-(HN-F) at 12 and 24 h may be explained by assuming that the limited cell–cell spread of viruses that lack the Anhinga F gene compared with viruses that do contain this gene, due to differences in cleavage of the F proteins. But, there was no significant difference between rClone30 and chimeric virus rClone30-Anh(HN) in growth. These results indicate that the replacement of HN gene dose not influence the growth kinetics of rClone30 and the replacement of F gene enhance the fusogenic property of rClone30.

Comparison of virus titer and pathogenicity.

| **Virus** | **HA** | **TCID50** | **EID50** | **MDT** | **ICPI** |
| --- | --- | --- | --- | --- | --- |
| rClone30 | 29 | 2.09 × 107 | 6.67 × 109 | >120 h | 0.05 |
| rClone30-Anh(HN) | 27 | 1 × 107 | 1 × 109 | >120 h | 0.08 |
| rClone30-Anh(F) | 29 | 1.62 × 108 | 3.16 × 109 | 96 h | 1.17 |
| rClone30-Anh(HN-F) | 27 | 1.1 × 108 | 1 × 109 | 92 h | 1.21 |
| rAnh | 27 | 3.24 × 107 | 4.27 × 108 | 82 h | 1.47 |

The susceptibility of the selected cancer cells to NDV infection was different

To investigate the susceptibility of cancer cells to NDV infection, Vero cells which is susceptible to NDV infection was used as a reference. The expression levels of RFP were detected by fluorescence microscopy and flow cytometry after the HepG2, MDA-MB-231, SH-SY5Y, A549, MCF7, and LoVo cells were infected with rClone30-RFP or rAnh-RFP at 0.1 MOI, respectively. At 24 h post-infection, red fluorescence was observed in these cells except for the mock-infected cells (Fig. ). The fluorescence intensity generated by rClone30-RFPs or rAnh-RFP was higher in HepG2, SH-SY5Y, and MDA-MB-231 cells than that in A549, MCF7, and LoVo cells. The HepG2 cells infected with rClone30-RFPs or rAnh-RFP displayed the highest red fluorescence intensity compared with other cell lines while the LoVo cells showed the lowest. The red fluorescence intensity of HepG2 cells was tenfolds than that of LoVo cells. To detect whether the susceptibility of cancer cells was different due to the different NDV strains, the red fluorescence intensity of the selected cancer cells infected with rClone30-RFP or rAnh-RFP was observed. The result showed that there was no significant difference between rClone30-RFP and rAnh-RFP (P > 0.05, Fig.  c). Furthermore, the direct cytotoxic activity of rClone30-RFP and rAnh-RFP were tested in HepG2, MDA-MB-231, SH-SY5Y, A549, MCF7, and LoVo cells by a short-term MTT assay. As shown in Fig. , rClone30-RFP and rAnh-RFP induced cell death at 48 h post-infection, HepG2, SH-SY5Y, and MDA-MB-231 cells was dramatically inhibited compared with A549, MCF7, and LoVo cells, the chimeric virus rAnh-RFP was superior to rClone30-RFP in suppressing the growth (p < 0.05). The susceptibility of cancer cells to NDV infection was categorized into three groups by analyzing the red fluorescence intensity and the growth inhibition rate: HepG2, SH-SY5Y, and MDA-MB-231 cells were more susceptible, A549 and MCF7 were moderately susceptible, LoVo cells were less susceptible. These results suggest that the susceptibility of cancer cells to NDV infection is different, and cells from the same organ also demonstrated different susceptibility like the breast cancer cells MDA-MB-231, which was more susceptible to NDV infection than MCF7 cells.

The susceptibility of cancer cells to NDV infection.

a–c rClone30-RFP or rAnh-RFP at MOI of 0.1 were used to infect Vero cells and cancer cells in six-well plate. the fluorescence in the infected cells were detected and digitally photographed by fluorescence microscopy at ×100 magnification at 24 h (a), and analyzed using flow cytometry (b), the results of RFP fluorescence intensity were expressed as the percentage of RFP positive cells with SEM (\*P < 0.05; \*\*P < 0.01) (c). d Cytotoxicity effects of recombinant viruses on Vero cells and six cancer cells, the cells incubated with normal allantoic fluid were used as control. MTT method was used to detect the cell density at 490 nm. The ***data*** are the means ± SEM of triple samples (\*P < 0.05; \*\*P < 0.01), Vero cells were used as a reference.

The mechanism responsible for cancer cell susceptibility to NDV infection

To explore the mechanism responsible for cancer cell susceptibility to NDV infection, transcriptome sequencing was used to analyze differentially expressed genes in susceptible MDA-MB-231 and less susceptible MCF7 cells infected with rClone30-RFP or rAnh-RFP. The results showed that many genes were differentially expressed after MDA-MB-231 and MCF7 cells infected with the viruses. We found that alpha-sialic acid acyltransferase, Rac2, and HRAS were downregulated and the expression of interferon (IFN) was upregulated in less susceptible MCF7 cells compared with that in susceptible MDA-MB-231 cells (greater than twofold change). Furthermore, real-time PCR assay confirmed this result, the levels of IFN-α, IFN-β, IRF7, and IFIT1 in MCF7 cell infected with rClone30-RFP or rAnh-RFP were significantly upregulated, while the level of Glioma tumor suppressor candidate region gene 2 (GLTSCR2) attenuated IFN-β and ST6GALI associated with the formation of α2,6-linked sialic acid was significantly downregulated (Fig. ). These results suggest that the molecular mechanism which is responsible for cancer cell susceptibility to NDV infection was associated with the expression of IFN and α2,6-sialyltransferase.

Alpha-sialic acid were upregulated and interferon were downregulated in susceptible cells.

a Heat map of differentially expressed genes from MDA-MB-231 or MCF7 infected with rClone30-RFP and rAnh-RFP, respectively. b Total RNA was extracted and analyzed by RT-qPCR with primer sets against the following transcripts: IRF7, IFIT1, IFN-α, IFN-β, GLTSCR2, and ST6GALI. The mRNA transcription level is normalized to that of β-actin and is expressed as the fold change relative to growing cells. The cancer cells incubated with normal allantoic fluid were used as control. Values are means ± SEM of two independent samples with triplicate qPCR.

rClone30-Anh(F) and rClone30-Anh(HN-F) are more fusogenic in susceptible cells than in less susceptible ones

The susceptible cell lines HepG2, MDA-MB-231 and less susceptible cell lines A549, MCF7 were used to detect the fusogenic ability of chimeric virus in vitro. The results showed that more syncytia generated by rClone30-Anh(F) and rClone30-Anh(HN-F) compared with rClone30 and rClone30-Anh(HN) after infection with 0.1 MOI of viruses for 24 h in susceptible cell lines. However, in less susceptible cell lines, little syncytia was observed (Fig. ). The above results indicate that rClone30-Anh(F) and rClone30-Anh(HN-F) are more fusogenic in susceptible cells than in less susceptible ones, and rapid induction of cell–cell fusion, leading to extensive syncytial spread, is the mechanism of rClone30-Anh(F) and rClone30-Anh(HN-F)-mediated cell killing.

Chimeric viruses expressing the F gene of lytic strain Anhinga induces serious cell death in vitro.

a Syncytia promotion analysis of different cancers. Cancer cells (HepG2, MDA-MB-231, A549, and MCF7) were infected with recombinant viruses at MOI of 0.1, and photomicrographs of cell monolayers were captured at 24 h post-infection (left). Cells were counterstained with DAPI (4′,6-diamidino-2-phenylindole) for localization of nuclei (right). Representative fields of view were shown at ×100 magnification. The cancer cells incubated with normal allantoic fluid were used as control. b Cytotoxicity effects of recombinant viruses on cancer cells. The cancer cells HepG2, MDA-MB-231, A549, and MCF7 cells incubated with normal allantoic fluid were used as control. MTT method was used to detect the cell density at 490 nm. The ***data*** are the means ± SEM. of triple samples (\*P < 0.05; \*\*P < 0.01). c, d NDV induce more apoptotic cells in susceptible cells. Apoptosis cells were quantified by flow cytometry with Annexin V-FITC and PI. Representative scatter plots of PI (y-axis) versus FITC (x-axis). Values represent mean ± SEM. with three replicates. \*P < 0.05, \*\*P < 0.01, compared with control. c HepG2. d MCF7.

rClone30-Anh(F) and rClone30-Anh(HN-F) are potent in suppression of cancer cell growth in vitro

The direct cytotoxic activity of the recombinant viruses was tested in HepG2, MDA-MB-231, A549, and MCF7 cells. As shown in Fig. , all rNDVs induced cell death in a dose-dependent manner at 48 h post-infection, and the growth inhibition rate of rClone30-Anh(F) and rClone30-Anh(HN-F) was significantly higher than that of rClone30 and rClone30(HN) (p < 0.05). The growth inhibition was more obvious in the susceptible cells (HepG2, MDA-MB-231).

Apoptosis is enhanced by rClone30-Anh (F) and rClone30-Anh(HN-F) in both susceptible HepG2 cells and less susceptible MCF7 cells

To detect the sensitivity of tumor cells to virus-induced apoptosis, susceptible cells, and less susceptible cells (HepG2, MCF7) were infected with the recombinant viruses for 24 h, and the percentage of apoptotic cells was determined by the Annexin V-FITC and PI apoptosis detection kit. The Q2 and Q4 represent late apoptotic cells and early apoptotic cells, respectively. As shown in Fig. , there was detected apoptosis in the two cancer cell lines (HepG2 and MCF7) and the apoptotic rate of the HepG2 cells markedly increased compared with MCF7 cells. After HepG2 cells were infected with rNDVs at 0.1 MOI for 18 h, the apoptotic percentage of rClone30, rClone30-Anh(HN), rClone30-Anh(F), and rClone30-Anh(HN-F) was 7.35 ± 0.95%, 7.85 ± 0.55%, 15.55 ± 2.5%, and 15.8 ± 1.5%, respectively. These results indicate that rClone30-Anh(F) and rClone30-Anh(HN-F) were more effective in inducing apoptosis in the HepG2 cells and there was no significant difference between the two viruses (Fig. ).

rClone30-Anh(F) induces cell death by the initiation of autophagy

To elucidate the oncolytic mechanism of rClone30-Anh(F), the differential gene expression of MDA-MB-231 cells infected with rClone30 or rClone30-Anh(F) was analyzed by transcriptome sequencing. As shown in Fig. , Using a fold change >2 as criteria, we found that the expression of many genes was changed after MDA-MB-231 cells was infected with rClone30 or rClone30-Anh(F). The result showed that 297 genes were similarly affected, but the other 232 genes were changed only in MDA-MB-231 infected with rClone30-Anh(F) (Supplementary Fig. ). The apoptosis-related genes Caspase-3, Caspase-7, Caspase-9, BAX, and BCL2 were similarly affected in MDA-MB-231 cells with two viruses infected. However, Autophagy-related genes, AKT1, LAMTOR1, LAMTOR2, LAMTOR4, and LAMTOR5 were downregulated, TP53, ATG5, BECN1, ULK1, and MAP1LC3B were upregulated only in MDA-MB-231 cells infected with rClone30-Anh(F) (Fig. ). The expression of Caspase-3, BAX, BCL2, ATG5, BECN1, and MAP1LC3B was confirmed by RT-qPCR (Fig. ). These results suggest that rClone30-Anh(F) induced the syncytia formation is associated with autophagy.

rClone30-Anh(F) upregulated the autophagy-related genes.

a The breast cancer cells MDA-MB-231 infected with rClone30 or rClone30-Anh(F) were harvested to carried out transcriptome analysis, and form a heat map of genes comprising apoptosis and autophagy. b The MDA-MB-231 cells infected with recombinant viruses were ***collected*** and total RNA were extracted. The mRNA transcription level of caspase-3, Bax, Bcl2, ATG5, Beclin 1, and LC3B were measured by Real-time PCR. ***Data*** represent mean ± SEM of triplicate samples (#P < 0.05, ##P < 0.01,compared with rClone30 group).

rClone30-Anh(F) and rClone30-Anh(HN-F) show a stronger oncolytic effect in H22-induced xenograft than 4T1-induced xenograft

After mice were injected with susceptible H22 cells or less susceptible 4T1 cells, their volume and weight of tumors were recorded every 2 days, as shown in Fig. , compared with the model group, the average tumor volume and the average tumor weight decreased in all viral treatment groups. In the H22 tumor-bearing model, the average tumor size for the rClone30 group was 891.04 ± 75.73 mm3, the average tumor size for the rClone30-Anh(HN) group was 812.5 ± 98.02 mm3, while 400.91 ± 57.74 mm3, 307.5 ± 75.71 mm3, noted for the rClone30-Anh(F) and rClone30-Anh(HN-F) group (Fig. ). The average tumor weight for rClone30 and rClone30-Anh(HN) groups was 0.23 ± 0.027 g and 0.2 ± 0.033 g compared with 0.1 ± 0.03 g and 0.09 ± 0.03 g for rClone30-Anh(F) and rClone30-Anh(HN-F) groups, respectively (Fig. ). After necropsy, tumors excised from the model group were fairly large in size, the tumors in rClone30 and rClone30-Anh(HN) groups decreased slightly and tumors isolated from the rClone30-Anh(F) and rClone30-Anh(HN-F) groups were generally small (Fig. ). Furthermore, the survival rate of the tumor-bearing mice was also recorded. Over the 100 days (Fig. ), all ten mice in the model group were died, tumors of remaining 8/10 mice in the rClone30 and rClone30-Anh(HN) groups developed significant size and needed to be sacrificed. While only 4/10 mice in the rClone30-Anh(F) group and rClone30-Anh(HN-F) group developed tumors that required to be sacrificed. The overall survival of the mice in the long-term study was 0% for the model group, 20% for rClone30 and rClone30-Anh(HN) group, 60% for rClone30-Anh(F) group and rClone30-Anh(HN-F) group. 4T1-bearing mice treated with chimeric viruses rClone30-Anh(F) and rClone30-Anh(HN-F) showed a slightly suppression in tumor volume compared with the rClone30 group and rClone30-Anh(HN) group (P < 0.05) and there was no significant difference between rClone30-Anh(F) and rClone30-Anh(HN-F) groups. After experimental period, 10/10 mice in the model group, rClone30 group and rClone30-Anh(HN) group died, 8/10 mice in the rClone30-Anh(F) and rClone30-Anh(HN-F)groups died (Fig. ). Remaining mice in rClone30-Anh(F) and rClone30-Anh(HN-F) groups also developed significant size, which the average diameter was 17.77 and 16.85 mm, respectively. These results suggest that the oncolytic effect of NDV on less susceptible cells 4T1-derived xenograft is inferior to susceptible cells H22-derived xenograft.

Chimeric viruses expressing the F gene of lytic strain Anhinga show enhanced oncolytic effect in vivo.

Six-week-old female BALB/c mice were injected in the right groin with 106 H22 cells or 4T1 cells. Seven days post-infection the tumors were intratumorally treated with allantoic fluid, 1 × 108 pfu of recombinant Newcastle disease virus. a Tumor Tissues. b Tumor Weight. c The tumor volume of H22 (left) or 4T1 (right) tumor-bearing mice was measured every other day using digital calipers in two dimensions. d Survival of H22 (left) or 4T1 (right) models animal in 100 days period after treatment. The tumor-bearing mice were sacrificed when the tumor volume grew to a significant size (diameter > 18 mm). Control: untreated mice. Model: mice treated with allantoic fluid. \*P < 0.05, \*\*P < 0.01, compared with the Model group, #P < 0.05, ##P < 0.01, n = 6, compared with the rClone30 group.

rClone30-Anh(F) and rClone30-Anh(HN-F) enhance T-cell infiltration and apoptosis in the xenograft of tumor-bearing mice

To illustrate the histopathologic changes of tumors infected with recombinant viruses, H&E staining was performed. The H&E staining pattern of the rClone30-Anh(F) and rClone30-Anh(HN-F)-infected xenografts exhibited more tumor-infiltrating lymphocytes and necrotic cells compared with rClone30 and rClone30-Anh(HN)-infected xenografts in both H22 and 4T1-bearing mice (Fig. ). Then we evaluated the cytotoxic effect of the recombinant virus on tumor tissue by TUNEL assay. Compared with the model group, we found an increase of the apoptotic cells in the rClone30 and rClone30-Anh(HN)-infected tumors in H22-bearing mice, but not in 4T1-bearing mice. rClone30-Anh(F) and rClone30-Anh(HN-F) infection resulted in more apoptotic cells in both H22 and 4T1-bearing mice, this effect was more obvious in the tumors of H22-bearing mice (Fig. ). Real-time PCR showed that the transcriptional levels of Bax significantly increased and the transcriptional level of Bcl2 decreased in the rClone30-Anh(F) and rClone30-Anh(HN-F) groups compared with rClone30 and rClone30-Anh(HN) groups in the H22 tumor tissues. However, in the 4T1 tumor tissues, the transcriptional levels of Bax / Bcl2 of rClone30-Anh(F) and rClone30-Anh(HN-F) groups increased a little (p < 0.05, Fig. ). These results suggest that rClone30-Anh(F) and rClone30-Anh(HN-F) is stronger than rClone30 and rClone30-Anh(HN) in T-cell infiltration and apoptosis of the xenografts and this effect is more obvious in H22-bearing mice.

Chimeric viruses expressing the F gene of lytic strain Anhinga induce more T-cell infiltration, necrotic foci, and apoptotic cells in vivo.

a H&E staining of H22 tumor sections (left) and 4T1 tumor sections (right) after treatment of viruses. Representative fields of view were shown at ×100 magnification and ×400 magnification. b TUNEL assay (terminal deosynucleotidy transferase-mediated dUTP nick and labeling assay) was used to detect the apoptosis of tumor cells and the results were shown in brown. The larger the brown area, the more serious the apoptosis of cancer cells was. Representative fields of view were shown at ×100 magnification. c, d Transcriptional levels of Bax and Bcl2 genes in the tumor of H22 (left) and 4T1(right) tumor-bearing mice were calculated relative to the β-actin. Control: untreated mice. Model: mice treated with allantoic fluid. \*P < 0.05, \*\*P < 0.01, compared with the Model group. #P < 0.05, ##P < 0.01, n = 3, compared with the rClone30 group.

rClone30-Anh(F) and rClone30-Anh(HN-F) infection resulted in systematic T lymphocytes accumulation

The immunomodulatory effect induced by recombinant viruses in BALB/c tumor-bearing mice was analyzed by flow cytometry. There was a significant decrease in the number of CD4+ and CD8+ T lymphocytes in the spleen of the tumor-bearing mice compared with control group in both H22 and 4T1-bearing mice (p < 0.05, Fig. ). After treated with viruses, CD4+ and CD8+ T cells significantly increased, and more CD4+ and CD8+ T cells were detected in rClone30-Anh(F) and rClone30-Anh(HN-F)-infected groups than in rClone30 and rClone30-Anh(HN)-infected groups. There was no significant difference in the number of the T lymphocytes between rClone30-Anh(F) group and rClone30-Anh(HN-F) group.

Chimeric viruses expressing the F gene of lytic strain Anhinga increase CD4+ T and CD8+ T cells.

a, b, c The CD4+ T and CD8+ T cells of the spleen in H22 (left) or 4T1 (right) tumor-bearing mice allantoic fluid-treated or treated with recombinant viruses were analyzed by flow cytometry, a CD4 + T cells. b CD8 + T cells. c The percentage of CD4+ T and CD8+ T cells. (Control: untreated mice. Model: mice treated with allantoic fluid. \*P < 0.05, \*\*P < 0.01, compared with the Model group. #P < 0.05, ##P < 0.01, n = 3, compared with rClone30 group).

rClone30-Anh(F) and rClone30-Anh(HN-F) demonstrate tumor specificity and safety

Recombinant viruses rClone30-RFP and rAnh-RFP were intravenously injected into subcutaneous tumor-bearing mice or normal mice to observe the distribution of viruses. As shown in Fig. , the RFP was not detected in the tissues except tumor site, indicating that in one hand these viruses are tumor specific, in the other hand they are safe because virus is not distributed in the healthy tissues. After fifteen intraperitoneal injections of rClone30, rClone30-Anh(HN), rClone30-Anh(F), and rClone30-Anh(HN-F) for 30 days, the blood of normal mice and the mice injected with the viruses was ***collected***. Serum chemistries revealed insignificant changes in BUN, creatinine levels, AST and ALT (Fig. ). These results suggest that NDV is safe for cancer therapy.

NDV treatment demonstrates tumor specificity and safety.

a Recombinant viruses rClone30-RFP and rAnh-RFP was intravenously injected into subcutaneous tumor-bearing mice or normal mice to observe the distribution of virus. Control: normal mice intravenously treated with rAnh-RFP. rClone30-RFP: tumor-bearing mice intravenously injected with rClone30-RFP. rAnh-RFP: tumor-bearing mice intravenously injected with rAnh-RFP. b The serum biochemistry ***data*** of the experimental mice after injection of recombinant viruses. After 15 injections of rClone30, rClone30-Anh(HN), rClone30-Anh(F), and rClone30-Anh(HN-F), the blood of mice was drawn for measurement of serum chemistries. Control: normal mice. Values are expressed as mean ± SEM. ALT alanine aminotransferase, AST aspartate transaminase, BUN blood urea nitrogen, CREA creatinine.

Discussion

Since the first approval of the oncolytic virus, Amgen’s oncolytic herpes virus Imlygic (talimogene laherparepvec) in Europe and the United States, the OV field has gained much attraction. The therapeutic potential of oncolytic viruses is now being realized []. NDV as one of the oncolytic viruses represents a new class of therapeutic agents of cancer therapy. The oncolytic effect of wild and recombinant NDV strain has been demonstrated for being effective by multiple studies in experimental models and clinical trials [–]. Though the great progress in the oncolytic effect of NDV has been made by humanity, there still remain many challenges.

One of the major challenges of oncolytic virotherapy is that the susceptibility to oncolysis ranges among different cancer cell types. Li [] had reported that the replication of M1 highly associates with oncolysis. The large-scale screen of cell line revealed that the susceptibility to M1 are quite variable, cells infected with M1 oncolytic virus could be defined as hypersensitive cell, sensitive cell, and refractory cell. M1 replication was significantly higher in hypersensitive cancer cells and lower in refractory cancer cells, indicating that it is important for enhancing the oncolytic effect to investigate the susceptibility of cancer cells to oncolytic virus infection. Previous study showed that a broad spectrum of human cancer cells including tumor cell lines of ecto-, endo-, and meso-dermal origin [] were killed by NDV in vitro, but our unpublished ***data*** showed the susceptibility of cancer cell lines to NDV infection was substantially different. It is necessary to conduct a systematic study on the susceptibility of cancer cells to NDV infection. According to global cancer ***statistics*** 2018, the incidence or mortality of lung cancer, breast cancer, colorectal cancer, liver cancer, and brain cancer are high []. Among the five types of cancer, we chose the representative cell lines HepG2, MDA-MB-231, SH-SY5Y, A549, MCF7, and LoVo to investigate the susceptibility of cancer cells to NDV infection. The susceptibility of cancer cells to non-lytic strain (rClone30-RFP) and lytic strain (rAnh-RFP) was determined by the expression of RFP, the number of syncytia formation, and the inhibition rate of the two viruses on cancer cells. We found that the susceptibility of cancer cells to NDV infection is different and the infection of NDV are higher in HepG2, MDA-MB-231, SH-SY5Y cells (the fluorescent intensity were 74.9%, 52.25%, and 44.3%) (hypersensitive cancer cells), intermediate in A549, and MCF7 cells (the fluorescent intensity were 27.65% and 33.5%) (sensitive cancer cells), lower in LoVo cells (the fluorescent intensity were 6.7%) (refractory cancer cells). The cytotoxicity of rClone30-RFP, rAnh-RFP showed the same trends, indicating that the infection and replication ability of NDV is positively correlated with the effect of oncolytic effect.

In the six cells involved in viral infection experiments, only MDA-MB-231 and MCF7 derive from the same tissue and thus have more similar genetic background, contributing to precisely determined which gene is responsible for the susceptibility to NDV infection. To investigate the molecular mechanism which is responsible for cancer cell susceptibility to NDV infection, transcriptome sequencing was carried out to analyze the differentially expressed genes between susceptible MDA-MB-231 and less susceptible MCF7. Cells without viral infection served as a negative control. The results showed that many genes were differentially expressed after MDA-MB-231 and MCF7 cells infected with viruses (Fig. ). Here, we focus on sialic acid and IFN. Previous research showed the abundant presence of sialoglycoproteins on the surface of cancer cells most likely promotes preferential association of the virus with malignant and contributes to their selective oncolytic effect [, ]. Furthermore, it was confirmed that α2,6-linked sialic acid serves as a high-affinity receptor for NDV therapy. ST6GalI-transfected CHO-K1 cells increase the α2,6-linkage level, enhancing NDV binding and cytopathic effect []. We found the transcriptional level of alpha-sialic acid acyltransferase (ST6GalI) highly expressed in MDA-MB-231 cells than that in MCF7 cells (Fig. ). Meanwhile, previous studies show that the replication and spread of NDV is significantly reduced in normal cells compared with cancer cells due to antiviral signaling pathways []. After cancer cells were infected with NDV, the viral replication can be promoted specifically in tumors due to the specific genetic defects of the IFN and apoptotic pathways based on type I IFN signaling []. IRF3 and IRF7 are the main regulators of type I IFN expression, when cells are stimulated with virus infection, IRF3 are phosphorylated by the serine/threonine kinases, TBK1 and IKKɛ, and then homodimerized IRF3 translocates from the cytosol into the nucleus and binds to responsive elements for IFN-β gene transcription []. GLTSCR2 as a nuclear protein support the viral replication of paramyxovirus in cells. Viral infection induced translocation of GLTSCR2 from nucleus to cytoplasm that enabled GLTSCR2 to attenuate type I interferon IFN-β and promote viral replication []. In this study, when the changes of these genes mentioned above in two kinds of cells (susceptible MDA-MB-231 and less susceptible MCF7) infected with NDV were analyzed, we observed that, compared with MCF7 cells, the expression of GLTSCR2 were upregulated in MDA-MB-231 and the expression of IFN-related genes was downregulated. We further identified that, though cancer cell are specifically infected by NDV, the cancer cell susceptibility to NDV infection was different, sialic acid and the IFN were responsible for cancer cell susceptibility. These genes can be used as markers of cancer cell susceptibility to NDV infection, which lays a foundation for clinical screening of susceptible tumor types. But the most important genes for cell susceptibility to viruses infection need more study.

To study the effect of cancer cell susceptibility on the NDV treatment, the oncolytic effects of chimeric virus on susceptible cell lines HepG2, MDA-MB-231, H22 and less susceptible cell lines A549, MCF7, and 4T1 were tested (Fig.  and Supplementary Fig. ). In vitro, compared with less susceptible cell lines, a huge syncytium was induced by rClone30-Anh(F) and rClone30-Anh(HN-F) on susceptible cell lines (Fig.  and Supplementary Fig. ). The growth inhibition of rClone30-Anh (F) and rClone30-Anh (HN-F) on susceptible cells was stronger than that on less susceptible cells (greater than twofold change) (Fig.  and Supplementary Fig. ). When the cells were infected with virus of 0.1 MOI for 24 h, the apoptosis rate induced by rClone30-Anh(F) in HepG2 cells was 15.55% and 6.75% in MCF7 cells (Fig. ). In vivo experiments, to investigate the oncolytic effect of the chimeric viruses on xenographic mice derived from NDV susceptible (H22) and less susceptible (4T1) cells, the xenographic mice were intratumorally injected with allantoic fluid or 1 × 108 pfu of the indicated virus every day. In H22 tumor-bearing mice, rClone30-Anh(F) and rClone30-Anh(HN-F) showed a more obvious suppression in tumor volume, tumor weight, and tumor apoptosis rate than that in 4T1 tumor-bearing mice (Fig. ). In vivo and in vitro experiments were consistent, rClone30-Anh(F) and rClone30-Anh(HN-F) showed a more obvious oncolytic effect in the susceptible cells, suggesting that NDV play a more effective antitumor role in susceptible cells.

It is reported that NDV was classified by their pathogenesis in birds as lentogenic (avirulent, no clinical manifestations), mesogenic (intermediate, mild disease), or velogenic (virulent, high mortality) and none of the strains are associated with serious disease in humans []. All NDV strains are associated with antitumor immune activity, the mesogenic and velogenic types demonstrate a lytic replication cycle in human tumor cells leading to an amplification of the viral load but non-lytic lentogenic strains not, which reveals that lytic strains are more effective than non-lytic strains in tumor cytotoxicity. Normally, a lentogenic strain was chosen as an antitumor agent because of the minimal hazard for environment but the oncolytic effect of NDV will be limited []. The aim of research is to produce optimized NDV Clone30 vectors via virus-engineering strategies, which not only provide more potent cytotoxic effects, but also demonstrate enhanced safety profiles []. Considering the positive and negative features of both lytic strains (mesogenic, rAnh) and non-lytic strains (lentogenic, rClone30) as oncolytic virus platforms, we engineered a chimeric virus based on the lentogenic NDV backbone, in which the oncolytic ability was altered.

Extensive research in F gene has been performed to elucidate the molecular determinants for viral pathogenicity and fusion activity [, ], showing the F protein is the major contributor for virulence, and F protein is responsible for viral fusion with formation of syncytia []. The HN gene also plays an important role in NDV infection and budding process. Previous studies have shown that the stalk region of HN protein is also implicated in the activation of the fusion activity of the F protein []. Estevez et al. showed that the mutation at position 192 (Ile-Met) of HN proteins derived from the mesogenic NDV strain Anhinga decreased haemadsorption and neuraminidase activities and increased fusion promotion activity []. In addition, during viral infection, the binding of the HN protein to its cognate receptor, cellular sialic acid, causes a conformational change that facilitates the specific homotypic interaction between F and HN, triggering fusion of the viral envelope with the host cell membrane [] indicating that the interaction of homotypic HN and F proteins of paramyxoviruses is important for the proper function of these proteins.

To clarify which protein (F or HN) is mainly responsible for the oncolytic capacity of the NDV, a series of chimeric viruses rClone30-Anh(HN), rClone30-Anh(F), and rClone30-Anh(HN-F) were constructed by exchanging the HN gene, F gene, or both of non-lytic rClone30 strain with lytic strain Anhinga. In vitro, little syncytia was induced by rClone30 and rClone30-Anh(HN), but a huge syncytia was induced by rClone30-Anh(F) and rClone30-Anh(HN-F). The cytotoxicity of rClone30-Anh(F), rClone30-Anh(HN-F) to cancer cells was significant higher than that of rClone30 and rClone30-Anh(HN) (p < 0.05, Fig. ). In vivo, in comparison with rClone30 and rClone30-Anh(HN), the tumor volume of H22 and 4T1 tumor-bearing mice was significantly inhibited by rClone30-Anh(F) and rClone30-Anh(HN-F), the 100-day survival rate of rClone30-Anh(F), rClone30-Anh(HN-F)-treated mice was increased by 40% compared with rClone30, rClone30-Anh(HN)-treated mice in H22-bearing model, while 20% in 4T1-bearing model (Fig. ). HE and TUNEL analysis showed an increased tumor apoptosis rate in rClone30-Anh(F), rClone30-Anh(HN-F)-treated mice compared with that in rClone30, rClone30-Anh(HN)-treated mice (Fig. ). The more CD4+ T and CD8+ T-cell populations were found in the splenocytes isolated from the tumor-bearing mice treated with rClone30-Anh(F) or rClone30-Anh(HN-F) and the unpublished ***data*** showed rClone30-Anh(F) or rClone30-Anh(HN-F) treatment downregulated the immunosuppressive factor, which suggest that chimeric viruses expressing the F gene of lytic strain Anhinga can circumvent immune suppression and enhance the systemic antitumour immunity (Fig. ). Meanwhile, both rClone30-Anh(F) and rClone30-Anh(HN-F) showed a decreased pathogenicity compared with parental virus Anhinga (lower ICPI score and higher MDT) (Table ). These results indicate that the F protein plays a major role in NDV-induced oncolytic effect on xenograft derived from cancer cells (susceptible cell lines H22 and less susceptible cell lines 4T1). The F gene of lentogenic rClone30 with clear genetic background is recommended to be exchanged with the F gene of NDV strains with strong fusion ability to enhance the oncolytic effect of the wild-type rClone30.

To elucidate the oncolytic mechanism of rClone30-Anh(F), the differential gene expression of MDA-MB-231 cells infected with rClone30 or rClone30-Anh(F) was analyzed by transcriptome sequencing (Supplementary Fig. ). Previous studies reported that the LC3/LC3II turnover assay is used as a classical method to investigate the autophagic flux dynamics []. Autophagy related 5 (ATG5) as a key protein in the extension of the phagophoric membrane in autophagic vesicles is necessary for LC3I conjugation to phosphatidylethanolamine to form LC3II []. The other autophagy marker Becline-1 positively regulates autophagy by generating membrane-bound protein complexes, promoting the formation of autophagosome []. As shown in Fig. , transcriptome analysis and real-time PCR analysis revealed that the genes ATG5, becline-1, and MAP1LC3B were upregulated in MDA-MB-231 cells infected with rClone30-Anh(F). Our ***data*** has shown cell death induced by rClone30-Anh(F) and rClone30 was different, and maybe the oncolytic mechanism of rClone30-Anh(F) is associate with autophagy but rClone30 not. Ren et al. [] show that the syncytia is generated by activating AMPK-mTORC1-ULK1 signaling. Under ***nutrient***-rich conditions, the suppression of autophagy can be leaded since mTORC1 phosphorylates unc-51 like autophagy activating kinase 1 (ULK1) inhibit its interaction with AMPK []. But, cellular energy depletion induces AMPK-mediated mTORC1 inhibition and then leads to autophagy induction []. Ragulator as a key protein complex in the mTOR signaling pathway plays an important role in binding Rag GTPases to the surface of lysosomes in the mTOR pathway and activating mTORC1. mTORC1 is a complex composed of p18, p14, MP1, Lamtor4, and Lamtor5 proteins encoded by LAMTOR1, LAMTOR2, LAMTOR3, C7orf59, and HBXI [, ]. The results showed that, in comparison with rClone30, rClone30-Anh(F) downregulated the transcriptional level of LAMTOR1, LAMTOR2, LAMTOR4, LAMTOR5, and RHEB GTP-binding protein, but upregulated the transcriptional level of ULK1 (Fig. ). We made a hypothesis that mTORC1 is inhibited by rClone30-Anh(F), thus leading to autophagy induction, but there still are much work need to be done to confirm that rClone30-Anh(F) activates AMPK-mTOR-ULK1 signaling for the initiation of a complete autophagic flux and the subsequent formation of syncytia.

In conclusion, this study elaborated the methods to improve the oncolytic effect of NDV Clone30 from two aspects of host cells and virus per se. The results showed that the susceptibility of cancer cells to NDV infection was substantially different and NDV treatment is more effective in susceptible cells, which was related to the expression of alpha-sialic acid acyltransferase and interferon. rClone30-Anh(F) and rClone30-Anh(HN-F) as oncolytic agents showed a stronger oncolytic effect compared with rClone30, indicating that the F gene plays an important role in oncolytic capability of NDV in vivo. Thereby we offered an ideal strategy to enhance the oncolytic effect of NDV Clone30 by the selecting of susceptible tumor type as indications and constructing chimeric virus based on lentogenic virus with F gene derived from virus with strong fusion ability in consideration to the epidemiology of NDV in a giving region.

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**Notes**

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**Body**

Introduction

The evolution of modern humans involved extensive migration to diverse geographic regions with shifting environmental conditions. Changes in climate, diet, and novel exposures to pathogens coincided with transitions in sociocultural organization (Laland et al. ). During these shifts, changes in the genome that initially arose as stochastic events within individuals of populations were subjected to evolutionary forces over generational time. These forces of random genetic drift, gene flow, and natural selection have together shaped the genetic diversity of our species. Evidence supports that a large portion of this variation has evolved neutrally (Harris ; Kimura , ). Nonetheless, environmental and cultural factors jointly have imposed selective pressures on the human genome, contributing to extant patterns of human genetic diversity (Feldman and Cavalli-Sforza ). Local adaptation as result of natural selection contributes to the phenotypic variation observed across human populations (Bamshad and Wooding ; Vitti et al. ). Deciphering which genetic changes from natural selection underlie adaptive traits in humans is an ongoing area of investigation in evolutionary biology. Additionally, current environments may no longer be suitable for formerly beneficial alleles, resulting in a gene–environment mismatch underlying human disease (Gluckman et al. ; Nesse et al. ; Nesse and Stearns ; Williams and Nesse ). Determining the genetic basis of human adaptation therefore has broad implications for understanding human biology, health, and disease.

Natural selection can be described in three general categories: positive directional selection, balancing selection, and negative purifying selection (Fig. a). Each mode of natural selection will influence the alleles in a population in different ways (Gillespie ). Positive selection favors the fixation of an advantageous allele that increases the evolutionary fitness of its carrier. Balancing selection acts to maintain frequencies of multiple alleles at a locus for fitness benefit. Purifying selection, also known as background selection, removes deleterious alleles that reduce the fitness of the carrier from the population (Charlesworth et al. ). Purifying selection is essential for the evolutionary conservation of biological function (Cvijovic et al. ). The effects of strong purifying selection on genomic diversity have been characterized in several organisms (Begun and Aquadro ; Cvijovic et al. ; McVicker et al. ). Here, we focus on the latter two forms of natural selection, positive and balancing, as these forms lead to the fixation or maintenance of adaptive alleles in a population over time (Maynard-Smith and Haigh ). Furthermore, these evolutionarily favored genetic changes can be identified through a process called selection mapping and functionally assessed for relevance to proposed adaptive biologies.

Natural selection influences genomic diversity. a Theoretical basis for population genetics models of natural selection. Each dotted strand represents a haplotype. Alleles that increase or decrease in frequency over time due to selection are represented as dots in purple (positive selection on de novo variants), blue (positive selection on standing variation), green (polygenic positive selection), yellow (balancing selection), red (negative selection), and shades of grey (linked variation to causal allele). b Types of adaptive genetic variants that can be acted upon by natural selection. A, ancestral; D, derived

Selection mapping refers to the process of using population genetics methods to detect genomic regions, genes, or variants that have been acted on by natural selection (Wisser et al. ). It is founded on the principle that phenotypic change in a population is accompanied by changes in allele frequencies (Fumagalli et al. ; Vitti et al. ; Wisser et al. ). Population-specific changes in allele frequency due to natural selection can leave distinct statistical signatures at the target loci relative to neutrally evolving loci (Fu ; Fu and Li ). Inferred signals of selection can be leveraged to identify fitness-related genomic regions, genes, and/or variants. Larger detected genomic regions can be further fine-mapped to pinpoint putative functional alleles contributing to adaptive phenotypes (Akbari et al. ; Schaid et al. ; Szpak et al. ). Indeed, selection mapping has been widely used by evolutionary and population geneticists to identify candidate functional alleles underlying adaptive phenotypic change in plant and animal populations, including humans (Akey et al. ; Matsumoto et al. ; Wisser et al. ).

This review will discuss the application of selection mapping approaches to identify genetic variation contributing to adaptive phenotypes across human populations, thus focusing on the microevolutionary scale. We begin by describing the search for candidate adaptive alleles, from the detection of selection signatures (namely positive and balancing) through genotypic-phenotypic association and fine mapping variants. We provide a review of the discovered candidate adaptive alleles in human populations followed by a summary of molecular approaches for functional validation of their biological role. While the bulk of genotyping and sequencing efforts have focused on European populations (Popejoy and Fullerton ; Sirugo et al. ), we detail several cases of selection mapping in non-European populations. Nevertheless, we acknowledge the impact of this major Eurocentric bias in the current map of natural selection in humans, and we conclude with comments on future directions and inclusivity considerations for population geneticists, human geneticists, and molecular anthropologists.

Detecting natural selection in the genome

Genetic variants that define the alleles subjected to natural selection, due to effects on biological fitness, are distributed across functional coding and non-coding genomic elements (Bamshad and Wooding ; Jha et al. ; Wooding et al. ; Zhao et al. ). The types of genetic variants targeted by natural selection include nucleotide substitution, insertion, deletion, duplication, inversion, and translocation (Fig. b). Natural selection can act on either de novo genetic variant(s) or standing genetic variation, leaving behind distinct signatures in the genome (Barrett and Schluter ; Hermisson and Pennings ; Przeworski et al. ). For selection on de novo variation, a novel variant arises in a population in which a selective pressure is present (Peter et al. ). For selection to act, this new variant will confer either an adaptive advantage or disadvantage to the existing pressure. Selection on standing variation may occur when a population faces an environmental change or range expansion that results in a new selective pressure (Przeworski et al. ). Thus, standing variation is preexisting variation in the ancestral population at the time the environmental conditions for selection appear (Barrett and Schluter ). Depending on the mode of natural selection, genomic diversity will be shaped differently in a population over time.

Distinguishing selection on de novo variants from standing variation

The structure of haplotypes—sets of alleles (or genetic variants) that are inherited together on a single chromosome in an individual—in a population offer clues into how natural selection has acted on the genome (Bamshad and Wooding ; Nordborg and Tavare ; Sabeti et al. ). In particular, the heterogeneity of haplotype backgrounds that comprise the allele under natural selection, as well as the changes in allele frequency, help to distinguish between signals of selection from standing variation versus de novo variation (Barrett and Schluter ; Peter et al. ). If a selective pressure is present before a favorable variant originates, as in the case of selection on a de novo variant, then the new (or derived) allele will come to exist on a single, distinct haplotype (Fig. a) in the study population, and it will be absent in the ancestral population, where only the ancestral allele will be found (Nielsen et al. ; Peter et al. ). If the derived allele reaches fixation rapidly from positive selection, haplotype homozygosity will be extensive around the selected allele before mutation and recombination act to break it down (Nielsen et al. ; Peter et al. ). In other words, the linkage disequilibrium (LD)—the non-random association of alleles in haplotypes—will be high as a result of genetic hitchhiking of neutral alleles linked to the adaptive allele during its rise in frequency (Maynard-Smith and Haigh ; Przeworski ). This is referred to as a ‘hard’ selective sweep. Effective population size and the effect size of the adaptive allele contribute to its fixation time, with shorter time to fixation in cases of small effective population size and large effect alleles (Pritchard et al. ). Once a derived allele has swept to high frequency, recombination acts to break up linkage with neutral sites resulting in an excess of both intermediate and high frequency alleles (Barrett and Schluter ; Fay and Wu ). However, if the selective sweep is incomplete, i.e., the beneficial allele is in the midst of being swept to fixation in the population, heterozygosity increases, and this is called a ‘soft’ sweep (Pritchard et al. ).

Selection also acts on standing variation. When selection favors variation already present in the population, the pre-adaptive alleles may exist on several distinct haplotypes, resulting in a greater number of linked neutral alleles at intermediate frequencies following selection (Fig. a) (Barrett and Schluter ; Peter et al. ; Przeworski et al. ). In other words, alleles that are maintained within the population as neutral or weakly functional before becoming selectively advantageous will have a longer population history than a new adaptive allele (Barrett and Schluter ). This protracted population history increases the likelihood that recombination has broken up haplotype blocks containing the standing variant, placing it on different backgrounds (Barrett and Schluter ; Peter et al. ; Przeworski et al. ). Selection on standing variants will integrate more polymorphisms than selective sweeps of de novo variants, and this distribution across haplotypes weakens the statistical signature of selection (Barrett and Schluter ; Hermisson and Pennings ; Peter et al. ; Przeworski et al. ). Variation around the fixed adaptive allele will therefore be lower in a population following selection on de novo variation compared to selection on standing variation (Barrett and Schluter ). Given the predicted effects of selection on alleles and haplotypes between populations, the type of sequence information acquired (SNP microarray, targeted sequencing, whole exome, whole genome, etc.) and selection of study populations will determine which methods (Table ) can be applied for detecting natural selection in the genome.

Summary of the different types of selection detection methods outlined in this review

| **Type** | **Abbreviation** | **Test name** | **Summary** | **References** |
| --- | --- | --- | --- | --- |
| Haplotype-based | EHH | Extended haplotype homozygosity | The EHH calculates the decay of LD (association of alleles) surrounding a core haplotype (or locus of interest), at varying distances from the core. From this, EHH then assesses the probability that any two haplotypes in a population carrying the core haplotype are identical by descent. This is useful for detecting recent positive selection | Sabeti et al. (, ) |
| LRH | Long-range haplotype | The Long-Range Haplotype combines EHH with the haplotype frequency in the population to detect regions of recent positive selection, primarily hard sweeps | Sabeti et al. (, ) |  |
| WGLRH | Whole genome long-range haplotype test | The Whole Genome Long-Range Haplotype test incorporates the LRH with patterns of LD to identify regions with long haplotypes, which may be indicative of positive selection | Zhang et al. () |  |
| iHS | integrated Haplotype Score | The integrated Haplotype Score measures the ratio of EHH decay of haplotypes carrying derived alleles to those carrying ancestral alleles. This method is useful for detecting soft selective sweeps | Voight et al. () |  |
| nSL | Number of segregating sites by length ***statistic*** | The Number of Segregating Sites by Length ***Statistic*** measures the ratio of EHH for haplotypes carrying derived alleles relative to those with ancestral alleles. However, unlike iHS, it incorporates segregating sites to measure distance rather than a genetic map. nSL is useful for detecting both hard and soft selective sweeps | Ferrer-Admetlla et al. () |  |
| XP-EHH | Cross population extended haplotype homozygosity | The Cross Population Extended Haplotype Homozygosity incorporates the integral of EHH, and compares haplotypes between two populations to detect those containing nearly fixed derived alleles. This is useful for detecting hard selective sweeps | Sabeti et al. () |  |
| Allele frequency | Tajima's *D* | Tajima's *D* ***statistic*** | Tajima's *D* measures the differences between segregating sites (?W) and the average nucleotide differences (?). It can be useful for detecting departures from neutrality, which may suggest balancing or positive selection. However, it is confounded by demographic conditions, such as population structure and growth | Tajima () |
| Fu and Li's *D* and *F* | Fu and Li's *D* and *F* ***statistics*** | Fu and Li?s *D* and *F* are based on coalescence, and compare the number of derived singleton variants to ?W and ?, respectively. These ***statistics*** can suggest recent positive, purifying, or balancing selection. Fu and Li?s *D* and *F* are more sensititve to detect selective sweeps acting on derived alleles compared to Tajima?s *D* | Fu and Li () |  |
| Fay and Wu's *H* | Fay and Wu's *H* ***statistic*** | Fay and Wu's *H* looks for a high frequency of derived variants to determine whether the locus has undergone positive selection compared to neutral expectations | Fay and Wu () |  |
| *FST* | Wright's Fixation Index | Wright's *FST* is a measure of genetic differentiation between two populations. This ***statistic*** can be used to identify loci under positive or balancing selection | Wright () |  |
| Phylogenetic-based | LSBL | Locus-specific branch length | The Locus Specific Branch Length incorporates *FST* for a three-population comparison, where distances between populations are represented by branch lengths | Shriver et al. () |
| PBS | Population branch ***statistic*** | The Population Branch ***Statistic***, similar to LSBL, uses a three-population comparison based on *FST*, except the values are log-transformed to incorporate phylogenetics | Yi et al. () |  |
| Composite | CLR | Composite likelihood ratio | The Composite Likelihood Ratio measures an excess of derived alleles across several sites in a single population | Nielsen et al. () |
| XP-CLR | Cross population composite likelihood ratio | The Cross Population Composite Likelihood Ratio measures the differences in the excess of derived alleles following population divergence of two populations: the target population and an ancestral population | Chen et al. () |  |
| CMS | Composite of multiple signals | The Composite of Multiple Signals ***Statistic*** combines results from *FST*, iHS, and XP-EHH to increase power of detecting high frequency, derived alleles between populations | Grossman et al. () |  |
| 3P-CLR | 3-Population composite likelihood ratio | The 3-population Composite Likelihood Ratio is based on CLR and XP-CLR, except it uses three populations to allow for the detection of selection within each of two populations, or shared selection among the two populations before splitting from a third outgroup population | Racimo () |  |
| SWIF(r) | Sweep inference framework (controlling for correlation) | The Sweep Inference Framework (controlling for correlation) combines a deep learning approach with a composite of the XP-EHH, iHS, and *FST* ***statistics***. This method does not require a genome-wide comparison | Sugden et al. () |  |

Haplotype tests of selection

Several extended haplotype tests for identifying selective sweeps exist and include the Long-Range Haplotype (LRH), integrated Haplotype Score (iHS), number of segregating sites by length ***statistic*** (nSL), and Cross Population Extended-Haplotype Heterozygosity (XP-EHH) (Table ) (Sabeti et al. ,; Voight et al. ). The LRH test takes into consideration both the length of extended haplotype homozygosity (EHH) and the frequency of the haplotype in the population (Sabeti et al. ). This test performs well when identifying haplotypes that arose quickly and have yet to be broken down by recombination, such as for hard sweeps. A modification of this test, the whole genome long-range haplotype (WGLRH) test, has been developed to use genome-wide ***data*** to detect selection by combining LRH with derived and ancestral allele status (Zhang et al. ). The iHS test quantifies the strength of selection acting at a locus in a single population by calculating the integral of EHH decay at varying distances away from a core allele (Fig. ) (Voight et al. ). It considers the ratio of haplotype homozygosity for haplotypes carrying the derived allele relative to those carrying the ancestral allele at the candidate locus. By doing so, iHS is sensitive to variation in recombination rates across the genome as the two alleles serve as controls for each other, canceling out heterogeneity in the estimated genetic map due to recombination coldspots and hotspots. This ***statistic*** is more powered to detect incomplete, or soft, selective sweeps (Pickrell et al. ; Voight et al. ). Similar to iHS, nSL uses the ratio of haplotype homozygosity for derived and ancestral alleles to identify positive selection in a single population (Ferrer-Admetlla et al. ). nSL differs from iHS in that it quantifies EHH length for a given haplotype pair based on the number of SNPs present in that region on all other haplotypes in the sample population (Ferrer-Admetlla et al. ; Voight et al. ). In doing so, a genetic map is not needed to calculate nSL, thereby further increasing sensitivity to varying recombination and mutation rates, with greater power for detecting both hard and incomplete/soft selective sweeps. XP-EHH compares haplotypes between populations to identify derived selected alleles that have recently reached or nearly reached fixation in one population yet remain polymorphic across all human populations (Sabeti et al. ). It performs well for detecting sweeps that have reached, or have almost reached, fixation (Pickrell et al. ; Sabeti et al. ; Voight et al. ). As such, it has weaker power to detect older selective sweeps that have been subjected to LD degradation by recombination over time.

Reverse genetics selection mapping workflow: First, perform statistical selection tests for a given dataset. Second, integrate with association mapping analyses and fine-mapping approaches to generate a list of high confidence candidate alleles for putative adaptive phenotypes. Third, identify the best research strategy to functionally investigate the candidate variation to model its biological role and inform hypotheses of adaptive human evolution

Confounding variables in haplotype-based tests

Population-specific recombination rate and copy-number variants (CNVs) may confound the results of haplotype-based tests of selection and should be taken into account (Sabeti et al. ). Certain regions of the genome exhibit variable recombination rates between populations (Abecasis et al. ). A long-range haplotype signal at these loci could result from a slower recombination rate in one population relative to other populations, instead of a spike in allele frequency from natural selection (Sabeti et al. ). To account for this, the level of EHH decay of non-selected alleles in the region surrounding the candidate allele can be compared to the EHH decay of those same non-selected alleles in other populations (Sabeti et al. ). If the EHH decay is similar between populations, variable recombination rate can be ruled out as the source of the long-range signal, bolstering claims of selection (Sabeti et al. ). CNVs can result in the increase of nearly identical sequence at a locus that will reduce heterozygosity (Lucas et al. ). This makes it challenging to distinguish a selective sweep from a region with high copy number variation (Iskow et al. ). Likewise, CNVs that lie close to a selected locus may falsely extend the signal (Sabeti et al. ). To account for potential confounding from CNVs, recent innovations in long-read sequencing technologies that avoid PCR amplification steps offer a platform to more accurately map and quantify CNVs (Pollard et al. ). Further, hybrid-sequencing approaches that combine long-read with short-read technologies that offer higher resolution and lower genotyping error rates, can afford both CNV accuracy and resolution (Kronenberg et al. ).

Allele frequency tests

The joint distribution of allele frequencies in a given population is referred to as the allele frequency spectrum (AFS) or the site frequency spectrum (SFS) (Ewens ). The standard neutral model SFS can be predicted theoretically under the assumptions of no selection, no recombination, and that all new genetic variants are unique (Ewens ). Selection can act to shift the AFS (Fig. ) (Fu ). Positive selection results in an increase in high frequency alleles and a near absence of intermediate frequency alleles whereas balancing selection results in an excess of alleles at intermediate frequency (Tajima ). Demographic events impact the SFS in the same manner as selective events (Marth et al. ). Similar to balancing selection, population subdivision reduces the number of highly shared alleles in the population as a whole, thereby increasing the number of intermediate frequency alleles (Tajima ). Conversely, population expansion increases the number of singletons and high frequency alleles, much like directional positive selection (Tajima ). However, demographic changes are expected to influence all loci across the genome in a similar manner whereas selection tends to be locus-specific (Biswas and Akey ; Przeworski et al. ). Therefore, to distinguish demography from selection, the SFS at one locus can be compared to the genome-wide average in a given population (Akey et al. ; Biswas and Akey ).

SFS summary ***statistics*** use sequence ***data*** to test for departures from neutrality and are useful for identifying loci that have undergone positive or balancing selection (Table ) (Fay and Wu ; Fu and Li ; Nielsen et al. ; Przeworski et al. ; Tajima ). Tajima’s D measures the difference between the number of segregating sites (ΘW) and the average number of nucleotide differences (π) (Tajima ). Under a neutral model, ΘW and π are equal, and Tajima’s D is zero. Positive values indicate an excess of intermediate frequency alleles suggesting either balancing selection or population subdivision (Nielsen et al. ; Przeworski et al. ; Tajima ). Negative values indicate an excess of rare alleles and may suggest positive selection or rapid population growth (Nielsen et al. ; Przeworski et al. ; Tajima ). Fu and Li’s D and F ***statistics*** compare population mutation rate estimates obtained from derived singleton variants, to ΘW and π, respectively. Both summary ***statistics*** rest on the premise that older variants tend to exist on internal branches, or roots of a phylogenetic tree, while newer variants exist on the external branches (Fu and Li ). Therefore, recent positive selection and purifying selection are predicted to result in an excess of variants that lie on the external branches resulting in negative values of the ***statistics***. Balancing selection is predicted to result in positive values of D and F. One benefit to Fu and Li’s D is that it is more sensitive to selective sweeps acting on derived alleles compared to Tajima’s D. However, selection acting on standing variation can favor ancestral alleles, limiting the ability of these ***statistics*** to distinguish positive selection on standing variation. Fay and Wu’s H ***statistic*** measures the amount of high and intermediate frequency derived variants to detect positive selection (Fay and Wu ). A negative value of H results from an excess of high frequency derived alleles while a positive value implies a lack of intermediate and high frequency derived alleles compared to neutral expectations (Fay and Wu ). While SFS summary ***statistics*** are popular statistical tests for identifying deviations from neutral evolution within a population, other methods have been developed for comparisons between populations.

Population-specific natural selection can result in allele frequency changes in one population compared to a neutrally evolving population. Wright’s fixation index ***statistic***, FST, measures the amount of genetic differentiation between two or more populations (Table ) (Wright ). Positive selection tends to increase the population differentiation estimates at a selected locus whereas balancing selection tends to decrease FST (Akey et al. ; Andolfatto ; Cavalli-Sforza ; Wright ). Genetic drift also may increase the level of differentiation between populations. However, while positive selection is confined to one or few loci, genetic drift is expected to influence heterogeneity at many unlinked loci across the genome.

Phylogenetic-based tests

Methods that expand on allele frequency differences to explore phylogenetic relationships have been developed to identify population-specific selective events (Table , Fig. ). The locus-specific branch length (LSBL) approach incorporates FST distances to analyze population-specific allele frequency shifts (Shriver et al. ). This method compares FST between three closely related populations in order to express distances between populations in terms of branch lengths (Shriver et al. ). Likewise, the population branch ***statistic*** (PBS) uses phylogenetic theory to evaluate changes in allele frequency since population divergence (Yi et al. ). Both LSBL and PBS test the null hypothesis that two closely related groups, A and B, have similar branch lengths when compared to an outlier group C. If population A experienced positive selection at a locus, the effect will be a longer branch length than expected. This tree structure will look very different from that of the tree using genome-averaged allelic differentiation values for the three populations.

Composite tests

Composite tests for selection combine a subset of the independent tests for selection described above to increase resolution of the selective signature. Composite methods thus decrease the probability that the signal detected is a false positive and are an effective way to fine-map causal variants. These methods include the composite likelihood ratio (CLR), cross population composite likelihood ratio (XP-CLR), 3-population composite likelihood ratio (3P-CLR), the composite of multiple signals (CMS), and the SWeep Inference Framework (controlling for correlation) (SWIF(r)) (Table ). CLR identifies an excess of derived alleles across several sites in a single population (Kim and Stephan ; Nielsen et al. ) whereas XP-CLR does so in two populations (Chen et al. ; Vitti et al. ). By integrating multiple populations, XP-CLR models allele frequency differences across a chromosome as predicted by the genetic distance from the selected allele (Chen et al. ). XP-CLR has greater power to detect selection from standing variation as well as ‘ancient’ selective sweeps—sweeps that arose following the divergence of two populations, yet ended several thousand generations before the present (Chen et al. ). 3P-CLR is a modification of CLR used to distinguish selection events following the divergence of two populations, as well as selection sweeps shared between the two populations prior to the divergence from a third outgroup population (Racimo ). The CMS method combines FST, iHS, and XP-EHH for derived, high frequency alleles in one population compared to other populations (Grossman et al. ). This method has been shown to significantly reduce the number of genomic candidates of recent selection for local adaptation in human populations (Grossman et al. , ). Similar to CMS, SWIF(r) combines scores from FST, iHS, and XP-EHH (Sugden et al. ). However, this method also incorporates a machine learning mechanism whereby SWIF(r) is trained on simulations from user-selected demographic models (Sugden et al. ). By doing so, the probabilistic ***statistic*** does not require comparison with a genome-wide distribution, as is the case for CMS, and potentially increases power to localize candidate adaptive loci in both soft and hard selective sweeps (Sugden et al. ).

Polygenic adaptation

Polygenic adaptation occurs when multiple adaptive variants across many loci are favored by selection. Selection for polygenic traits only produces slight changes in frequencies of each of the causal alleles (Fig. a) (Pritchard et al. ). As a consequence, the response of a single allele will be statistically negligible and the signal of selection only can be identified in the cumulative frequency shift of all alleles associated with the phenotype in the population. In other words, polygenic selection for adaptive traits will dampen the signature of selection at each independent locus (Berg and Coop ; Haasl and Payseur ; Latta ), reducing the power of detection by summary ***statistics*** (Latta ; Le Corre and Kremer ). One strategy to increase sensitivity to detection of selection on multi-allelic traits is to apply regression analysis to extended haplotype homozygosity measures (Wiener and Pong-Wong ). The regression approach has been proven to be most effective at detecting polygenic selection when allelic diversity is high (Wiener and Pong-Wong ).

Limitations for selection mapping on ancient DNA

Selection mapping also has been applied in the burgeoning field of archaeogenetics that seeks to use ancient DNA (aDNA) to resolve questions of hominin evolution, including the timing of selection events (Knapp and Hofreiter ). However, while some have performed aDNA selection scans (Fehren-Schmitz and Georges ; Lewandowska et al. ; Lindo et al. ; Mathieson et al. ), applying a selection mapping approach with aDNA sequences is often very difficult given the highly degraded, short-fragment nature of recovered samples (Knapp and Hofreiter ). This results in low sequencing coverage, often with only one mapped read at each nucleotide site (Gunther and Nettelblad ; Haak et al. ; Monroy Kuhn et al. ). Given this low sequencing coverage, diploid calls cannot be made, resulting in sequences that cannot be confidently phased and thus are unsuitable for haplotype-based selection tests (Gunther and Nettelblad ; Haak et al. ; Monroy Kuhn et al. ). Therefore, aDNA selection scans are limited to allele frequency-based tests (Gunther and Nettelblad ; Haak et al. ; Monroy Kuhn et al. ). Technological advances in aDNA recovery that improve sample quality and yield upon ***collection*** and extraction, as well as methodological improvements of imputation and phasing, may offer more opportunities in the future for selection mapping of aDNA to inform evolutionary models of the chronology and tempo of selective events.

Identifying candidate adaptive variation in human populations

The suite of aforementioned statistical methods provides a means for detecting genomic loci with evidence of positive or balancing selection that can be further dissected to assess their contribution to biological adaptations. Study designs utilizing selection detection methods to hunt down functional adaptive alleles in the genome, and to inform evolutionary hypotheses of human adaptation, can be thought of in two categories: forward genetics or reverse genetics. Those pursuing forward genetics approaches start with a putative adaptive phenotype and uncover the genetic basis (Bigham and Lee ; Vitti et al. ). In this way, forward genetics seeks to test a specific hypothesis. A classic example of hypothesis-driven, forward genetics using selection mapping to understand human adaptation is the discovery of a causal variant in HBB underlying sickle cell anemia that was subsequently found to be under balancing selection in populations living in malaria-endemic regions (Allison ; Vitti et al. ).

Reverse genetics, on the other hand, seeks to understand the biological function of observed genetic variation, and therefore is hypothesis-generating (Fig. ) (Hardy et al. ). With advancements in genotyping arrays and genome sequencing technology, there have been a burst of whole-genome scans for signals of adaptive evolution in human populations (Crawford et al. ; Eaaswarkhanth et al. ; Grossman et al. ; Ilardo et al. ; Karlsson et al. ). Often, these scans identify several candidate genes and/or regulatory regions, or detect signals spanning large segments of the genome (Vitti et al. ). In order to pinpoint the causal variant(s) that underlies a putative adaptive phenotype and understand its function, work must first link genetic variation to biological phenotypes.

Identifying putative adaptive phenotypes associated with selection signatures

A common strategy for linking genetic variation to phenotypic variation is to perform genotype–phenotype association analyses. Association analysis can be targeted, such as candidate gene association studies, or genome-wide, such as genome-wide association studies (GWAS) (Rodriguez-Murillo and Greenberg ). Population-based association mapping is the process of linking genotypes to phenotypes within a population of unrelated individuals by leveraging LD (Singh and Singh ). Study designs include case–control association using a logistic regression and linear regression for quantitative traits (Tak and Farnham ). These approaches can help detect genomic regions harboring functional variants, but need to be followed up with further statistical and functional testing to identify the causal variants driving the association (Schaid et al. ).

The power of association mapping is dependent upon genotyped markers that lie in regions of strong, detectable LD in the population of interest (Risch and Merikangas ; Tak and Farnham ). Sample size, effect size, number of causal variants, and allelic heterogeneity all influence the statistical power of detecting an association (Schaid et al. ). A major issue with association mapping is that neutral variants linked to the causal variant can be identified as false positives (Tak and Farnham ). Also, association mapping is less powered to detect rare functional variants and those of small effect size (Xu et al. ). Better phenotypic measurements can sometimes improve the genetic effect size as can increased SNP density and sample size (Schaid et al. ). Furthermore, when phenotypic variation correlates with genetic relatedness, or when the study sample has unidentified population structure, markers may produce a false signal of association (Kang et al. ). Study designs can control for population structure to reduce the number of false associations (Kang et al. ). Given that association mapping can become cumbersome when several causal alleles exist or the relevant phenotypic variation is unavailable, a more efficient strategy to find and prioritize candidate alleles may be preferred. For example, some association methods combine expression ***data*** with genetic and phenotypic variables, such as with expression Quantitative Trait Locus (eQTL) mapping (Hormozdiari et al. ) and Backward Three-way Association Mapping (BTAM) (Lee et al. ).

Integrating selection mapping with association analysis can be a powerful tool to refine loci and localize candidate adaptive alleles (Guo et al. ; Johnsson ). For example, testing genetic variation in the candidate pigmentation gene, SLC24A5, that is under positive selection revealed that the rs1426654-A allele was able to explain ~ 22–32% of total skin color variation in a cohort of individuals from across South Asia (Basu Mallick et al. ). Furthermore, selection mapping can be performed before or after genotype–phenotype association analysis, or the two can be statistically combined. However, most combined selection-association mapping studies identify several candidate genes or larger candidate genomic regions. For instance, studies in Bangladeshi individuals from the Ganges River Delta show evidence that cholera has exerted strong selective pressures at ~ 305 candidate genes (Chowdhury et al. ; Faruque et al. ; Karlsson et al. ). Likewise, for putative polygenic adaptations, extensive lists of candidate loci driving overlapping selection and association signals have been compiled, such as for high animal-fat diet adaptation in indigenous Central Siberian populations (lipid and fatty acid metabolism genes FADS1, FADS2, HADHA, HADHB, MAN1B1, PLD2, and AGPAT1) (Hsieh et al. ), or pygmy stature adaptation in African rain forest hunter-gatherers (~ 60 Mb region comprising genes DOCK3, MAPKAP3, and CISH) (Jarvis et al. ). While these ***data*** represent key initial steps to understanding human genetic adaptation, they nevertheless substantiate the need for further strategies to map causal alleles. These datasets thus serve as rich sources for the fine-mapping and prioritization of candidate adaptive variants for functional testing.

Fine mapping and functional annotation to prioritize candidate adaptive alleles

‘Fine mapping’ is a strategy to localize causal variants from association and/or selection mapping hits through statistical, bioinformatic, and/or functional approaches (Schaid et al. ). Common statistical fine mapping methods, developed for GWAS hits, include heuristic methods (analyze pairwise correlations of each surrounding SNPs with the identified lead SNP), penalized regression models (use cross-validation to randomly partition into training sets to select SNPs to use in the regression), and Bayesian methods (probabilistic modeling) (Schaid et al. ). Fine mapping methods include CMS (described above), ‘selection detection by conditional coalescent tree’ (SCCT) (Wang et al. ), ‘integrated selection of allele favored by evolution’ (iSAFE, exploits the shoulders of sweeps with high performance up to 5 Mbp regions) (Akbari et al. ), and Fine-Mapping of Adaptive Variation (FineMAV, combines population differentiation, derived allele frequency, and molecular functional annotation) (Szpak et al. ).

Functional annotation of variants present within candidate genes or non-coding regulatory regions can help rank and prioritize variants for functional investigation. It can be used to inform statistical fine mapping or be assessed following fine mapping analyses (Schaid et al. ). Annotation criteria include mutation type (substitution, insertion, deletion, duplication, inversion, translocation), effect on coding sequence (missense, nonsense, frameshift, splice), and non-coding regulatory element type (promoter, enhancer, silencer, insulator) (Ip et al. ; Zhou and Zhao ). Variants also can be prioritized based on where they localize in the functional element, such as within a particular protein domain, splicing site, transcription factor binding site, among others (Ip et al. ; Zhou and Zhao ).

Functional annotations can be made from searching published literature, mining publicly available functional annotation databases, and using free bioinformatics tools. CAUSALdb is a free database that offers uniform fine-mapping of GWAS summary ***data*** pulled from 3000 studies using three state-of-the-art tools (including PAINTOR, CAVIARBF and FINEMAP), combined with functional annotation, offering users a browser view of variant-, gene-, and trait-level causal relations (mulinlab.tmu.edu.cn/causaldb, (Wang et al. ). Some tools have been curated for improving variant prioritization based on annotation ***data*** and functional prediction, such as Variant Prioritization Ordering Tool (VPOT) (Ip et al. ). The Encyclopedia of DNA Elements (ENCODE) Project portal (encodeproject.org) is a great resource for genome-wide annotations of functional elements, including a web interface called SCREEN, or Search for Candidate cis-Regulatory Elements by ENCODE (screen.wenglab.org). The UCSC Genome Browser is another excellent resource to simultaneously visualize functional annotations across a genomic interval from several databases, with annotation tracks for cross-species conservation scores, structural variants, phenotype-associated variants from the Online Mendelian Inheritance in Man (OMIM, omim.org), ClinVar (ncbi.nlm.nih.gov/clinvar/), UniProt (uniprot.org), and GWAS studies, to name a few. The browser also includes tracks for common SNPs from catalogs such as dbSNP (ncbi.nlm.nih.gov/projects/SNP) and the Genome Aggregation Database (GnomAD) (gnomad.broadinstitute.org). The GnomAD browser, developed by the BROAD Institute, compiles whole genome and exome sequencing ***data*** from disease-specific and population genetic cohorts, totaling 213,158 unrelated individuals, offering variant-level annotations (gnomad.broadinstitute.org). The Genotype-Tissue Expression (GTEx) Portal (gtexportal.org) provides extensive information on the relationship between genetic variants and human gene regulation/expression by using global RNA expression ***data*** across several tissue types and eQTL analysis. The WashU Epigenome Browser (epigenomegateway.wustl.edu) is a great visualization tool of high-throughput epigenomic and expression ***data*** from diverse adult and embryonic cell types, including annotated regions of open chromatin from DNAse hypersensitivity assays as well as histone modifications associated with gene repression or activation.

Insight into the molecular mechanism of an adaptive change can be gained from determining where candidate variants localize with respect to protein structure and protein sequence. Some popular biomolecular structure databases include Protein ***Data*** Bank (PDB, rcsb.org/pdb), Structure Classification of Proteins (SCOP, scop.berkeley.edu), and ‘Class, Architecture, Topology’ (CATH, cathdb.info). Three-dimensional structural analysis can be helpful to model the variant effect on protein structure, which can be achieved using free bioinformatics tools, such as PyMol (pymol.org/2/) and Missense3D (sbg.bio.ic.ac.uk/ ~ missense3d/). PDB offers a suite of other available molecular graphics software (rcsb.org/pages/thirdparty/molecular\_graphics). Useful resources to analyze protein function and domain information include PFam (pfam.xfam.org), Prosite (prosite.expasy.org), and PRINTS (130.88.97.239/PRINTS/index.php). Lastly, phenotype-drive mutagenesis screens, using different genome editing tools, are a rich source of annotated variants with visible phenotypes. Several high-throughput mutagenesis screens have been performed in diverse human cells, and available databases include GenomeRNAi (genomernai.org) and GenomeCRISPR (omictools.com/genomecrispr-tool). Functional annotation and bioinformatic modeling of genetic variants across diverse criteria using different online resources is a cost- and time-effective way to prioritize candidate variants for additional allele frequency tests and for functional investigation. Together these ***data*** can build a case for putative adaptive function in human evolution.

Major challenges remain for fine-mapping and variant prioritization despite the growing number of functional annotation resources and tools. This is particularly the case when results from integrated selection and association mapping studies detect extensive and/or numerous genomic loci; or when several causal variants of small effect contribute to the statistical signature of selection (Akbari et al. ; Schaid et al. ; Szpak et al. ; van de Bunt et al. ). While it remains an ongoing challenge to pinpoint the functional allele(s) driving the selection signal, we discuss successful examples in human populations below including infectious disease resistance and/or susceptibility, climatic adaptations, and dietary adaptations (Fig. , Table ).

Map illustrating the suite of discovered candidate adaptive alleles within diverse human populations highlighted in this review. These alleles are represented by rectangular bands, color-coordinated by the general geographic region of the study population(s), and mapped to the respective broader chromosomal region. Selection type is indicated by pattern: solid (positive selection) and striped (balancing selection). Multi-colored bands indicate loci where adaptive alleles are found in multiple populations. Note: this is not a comprehensive map of all identified candidate adaptive alleles in humans

Candidate human adaptive alleles discussed in this review and illustrated in Fig.

| **Category** | **Variant Type** | **Candidate Adaptive Allele** | **Functional Annotation** | **Chromosomal position (Hg38)** | **Gene (within or nearby)** | **Population(s)** | **Selection Mode** | **Trait** | **References** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Immunity | Substitution | rs2814778-G | 5? UTR1 | Chr1:159204893 | *DARC* | Sub-Saharan African, Malagasy | Positive | Infectious disease resistance (Malaria) | Hamblin and Di Rienzo (), Hodgson et al. () |
| Climatic | Substitution | rs11578671-A | Intergenic | Chr1:189811662 | *BRINP3* | High-Altitude Andean | Positive | Polycythemia tolerance from high altitude adaptation | Crawford et al. () |
| Climatic | Substitution | rs12097901-C | Exonic: missense (p.Cys127Ser) | Chr1:231421509 | *EGLN1* | High-Altitude Tibetan | Positive | High altitude adaptation | Lorenzo et al. () |
| Climatic | Substitution | rs186996510-G | Exonic: missense (p.Asp4Glu) | Chr1:231421877 | *EGLN1* | High-Altitude Tibetan | Positive | High altitude adaptation | Lorenzo et al. () |
| Dietary | Substitution | rs41525747-G | Intronic | Chr2:135851073 | *MCM6* | African Pastoralist (Tanzania, Kenya, Sudan) | Positive | Lactase persistance | Tishkoff et al. () |
| Dietary | Substitution | rs4988235-T | Intronic | Chr2:135851076 | *MCM6* | Northern European | Positive | Lactase persistance | Enattah et al. () |
| Dietary | Substitution | rs41380347-G | Intronic | Chr2:135851081 | *MCM6* | African Pastoralist (Tanzania, Kenya, Sudan) | Positive | Lactase Persistance | Tishkoff et al. () |
| Dietary | Substitution | rs145946881-C | Intronic | Chr2:135851176 | *MCM6* | African Pastoralist (Tanzania, Kenya, Sudan) | Positive | Lactase persistance | Tishkoff et al. () |
| Dietary | Substitution | rs182549-A | Intronic | Chr2:135859184 | *MCM6* | Northern European | Positive | Lactase persistance | Enattah et al. () |
| Immunity | Deletion | *CCR5?32* (rs333) | Exonic: frameshift deletion | Chr3:46373453 | *CCR5* | European | Positive | Infectious disease resistance (HIV) | Liu et al. (), Samson et al. () |
| Immunity | CNV2 | DUP4 | Fusion protein: GYPB/GYPA | Chr4:143870000?144150000 | Affects glycoporin locus | East African | Positive | Infectious disease resistance (Malaria) | Algady et al. () |
| Immunity | Substitution | rs7687256-T | Exonic: missense (p.Glu24Gly) | Chr4:144120555 | *GYPA* | Sub-Saharan African, South Asian, European | Balancing | Infectious disease resistance (Malaria) | Bigham et al. (), Ko et al. () |
| Immunity | Substitution | rs7682260-A | Exonic: missense (p.Ser20Leu) | Chr4:144120567 | *GYPA* | Sub-Saharan African, South Asian, European | Balancing | Infectious disease resistance (Malaria) | Bigham et al. (), Ko et al. () |
| Immunity | Substitution | rs40401-T | Exonic: missense (p.Pro27Ser) | Chr5:132060785 | *IL3* | Orang Asli, Ghanaian, Nigerian, African American | Positive | Infectious disease resistance (Malaria) | Liu et al. () |
| Immunity | Substitution | rs2243250-T | Intergenic | Chr5:132673462 | *IL4* | Orang Asli | Positive | Infectious disease resistance (Malaria) | Liu et al. () |
| Immunity | Substitution | rs2070874-T | 5? UTR | Chr5:132674018 | *IL4* | Orang Asli | Positive | Infectious disease resistance (Malaria) | Liu et al. () |
| Climatic | Substitution | rs16891982-G | Exonic: missense (p.Phe374Leu) | Chr5:33951588 | *MATP* | European | Positive | Skin pigmentation adaptation | Lao et al. (), Norton et al. () |
| Climatic | Substitution | rs3008052-T | Intronic | Chr6:165653494 | *PDE10A* | Sama-Bajau | Positive | Deep-sea diving adaptation | Ilardo et al. () |
| Dietary | Substitution | rs77768615-C | Intronic | Chr7:141999184 | *MGAM* | Andean | Positive | High starch diet adaptation | Lindo et al. () |
| Dietary | Substitution | rs7085104-G | Intronic | Chr10:102869116 | *AS3MT* | Colla | Positive | Arsenic water adaptation | Eichstaedt et al. () |
| Dietary | Substitution | rs1046778-C | Intronic | Chr10:102901727 | *AS3MT* | Colla | Positive | Arsenic water adaptation | Eichstaedt et al. () |
| Metabolic | Substitution | rs3135506-A | Exonic: missense (p.Ser19Trp) | Chr11:116791691 | *APOA5* | Mexican American | Positive | Increased dyslipidemia risk (Gene-environment mismatch) | Ko et al. () |
| Metabolic | Substitution | rs662799-C | Intergenic | Chr11:116792991 | *APOA5* | Mexican American | Positive | Increased dyslipidemia risk (Gene-environment mismatch) | Ko et al. () |
| Metabolic | Substitution | rs662799-C | Intergenic | Chr11:116792991 | nearby *LPL* | Mexican American | Positive | Increased dyslipidemia risk (Gene-environment mismatch) | Ko et al. () |
| Metabolic | Substitution | rs139961185-A | Intronic | Chr11:116936627 | *SIK3* | Mexican American | Positive | Increased dyslipidemia risk (Gene-environment mismatch) | Ko et al. () |
| Immunity | Substitution | rs334-T | Exonic: missense (p.Glu7Val) | Chr11:5227002 | *HBB* | Sub-Saharan African, Middle Eastern, South Asian | Balancing | Infectious disease resistance (Malaria) | Allison (); Piel et al. () |
| Climatic | Substitution | rs11230664-C | Intronic | Chr11:61308900 | *DDB1* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs7948623-T | 3? UTR | Chr11:61369675 | *TMEM138* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs80356779-T | Exonic: missense (p.Pro479Leu) | Chr11:68780662 | *CPT1A* | Siberian | Positive | Cold climate adaptation | Clemente et al. (), Cardona et al. () |
| Climatic | Substitution | rs80356779-T | Exonic: missense (p.Pro479Leu) | Chr11:68780662 | *CPT1A* | Alaskan Yup?ik | Positive | Cold climate adaptation | Clemente et al. () |
| Climatic | Substitution | rs1042602-A | Exonic: missense (p.Ser192Tyr) | Chr11:89178528 | *TYR* | European | Positive | Skin pigmentation adaptation | Norton et al. () |
| Immunity | Substitution | rs34137742-T | Intronic | Chr12:112910856 | *OAS1* | European | Positive | Infectious disease susceptibility (West Nile Virus) | Bigham et al. () |
| Climatic | Substitution | rs10744822-C | Intronic | Chr12:114346235 | *TBX5* | High-Altitude Andean | Positive | Polycythemia tolerance from high altitude adaptation | Crawford et al. () |
| Climatic | Substitution | rs1800414-G | Exonic: missense (p.His615Arg) | Chr15:27951891 | *OCA2* | East Asian | Positive | Skin pigmentation adaptation | Lao et al. () |
| Climatic | Substitution | rs1800404-C | Exonic: synonymous | Chr15:27990627 | *OCA2* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs1448484-T | Intronic | Chr15:28038295 | *OCA2* | European, East Asian | Positive | Skin pigmentation adaptation | Lao et al. () |
| Climatic | Substitution | rs6497271-A | Intronic | Chr15:28120285 | *HERC2* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs4932620-T | Intronic | Chr15:28269135 | *HERC2* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs1426654-A | Exonic: missense (p.Thr111Ala) | Chr15:48134287 | *SLC24A5* | European | Positive | Skin pigmentation adaptation | Lamason et al. (), Norton et al. () |
| Climatic | Substitution | rs34913965-T | Intronic | Chr17:27806151 | *NOS2* | High-Altitude Andean | Positive | Polycythemia tolerance from high altitude adaptation | Crawford et al. () |
| Immunity | Deletion | *SLC4A1?27* (rs769664228) | Exonic: in-frame deletion | Chr17:44258043 | *SLC4A1* | Indonesian | Balancing | Infectious disease resistance (Malaria) | Jarolim et al. (), Paquette et al. (), Wilder et al. () |
| Climatic | Substitution | rs56203814-T | Exonic: synonymous | Chr19:3544894 | *MFSD12* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs10424065-T | Intronic | Chr19:3545024 | *MFSD12* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs6510760-A | Intergenic, regulatory | Chr19:3565255 | *MFSD12* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Climatic | Substitution | rs112332856-C | Intergenic, regulatory | Chr19:3565601 | *MFSD12* | African, South Asian, Australo-Melanesian | Positive | Skin pigmentation adaptation | Crawford et al. () |
| Immunity | Substitution | rs2304207-C | Intronic | Chr19:49664469 | *IRF3* | European | Positive | Infectious disease susceptibility (West Nile Virus) | Bigham et al. () |
| Climatic | Substitution | rs6058017-G | Intronic | Chr20:34269192 | *ASIP* | African | Positive | Skin pigmentation adaptation | Norton et al. () |
| Climatic | Substitution | rs4911178-A | Intronic, Regulatory | Chr20:35364817 | *GROW1*(*GDF5* enhancer) | East Asian | Positive | Body size and proportion | Capellini et al. () |
| Immunity | Substitution | rs7280422-G | Intronic | Chr21:41429640 | *MX1* | European | Positive | Infectious disease susceptibility (West Nile Virus) | Bigham et al. () |
| Immunity | Substitution | rs2071748-A | Intronic | Chr22:35381625 | *HMOX1* | Orang Asli | Positive | Infectious disease resistance (Malaria) | Liu et al. () |
| Immunity | Substitution | rs8139532-G | Intronic | Chr22:35383575 | *HMOX1* | Orang Asli | Positive | Infectious disease resistance (Malaria) | Liu et al. () |
| Immunity | Substitution | rs5030868-T | Exonic: missense (p.Ser188Phe) | ChrX: 154534419 | *G6PD* | Southern European, Middle Eastern, Indian | Balancing | Infectious disease resistance (Malaria) | Tishkoff et al. (), Verrelli et al. () |
| Immunity | Substitution | rs1050828-A | Exonic: missense (p.Val98Met) | ChrX: 154536002 | *G6PD* | Sub-Saharan African | Balancing | Infectious disease resistance (Malaria) | Saunders et al. (, ), Tishkoff et al. (), Verrelli et al. () |
| Immunity | Substitution | rs137852331-G | Exonic: missense (p.Asn165Asp) | ChrX:154534489 | *G6PD* | Sub-Saharan African | Balancing | Infectious disease resistance (Malaria) | Saunders et al. (, ), Tishkoff et al. (), Verrelli et al. () |

1UTR untranslated region

2CNV copy number variant

Candidate adaptive alleles identified in human populations

Infectious disease adaptations: malaria

Searching for signatures of selection to identify susceptibility alleles for infectious disease is an appealing strategy as pathogens are hypothesized to have exerted strong selective pressures on evolving modern humans (Fumagalli et al. ; Haldane ; Karlsson et al. ). Many genes subject to local positive natural selection (e.g. DARC) or balancing natural selection (e.g. G6PD, SLC4A1) are associated with susceptibility to infectious disease (Bamshad et al. ; Hughes and Yeager ; Sabeti et al. ). Malaria, perhaps the most extensively studied human infectious disease, imparts one of the strongest selective pressures on modern humans (Evans and Wellems ). Co-evolution with the malaria parasite has led homozygous deleterious alleles that are associated with particular blood disorders to confer a selective advantage in the heterozygous state (Kwiatkowski ; Luzzatto ). The most well-known adaptive allele that confers resistance to Plasmodium falciparum malaria is the sickle cell allele (HbS) of the beta-globin locus, HBB, wherein individuals heterozygous for the HbS allele are protected from malaria invasion due to the malformation of a portion of the erythrocytes, yet do not present with severe sickle cell anemia (Allison ; Haldane ; Piel et al. ). The HbS allele of SNP rs334, caused by a missense variant c.20A>T(p.Glu7Val) in HBB, may function to reduce malarial virulence by reducing surface expression of P. falciparum erythrocyte membrane protein-1 (PfEMP-1) on infected erythrocyte cells, thereby impairing their cytoadherence to microvascular endothelial cells, a property necessary for the parasite to escape bloodstream removal by the spleen (Cholera et al. ).

In addition to the well-known HBB example, additional candidate alleles under balancing selection have been identified that underlie malarial resistance adaptations. Hypomorphic alleles at the glucose-6-phosphate dehydrogenase locus (G6PD) on the X chromosome that cause G6PD enzyme deficiency are the genetic basis for a number of hemopathologies in humans (Gregg and Prchal ). Among these alleles, the rs137852331-G (or “G6PD A”) allele and the rs1050828-A (or “G6PD A-”) allele are under balancing selection for partial malaria resistance in sub-Saharan African populations, while the rs5030868-T (or “G6PD Mediterranean”) allele may be under balancing selection in Southern European, Middle Eastern, and Indian populations (Kwiatkowski ; Saunders et al. , ; Tishkoff et al. ; Verrelli et al. ). The G6PD A- allele results in the missense change c.292G > A(p.Val98Met) that reduces G6PD activity by 82% compared to the ancestral allele and is associated with a 46–58% reduction in severe malaria risk in both heterozygous females and hemizygous males (Ruwende et al. ). Southeast Asian Ovalocytosis (SAO) is another blood disease resulting in oval-shaped erythrocytes that is protective against severe vivax malaria (Jarolim et al. ). A 27 base-pair deletion (Δ27) in the SLC4A1 gene which encodes an anion transport protein is responsible for this phenotypic trait, and while the SLC4A1Δ27 allele is protective against malaria and typically asymptomatic in heterozygous individuals, it is lethal in its homozygous state (Jarolim et al. ; Paquette et al. ; Wilder et al. ). Indonesian populations exhibit an excess of high-frequency, derived variants around SLC4A1Δ27 (Wilder et al. ), suggesting that natural selection has acted recently on this locus.

The Duffy antigen receptor for chemokine, DARC (or ACKR1), is another target of selection from malarial pressure (Oliveira et al. ). DARC encodes the transmembrane glycoprotein Duffy antigen (Fy) (Hadley and Peiper ), which exhibits allelic differentiation by geographic region with near fixation for the Duffy-null allele, Fy-, in the majority of sub-Saharan Africa (Livingstone ). The Duffy-null allele is due to a A>G substitution at rs2814778 in the GATA promoter of DARC, and individuals homozygous for Duffy-null (Fy-/Fy-) are resistant to erythrocyte invasion by Plasmodium vivax malaria (Miller et al. ). The selection signature around DARC extends ~ 6 kb upstream of the 5′ UTR (Hamblin and Di Rienzo ). Levels of sequence diversity and site frequency spectrum results indicate directional positive selection at DARC in sub-Saharan African populations (the Mandinka, Beti, Hausa, Mbuti, and Luo) when compared to sequence ***data*** from non-African groups (Italian, Han Chinese, Pakistani) that do not fit simple models of selection (Hamblin and Di Rienzo ; Hamblin et al. ). These results support the hypothesis that the fixation of the Duffy-null allele in mainland sub-Saharan Africa was the result of selective pressures from vivax malaria. Additionally, multiple Malagasy populations in Madagascar show high frequencies of the Duffy-null allele, with evidence for recent positive selection in the Merina Highlanders (Hodgson et al. ).

The GYPA locus encodes a ligand of the glycophorin A receptor expressed on the cell surface of erythrocytes that P. falciparum malaria uses to gain cell entry (Camus and Hadley ; Sim et al. ; Tolia et al. ). From targeted selection tests, GYPA shows patterns of variation supporting balancing selection in both malaria-endemic populations as well as in European populations (Bigham et al. ; Ko et al. ). Candidate adaptive alleles driving balancing selection at GYPA are the ancestral alleles rs7682260-G and rs7687256-C, and derived alleles rs7682260-A and rs7687256-T, which encode the M and N antigens on GYPA, respectively (Bigham et al. ; Ko et al. ). Alleles rs7682260-A and rs7687256-T result in missense changes p.Ser20Leu and p.Glu24Gly, respectively. In addition, the glycophorin locus (spanning genes GYPE, GYPB, and GYPA) is known to undergone copy number variation and gene conversion in the human population (Algady et al. ; Leffler et al. ; Suktitipat et al. ). A structural variant called DUP4, likely the result of a series of six copy number changes at the glycophorin locus, generates a GYPB-GYPA fusion protein (Leffler et al. ). The DUP4 allele is under positive selection in East African populations, likely conferring protection against P. falciparum infection by altering the parasite’s ability to interact with erythrocyte surface receptors (Algady et al. ). Differential signals of positive selection also have been discovered across Orang Asli populations from peninsular Malaysia in the immune response interleukin genes IL3 and IL4, as well as genes HMOX1, LTA, TNF, CDH13, NOS2, IRF1, and FAS, supporting the hypothesis that these groups have undergone convergent adaptation to counteract malaria (Liu et al. ). Fine mapping of candidate alleles within IL3 and IL4 genes that are under positive selection in the Che Wong population identified top candidate SNPs rs40401, rs2243250, and rs2070874 (Liu et al. ). The rs40401-T allele of IL3, which causes a missense change c.79C>T(p.Pro27Ser), is observed at high frequency in the Che Wong, as well as in Ghanaian, Nigerian, and African American populations (Liu et al. ). Furthermore, epidemiological studies found a 33% protective effect from recurrent malaria episodes in Ghanaians (Meyer et al. ). Top candidate alleles of IL4 (rs2243250-T and rs2070874-T) lie within the promoter, and are associated with higher anti-malarial antibody levels (Liu et al. ). The only other candidate alleles identified were in the Jakun population in the heme oxygenase regulator HMOX1 gene (rs2071748-A and rs8139532-G) (Liu et al. ), both were previously found to be associated with cerebral malaria protection (Sambo et al. ). Altogether, the above examples from diverse populations demonstrate that malaria has been a robust evolutionary pressure resulting in localized adaptations in immune response.

Infectious disease adaptations: HIV-1

Selection mapping also can be used to identify risk alleles to modern pathogens that were not the past selective agent (Karlsson et al. ). This is particularly relevant given the high level of redundancy of cellular and molecular protective activity within the immune system (Nish and Medzhitov ). This evolved redundancy arms the immune system with surplus compensatory mechanisms, for example, when loss of function variants disrupt certain immune response pathways (Fischer and Rausell ). In this way, host immune response utilizes existing genomic and molecular variation to respond to novel pathogens. Favored host genetic variation from past selective pressures from ancient pathogens can influence host immune resistance or susceptibility phenotypes in the face of novel pathogens. One well-studied immune locus under natural selection in human populations is the gene CCR5, which encodes a protein expressed on the cell surface of white blood cells (Libert et al. ; Novembre et al. ; Stephens et al. ). A 32 base-pair deletion (Δ32) at this locus, CCR5Δ32, is at high frequencies and under selection in Europe and western Asia (Novembre et al. ). Interestingly, the CCR5Δ32 allele confers resistance to infection by Human Immunodeficiency Virus-1 (HIV-1) by abrogating expression of the CCR5 chemokine receptor exploited by HIV-1 for entry into CD4 + T cells (Liu et al. ; Samson et al. ). The HIV-1 lentivirus evolved less than 100 years ago in Africa from simian immunodeficiency virus, and is therefore not the selective pressure that previously acted on the CCR5 locus (Sharp et al. ). Through the reconstruction of historical events, scholars hypothesize a different pathogen, such as smallpox, drove the signature of selection observed at this locus (Galvani and Slatkin ). The story of the CCR5Δ32 allele demonstrates how previously adaptive genetic variation can influence current susceptibility to modern infectious diseases. Further, it substantiates the use of selection mapping for identifying genes and/or regulatory elements that harbor resistance and/or susceptibility alleles to modern pathogens.

Infectious disease adaptations: West Nile Virus

West Nile Virus (WNV) is second modern pathogen for which susceptibility alleles have been identified by prioritizing genes with strong signatures of natural selection (Bigham et al. ; Lim et al. ; Yakub et al. ). WNV is responsible for highly variable infection outcomes across populations wherein infected individuals may be asymptomatic, present with West Nile fever, or develop potentially fatal West Nile neuroinvasive disease (Bigham et al. ). A case–control association study informed by selection mapping to identify host genetic susceptibility factors to WNV infection among Europeans found strong associations at intronic SNPs in IRF3 (rs2304207-C allele) and MX1 (rs7280422-G allele) with symptomatic WNV infection, as well as in OAS1 (rs34137742-T allele) with severe infection (Bigham et al. ). This research illustrates how selection mapping can be used to prioritize candidate genes for case–control association testing to localize susceptibility alleles.

Climatic adaptations: high altitude

High altitude, defined as regions lying above 2,500 m, represents one of the most marginalized and harsh environments inhabited by humans (Niermeyer et al. ). There are three high-altitude regions where humans have resided for millennia: the Tibetan Plateau, the Andean Altiplano, and the Semien Plateau of Ethiopia (Beall ). Populations from these regions display physiological and genetic adaptations to overcome reduced oxygen levels (Bigham and Lee ; Scheinfeldt and Tishkoff ; Simonson et al. ). Genome-wide and candidate gene research has identified compelling evidence for selection on the hypoxia-inducible factor (HIF) pathway and hypoxia-related genes (Alkorta-Aranburu et al. ; Beall et al. ; Bigham et al. ; Scheinfeldt et al. ; Simonson et al. ; Yi et al. ). Candidate alleles in EGLN1, EPAS1, and PRKAA1 are suggested to underlie altitude-adaptive phenotypes including hemoglobin concentration, birth weight, and maximal oxygen consumption during exercise (Beall et al. ; Bigham et al. , ; Brutsaert et al. ; Eichstaedt et al. ; Simonson et al. ; Yi et al. ). For example, high frequency candidate alleles in EGLN1, rs12097901-C and rs186996510-G (resulting in missense changes c.380G>C(p.Cys127Ser) and c.12C>G(p.Asp4Glu), respectively), are associated with hemoglobin concentration in Tibetan highlanders (Lorenzo et al. ). In addition to high altitude, human adaptation to hypoxic conditions may have occurred in the Bajau deep-sea divers of Southeast Asia. An intronic SNP in PDE10A (rs3008052) that is found within a peak positive selection signal in this population, shows significant association with enlarged spleen size (Ilardo et al. ). The discovery and functional investigation of adaptive alleles that mitigate hypoxia has translational implications for understanding and treating the disease biology caused by chronic hypoxia, including cases of ischemic heart disease, cerebrovascular disease, anemia, chronic obstructive pulmonary disease, and pulmonary hypertension.

Climatic adaptations: cold climate

Another extreme environmental pressure that challenges human survival is cold climate. Siberia is the coldest region inhabited by humans with an average annual temperature roughly 5 °C. Archaeological ***data*** estimate first human arrivals into the region around 45–40 kya (Goebel ; Goebel et al. ). Although cultural adaptations can help buffer humans from the physiological stressors of extreme cold, biological adaptations, such as increased levels of thermogenic brown adipose tissue (Daanen and Van Marken Lichtenbelt ), are necessary to withstand continued sub-zero temperatures. Genome-wide selection scans on indigenous populations from Siberia using iHS, XP-EHH, and PBS discovered a 3 Mb region on chromosome 11, containing ~ 79 genes with strong positive selection signals (Cardona et al. ; Clemente et al. ). While genes involved in the regulation of energy and metabolism (CPT1A, LRP5, and THADA) as well as the smooth muscle contraction, PRKG1, were identified in this scan, candidate alleles driving this signal we not identified (Cardona et al. ). However, further selection mapping work using whole genome sequencing ***data*** from Canadian and Greenland Inuit populations identified a nonsynonymous variant [c.1436C>T (p.Pro479Leu)] at the rs80356779 SNP in CPT1A, which is essential for fatty acid oxidation (Clemente et al. ). Given the rs80356779-T allele also is observed at a very high frequency in the Northeast Siberian populations from Cardona et al., , it is a top candidate causal allele driving the strong signal of positive selection from cold exposure (Clemente et al. ). Functional evidence shows that the CPT1A c.1436C>T (p.Pro479Leu) missense variant decreases fatty-acid oxidation and ketogenesis, decreases mitochondrial inhibition of malonyl-CoA on fatty acid β-oxidation, and is associated with increased high-density lipoprotein cholesterol with reduced adiposity in the Alaskan Yup’iks population (Clemente et al. ; Greenberg et al. ; Lemas et al. ). Together these ***data*** suggest an adaptive metabolic role based on gene-environment interaction (Clemente et al. ; Collins et al. ). Functional models seeking to recapitulate an adaptive function of this allele based on different environmental parameters of temperature and diet will be important to shed light on gene-environment interaction hypotheses. In addition, further fine mapping and functional investigation of other candidate adaptive alleles underlying cold adaptation in humans may help to uncover regulatory mechanisms of human adipogenesis, with potential to inform medical research of certain metabolic diseases, such as obesity.

In addition to metabolic adaptations, it is widely hypothesized that human body size and body proportions have adapted to temperature exposure for proper thermoregulation. Signatures of positive selection surrounding height loci have been identified (Amato et al. ; Voight et al. ; Wu et al. ). One interesting selection candidate for short stature is GDF5, which encodes the growth differentiation factor 5 protein involved in skeletal, joint, and central nervous system development (Buxton et al. ; Francis-West et al. ). Among East Asian populations, GDF5 shows evidence of positive selection and variation in this gene is associated with both decreased stature and osteoarthritis risk (Wu et al. ). Using a CMS approach, a strong selection peak was observed surrounding the 3ʹ UTR of GDF5 (Capellini et al. ). Functional fine-mapping analysis of this signal through a series of transgenic mouse reporter assays and gene rescue experiments led to the discovery of a novel growth enhancer of GDF5, named GROW1. A search for candidate alleles driving the positive selection signal surrounding GROW1 identified the regulatory rs4911178-A allele, which is associated with short height, observed at a high frequency in non-African populations, and is present in Neanderthal and Denisovan genomes (Capellini et al. ). These findings highlight the potential of selection mapping in unmasking adaptive variants in regulatory elements of the genome.

Climatic adaptations: ultraviolet radiation

Changes in exposure to ultraviolet radiation (UVR) accompanied changes in temperature as humans migrated out of Africa. The continuous spectrum of human skin color across the globe strongly maps onto the latitudinal distribution of UVR intensity (Chaplin ; Elias and Williams ; Jablonski and Chaplin , ). Darker pigmentation is caused by an increased production of eumelanin in the dermis, which acts to absorb UV light and scatter it. In this way, melanin protects against dermal damage as well as UV-A photolysis of folate—the breakdown of which can lead to neural tube defects (Brenner and Hearing ; Kaidbey et al. ; Schmitz et al. ). Conversely, in regions of low UVR, lighter pigmentation is hypothesized to have been selectively favored for sufficient endogenous synthesis of Vitamin D, minimizing risk of Vitamin D deficiency (Loomis ).

Selection scans for candidate alleles underlying skin pigmentation adaptation have uncovered a handful of candidate genes that differ in signals between human populations, supporting evolutionary convergence (Alonso et al. ; de Gruijter et al. ; Izagirre et al. ; Lamason et al. ; Lao et al. ; Myles et al. ; Norton et al. ; Voight et al. ). For instance, evidence for positive selection in African populations has been found at pigmentation-associated genes ASIP, MFSD12, DDB1, HERC2, TMEM138, OCA2, TP53BP1, DCT, TYRP1, EGFR, and DRD2 (Alonso et al. ; Crawford et al. ; Izagirre et al. ; Lao et al. ), whereas MC1R is under strong functional constraint by purifying selection (John et al. ; Harding et al. ; Rana et al. ). In European populations, the strongest signals of positive selection have been found in SLC24A5, TYRP1, KITLG, MATP, and TYR (Lamason et al. ; Lao et al. ; Norton et al. ). OCA2, DCT, KITLG, TYRP1, EGFR, and DRD2 have been suggested as candidates for positive selection in Asian populations (Alonso et al. ; Lao et al. ; Myles et al. ). In indigenous American populations, 14 candidate genes under positive selection have been identified, including SLC24A5, MATP, OPRM1, and EGFR (Quillen et al. ). Within these candidate genes, several candidate pigmentation alleles have been fine-mapped and functionally annotated. Identified dark pigmentation alleles include: rs6058017-G (ASIP); rs6510760-A, rs10424065-T, rs112332856-C, and rs56203814-T (MFSD12); rs11230664-C (DDB1); rs7948623-T (TMEM138); rs1800404-C (OCA2); rs4932620-T and rs6497271-A (HERC2) (Crawford et al. ). Associated light pigmentation alleles include: rs1426654-A (SLC24A5); rs16891982-G (MATP), rs6058017-A (ASIP); rs1800414-G and rs1448484-T (OCA2); rs1042602-A and rs1126809-A (TYR) (Lamason et al. ; Lao et al. ; Norton et al. ).

Recently, it has been suggested that light pigmentation alleles in modern human populations were present in the hominin lineage before modern humans evolved (Crawford et al. ), supporting a model of selection on standing variation instead of convergent de novo variants in northern latitude groups. Significant associations with skin pigmentation variants in SLC24A5, MFSD12, DDB1, TMEM138, OCA2, and HERC2 were observed among diverse African populations (Crawford et al. ). The well-known light-pigmentation allele in SLC24A5, rs1426654-A, was introduced via gene flow from non-African groups into East Africa (Crawford et al. ). The dark pigmentation alleles rs6510760-A, rs10424065-T, rs112332856-C, and rs56203814-T (MFSD12), rs11230664-C (DDB1), rs7948623-T (TMEM138), rs1800404-C (OCA2), rs4932620-T and rs6497271-A (HERC2) are identical by descent between African populations and populations from South Asia and Australo-Melanesia (Crawford et al. ). These fascinating results demonstrate the evolutionary complexity of human pigmentation as the result of both shared ancestry and derived adaptive variation. Together, the extensive body of research on the genetics of human pigmentation variation represents one of the greatest selection mapping efforts across diverse human populations.

Dietary adaptations

The advent of ***agriculture*** brought about new selective pressures on human populations in response to changes in diet. A prominent example of dietary adaptation is lactase persistence in diverse pastoralist populations. A 3.2 Mb region defining a strong signature of selection in these groups contains the lactase gene, LCT (Bersaglieri et al. ; Peter et al. ; Tishkoff et al. ; Voight et al. ). The protein encoded by this gene is responsible for breaking down lactose found in dairy products into glucose and galactose, thus enabling digestion in the intestines (Arribas et al. ). In northern European populations, two intronic SNPs upstream in MCM6 (within the regulatory region of LCT) are under strong positive selection (rs4988235-T and rs182549-A) and regulates LCT expression (Enattah et al. ). Evidence supports recent de novo selection for these regulatory alleles (Bersaglieri et al. ; Peter et al. ; Tishkoff et al. ; Voight et al. ). Among African pastoralist populations from Tanzania, Kenya, and Sudan, three derived alleles (rs145946881-C, rs41525747-G, and rs41380347-G) in intron 13 of MCM6 enhance LCT gene expression (Tishkoff et al. ). Lactase persistence thus represents another example of convergent evolution in humans from a shared cultural adaptation of adult milk consumption in northern Europe and East Africa.

Additional examples of dietary pressures driving human evolution include increased starch and fat consumption and exposure to arsenic in drinking water. Copy number variation of the salivary α-amylase gene (AMY1) is under positive selection among populations with dietary histories of high-starch consumption (Perry et al. ). Greater AMY1 copy number corresponds to increased salivary amylase protein expression, which has led to the hypothesis that increased AMY1 protein levels enhances starch digestion and/or plays a role in reducing risk of intestinal disease (Perry et al. ). However, conflicting evidence exists for the biochemical role of AMY1 in starch digestion, and some scholars argue AMY1 expression profiles across tissues need to be considered when hypothesizing an evolutionary role (Fernandez and Wiley ). Selection mapping in other populations points to additional parts of the genome involved in starch digestion. Signals of positive selection in the maltase-glucoamylase gene, MGAM, involved in the final stages of starch digestion, have been identified from comparative analysis of ancient Andean genomes (~ 7000 years ago) and contemporary lowland and highland Peruvians (Lindo et al. ). The top candidate adaptive allele in MGAM is the C allele of intronic SNP rs77768615—a locus annotated with promoter-associated histone modifications in intestinal cells and enhancer-associated histone marks in cells of the duodenum, stomach, and intestines (Lindo et al. ). The findings suggest an adaptive shift to a starch-rich diet in these Peruvian populations consistent with archaeological evidence of intensive potato processing and consumption in the region (Haas et al. ; Rumold and Aldenderfer ).

Aside from food pressures, exceptionally high levels of the carcinogen arsenic have permeated the water source of the Colla population in the Puna region of Northwest Argentina for thousands of years (Eichstaedt et al. ). Candidate adaptive alleles rs1046778-C and rs7085104-G, located within the arsenic methyltransferase gene, AS3MT, under positive selection in the Colla population, are associated with decreased expression of AS3MT and lower excreted monomethylarsonic acid levels in urine (Eichstaedt et al. ; Schlebusch et al. ). Given that high levels of monomethylarsonic acid are associated with arsenic-related illness, these ***data*** suggest adaptive variants altering AS3MT expression underlie adaptation to high arsenic environments in the Colla (Eichstaedt et al. ). Altogether, natural selection in response to dietary changes further exemplifies the diversity of adaptive genetic variation that underlies human adaptation.

Cardiovascular health

Selection mapping is useful for the study of complex diseases, such as cardiovascular disease. As discussed earlier, when a trait is subjected to positive directional selection, linked variation rises in frequency along with the causative adaptive allele(s). In some cases, linked deleterious variants may exist on the adaptive haplotype(s). If the fitness benefits of the adaptive allele(s) outweigh the costs of the accompanied deleterious variants, those variants may persist in a population through time. In addition, beneficial (or neutral linked) alleles in a past environment may become deleterious alleles in a novel or changing environment, resulting in a gene–environment mismatch or interaction (Corbett et al. ). A powered phenotype-genotype association analysis of the top candidate loci under positive selection in a Mexican–American cohort identified candidate risk alleles for dyslipidemia—a highly prevalent condition among Amerindian-origin populations that results in elevated lipid levels in the blood (Ko et al. ). Among the top associated hits were well-known obesity and cardiovascular disease genes, previously associated risk alleles rs3135506-A and rs662799-C of APOA5, and novel risk alleles rs139961185-A of SIK3 and intergenic rs28680850-A (nearby LPL) (Ko et al. ), potentially pointing to a gene-environment mismatch underlying disease risk in these populations. Similarly, it is well-described that high-altitude Andean populations, unlike other groups adapted to high altitude, exhibit polycythemia—an extreme production of red blood cells that can hinder blood flow to tissues from increased viscosity (León-Velarde ; Monge ). Top candidate alleles within haplotypes showing strong signatures of positive selection in a high-altitude Andean cohort—BRINP3 (rs11578671-A), NOS2 (rs34913965-T), and TBX5 (rs10744822-C)—were associated phenotypic variation in cardiovascular health (Crawford et al. ). The authors propose that high-altitude adaptation in Andeans involved changes in cardiovascular tolerance to polycythemia, instead of its reduction (Crawford et al. ). Together, this work emphasizes how the application of selection mapping can aid in the discovery of risk alleles for complex disease, particularly when disease expression depends upon gene-environment interactions. Subsequent functional investigation of identified human candidate alleles for both adaptive traits and disease risk is necessary to determine the molecular mechanism, build models of human evolution, and facilitate medical research.

Downstream approaches for functional validation of candidate adaptive alleles

Functional investigation of candidate alleles under natural selection predicted to mediate adaptive phenotypic change is necessary to link putative adaptive biology to underlying molecular mechanisms. With the exception of forward genetics approaches noted above (e.g. malaria resistance alleles), most candidate adaptive alleles identified by evolutionary geneticists and molecular anthropologists have not been investigated functionally. The following discussion offers suggestions on how to pursue functional validation in cases where candidate adaptive alleles are identified, yet the molecular mechanism is unknown and thus the link to physiological adaptation is unclear. We include examples of functional investigations of human candidate adaptive alleles that provide supporting evidence for evolutionary hypotheses.

Myriad functional assays are currently available to investigate the contribution of high-priority candidate adaptive genetic variants to adaptive phenotypes. In order to devise an effective research strategy to test for putative adaptive roles, it is imperative that researchers confirm a genetic mechanism of action for the candidate adaptive allele(s), identify a biological readout of the adaptive allele(s), and develop model systems (Fig. ). We divide this section into (1) functional assays to investigate genetic mechanism of candidate alleles, (2) systems to model molecular, cellular, and/or anatomical phenotypes, and (3) omics methods, which can collectively help link candidate adaptive variation to putative adaptive biology.

Functional assays for determining genetic mechanism

A major first step in detecting molecular phenotypes and ultimately linking this to adaptive biology is determining the genetic mechanism of candidate adaptive alleles. Genetic mechanism refers to the allele’s effect on functional sequence, RNA, and protein products (Marchetti et al. ). As mentioned earlier, mining functional databases and published research can help guide functional assays, e.g., by identifying the cell type(s) in which the variant is highly expressed. There are numerous functional analyses that allow researchers to assess the genetic mechanism of candidate allele(s) on molecular biology, such as the effect on spatial and temporal expression profiles of RNA and protein across cell types and development, subcellular localization, splicing patterns, 3D structure, molecular interactions, and chromatin organization (Musunuru et al. ). Genetic variants that alter the protein sequence can have consequences for the protein’s function, including loss-of-function alleles that reduce (hypomorph) or completely abrogate (null) protein activity, or gain-of-function alleles that confer novel or augmented (hypermorph) protein activity (Marchetti et al. ). For example, functional studies suggest both a gain-of-function and loss-of-function for alleles in EGLN1 alleles among Tibetan highlanders, acting to lower hemoglobin concentration (Tashi et al. ; Song et al. ). Quantitative PCR (qPCR) is a commonly used technique to assess RNA expression of target RNAs in a sample (Maddocks and Jenkins ), which may offer preliminary evidence of alterations to RNA expression from the adaptive allele compared to the ancestral allele. This method uses reverse transcription of RNA to complementary DNA (cDNA) and absolute quantification of target molecules by calibration with DNA standard controls (Peirson and Butler ). If the candidate adaptive variant lies within a non-coding regulatory element (i.e., promoter, enhancer, silencer, insulator), gene reporter assays can be used to assess the impact of regulatory changes on gene expression (Davidson et al. ; Fu and Xiao ; Smemo et al. ). In this assay, the regulatory element is inserted within an expression plasmid upstream of a minimal promoter that drives expression of a detectable reporter gene, such as lacZ or luciferase (Davidson et al. ; Fu and Xiao ; Smemo et al. ). The ability and strength of the regulatory element to drive expression is then measured in cells transfected with the reporter construct via enzymatic activity of the reporter proteins (Davidson et al. ; Fu and Xiao ; Smemo et al. ). For example, fine-mapped, dark pigmentation-associated variants rs6510760-A and rs112332856-C, under selection in an upstream regulatory element of MFSD12 in African populations, showed ~ 4.9 × decreased luciferase expression than light pigmentation-associated variants rs6510760-G and rs112332856-T (Crawford et al. ). This reporter method can be modified for testing sequences predicted to affect splicing patterns by inserting the sequence between two exons and measuring expression of spliced transcripts in transfected cells using qPCR (Cooper ). Comparison of assays with wildtype and variant sequence can help assess allele-specific effects on splicing.

A generic approach for evaluating a genetic variant’s effect on protein expression in a given biological sample is western blotting (Mahmood and Yang ). This technique first separates proteins by molecular weight through gel electrophoresis then transfers or blots proteins to a membrane where they are incubated with labeled protein-specific antibodies (Mahmood and Yang ). To determine if there is an impact on protein localization in the presence of the candidate adaptive variant, within tissues or specific cell-types, several techniques using protein- or RNA-specific labels have been developed, such as immunohistochemistry/immunocytochemistry and fluorescent in situ hybridization (FISH) (Coons et al. ; Langer-Safer et al. ). Cellular and subcellular localization also can be carried out using artificial peptide protein tags, such as a FLAG-tag or green fluorescent protein (GFP), genetically joined to the protein product via recombinant DNA techniques that require specific recognition antibodies for analysis (Einhauer and Jungbauer ; Kimple et al. ). The tag can then be visualized with immunofluorescence microscopy to reveal where the protein localizes (Einhauer and Jungbauer ; Kimple et al. ). Certain tags can be used in western blotting and immunoprecipitation, or to pull down the protein for 3D protein structure and X-ray crystallography analysis. Co-immunoprecipitation is a useful method for identifying altered or novel protein–protein interactions due to the variant using a protein-specific antibody to capture the target protein and any binding partners (Phizicky and Fields ). For every functional experiment, proper positive and negative controls as well as biological and technical replicates are crucial for validation. Steps to reduce experimental noise or off-target effects need to be taken to ensure the ***data*** reflect true molecular changes. After gaining preliminary insight into the basic molecular mechanism of the candidate adaptive allele, it is necessary to perform further experiments using appropriate model systems to delineate the contribution of the candidate adaptive alleles to putative adaptive biology (cellular, anatomical, physiological), and to inform evolutionary models of adaptation.

Modeling adaptive phenotypes

It is well known from work in molecular biology that the expression of specific RNA transcripts and protein isoforms, or use of certain regulatory elements, often exhibit developmental and cell-type specificity across organisms (Cardoso-Moreira et al. ; Mayer et al. ; Pollen et al. ; Sapkota et al. ). In vitro and in vivo model systems therefore offer a great opportunity to capture or enrich for the relevant, affected biology of the candidate variant predicted to underlie physiological adaptations. These model systems include bacteria, yeast, animal models, and cell culture. Model organisms such as the mouse, zebrafish, ferret, macaque, fruit fly, and C. elegans are commonly used (Leonelli and Ankeny ), depending on the ability of that organism to recapitulate the human phenotype(s) of interest, feasibility of genetic manipulation, and generational time course. In recent years, some studies have modified the genomes of animal models for functional characterization of candidate adaptive alleles and define their putative role in human evolution. Transgenic mouse models carrying the candidate derived regulatory allele (rs4911178-A) in the GROW1 enhancer of GDF5 for human height adaptation showed significantly reduced long bone length compared to the ancestral allele (Capellini et al. ). Additionally, a human-specific deletion of a regulatory enhancer for penile spine development, likely from selection relaxation in humans, results in failure of penile spine formation when knocked out in mouse models (McLean et al. ).

In conjunction with model organisms, researchers often use in vitro cell lines (Carter and Shieh ). Cell culturing is favorable as it offers a platform to model human cellular biology, and can offer a feasible, malleable, and quick way to obtain informative functional ***data*** (Carter and Shieh ). For example, cultured human keratinocytes were used to investigate the impact of a candidate adaptive SNP in KITLG under positive selection in Europeans and associated with blond hair color phenotypes, revealing an alteration in the LEF1 transcription factor binding site coupled with a reduction in enhancer activity (Guenther et al. ).

Cell lines for culturing can be obtained directly from primary tissue, or derived from an established cell line or strain. For instance, stem cell lines can be reprogrammed and differentiated into different cell types, or tissues, in the body (Park et al. ). Stem cells can either be embryonically-obtained or generated from chemically-inducing reprogrammable adult cells, such as fibroblasts, to a pluripotent stem cell-like state (Chin et al. ; Zhou and Ding ). The latter are referred to as induced pluripotent stem cells (iPSCs). Recent advancements in stem cell technology allow for the differentiation of iPSCs into 3D structures called ‘organoids’ that recapitulate in vivo organs, dependent on a standardized combination of ***nutrients***, growth factors, inhibitors, and other small molecules to specify organogenesis (Yin et al. ). This model system may be especially informative if the associated adaptive biology of the candidate allele is developmental (Lancaster et al. ). Perhaps the greatest insights from organoid models have come from modeling species-level adaptive variation in brain development (Kanton et al. ; Li et al. ; Pollen et al. ). For instance, recent work using cerebral organoids has demonstrated that human-specific NOTCH2NL gene duplicates—candidates for human brain evolution—are highly expressed in neural progenitor cells in the developing brain (Fiddes et al. ; Suzuki et al. ). Additionally, their expression is involved in delaying the differentiation of these cells, which corresponds to an increase in neuronal output underlying a larger brain (Fiddes et al. ; Suzuki et al. ). While this work shows the utility of organoid modeling of macroevolutionary differences, one can imagine the use of organoids for modeling putative adaptive alleles within human populations (e.g., spleen organoids to model the candidate PDE10A SNP for deep-sea diving adaptation (Ilardo et al. )). The appropriate model system is imperative for the applicability of functional findings to the understanding of human evolution. For example, using a mouse model to explore the role of a candidate genomic region during human brain development may be less useful than using human fetal brain tissue and/or human cerebral organoids as a result of unique features of cellular proliferation, differentiation, and organization of the human brain that are not conserved in the mouse (Huch and Koo ).

Upon selecting an appropriate model system, knockdown, knockout, and overexpression assays can be used to test sufficiency and/or necessity of the gene or regulatory region containing the variant for a particular biological feature, or to test the downstream targets of the variant, if not previously conducted. These ***data*** can help guide additional phenotyping. Such methods include CRISPR-Cas9 knockout (Ran et al. ), morpholino knockdown (Timme-Laragy et al. ), RNA interference (Agrawal et al. ), and CRISPR gene knock-in into a safe harbor locus (Verma et al. ). For example, morpholino knockdown of SLC24A5 in zebrafish (Lamason et al. ) and CRISPR-Cas9 knockout of MFSD12 in mice (Crawford et al. )—two genes under positive selection in humans and harboring candidate pigmentation alleles—confirmed a functional role in melanogenesis.

After selection of a suitable model system, one must determine a method for introducing the candidate allele. Given that the genetic variants may be as small as a SNV or as large as a chromosomal aberration, efficacy and feasibility must be considered. Two sources for which the desired allele can be acquired include: (1) original genomic sequence from the individual(s) with the allele, or (2) genetic engineering (Fig. ) (White ). Aside from primary tissue or iPSC-based analyses, cloning of the human genetic variants into a vector system for transfection may be desired for functional assays in bacteria, yeast, or in vivo transgenic models (Reed et al. ). For molecular cloning, the target region of interest is amplified and ligated into a selected cloning vector, generating recombinant DNA that can be introduced into the host organism for replication (Ashwini et al. ). Standard vectors contain a DNA replication origin, unique restriction endonuclease recognition sites for introduction of selectable marker gene(s) that aid in the selection of cells with successful integration of the vector sequence, and a tag gene for screening (Ashwini et al. ). In addition, if it is desired to have control over when the variant is expressed during development, or in which cell types, one might use a cell-type specific promoter or chemically inducible promoter systems, such as the piggy-bac transposon inducible expression system (Glover et al. ).

Artificially introducing genetic variation depends on the type of genetic variant. For instance, genetically engineering a bi-allelic substitution into the model system requires a different methodology than introducing a heterozygous deletion (Supharattanasitthi et al. ). The most recent and effective technique in gene editing is the CRISPR/Cas9 system in which guide RNAs direct the Cas9 nuclease to a specific genomic site and induce a double-stranded break (Cong et al. ). CRISPR/Cas9 is most often used to knockout a gene by introducing a deletion at the target site. However, current technological advancements allow for single base substitution changes by use of single-stranded oligodeoxynucleotides that are tethered to the Cas9-guide RNA ribonucleoprotein complex to promote homology-directed repair (Aird et al. ; Zhang et al. ).

Omics technologies

Downstream ‘omics’ approaches can offer valuable information on the global impact of the candidate adaptive variant(s) on expression dynamics and/or interaction networks involving several biological pathways across cells and tissues that underlie modeled phenotypes (Manzoni et al. ). These approaches include transcriptomics (RNA), proteomics (protein), and interactomics (molecular interactions) (Manzoni et al. ). Research studying human variation and disease is growing towards the integration of different omics techniques to concurrently evaluate different aspects of molecular biology (Karczewski and Snyder ). This exciting era of integrative omics analyses offers novel opportunities to investigate complex biological processes underlying adaptive evolution.

The complete set of transcribed or expressed RNA within a cell, tissue, or whole organism is referred to as the transcriptome (Berg ). Distinct features of expressed RNA can be exploited experimentally to capture the transcriptome of a sample using a method known as transcriptomics (Lowe et al. ). A popular method is bulk RNA-seq, a high-throughput sequencing approach that extracts and reverse transcribes RNA molecules from a population of cells in a given sample together (i.e., ‘bulk), generating a cDNA library for sequencing, processing, and alignment to a reference for averaged quantification of transcript expression within the sample (Wang et al. ). Library preparation for bulk RNA-seq can be performed to include the complex suite of functional RNA molecules present in the sample (including ribosomal RNA, transfer RNA, non-coding RNAs, and messenger RNA (mRNA)), or enriched for protein-coding mRNAs through polyadenylation capture techniques and/or depletion of non-mRNAs (Lowe et al. ; Wang et al. ; Zhao et al. ). Upregulation and downregulation of genes and gene sets in a sample positive for the candidate adaptive allele compared to wildtype can be assessed using bioinformatics analyses. For example, RNA-seq of cultured primary melanocytes obtained from African individuals carrying derived upstream regulatory alleles of MFSD12 (rs6510760-A and rs112332856-C) confirmed a significantly decreased expression of MFSD12 compared to cultured melanocytes derived from individuals carrying the ancestral alleles (Crawford et al. ).

More recently, methods have been developed to obtain sequencing ***data*** at single-cell resolution, allowing for the potential discovery of novel and/or unexpected biology not captured with traditional bulk sample approaches (Chen et al. ; Gierahn et al. ; Islam et al. ; Jaitin et al. ; Macosko et al. ). Single-cell RNA sequencing (scRNA-seq) methods resolve cellular heterogeneity in a sample, allow for cell lineage tracing during development, can uncover novel or rare cell populations, and often inform gene regulatory relationships (Hedlund and Deng ). The general analysis pipeline begins with sample dissociation, single-cell isolation, cell and transcript barcoding, library preparation, and high-throughput sequencing (Chen et al. ). Single-cell isolation can be carried out through the use of cell sorting techniques or through micro-well arrays, and transcripts are often captured via the 3ʹ end polyadenylation tail common to many protein-coding genes for reverse transcription (Gierahn et al. ; Islam et al. ; Jaitin et al. ; Macosko et al. ). Following sequencing, quality control and alignment to a reference genome are carried out, and ***data*** is often analyzed using unsupervised graph-based clustering methods, such as the Seurat R toolkit pipeline (Butler et al. ). Given proper control of batch effects, scRNA-seq comparison across genotypes can expose differentially expressed genes within an affected cell population of a sample, changes in cellular composition, and/or variation in cellular differentiation rates, together providing insight into allele-specific functional effects (Haghverdi et al. ). Current efforts in the field are focused on improving the ability to comprehensively integrate single-cell sequencing ***data*** across experiments and modalities (Stuart et al. ).

Other approaches seek to evaluate the entire set of translated proteins within a cell, tissue, or sample (the proteome) called proteomics. Two-dimensional gel electrophoresis combined with mass spectrometry, or more recently shotgun mass spectrometry, is often used for the identification and quantification of the sample proteome (Martins-de-Souza ). Proteome studies tend to combine approaches that characterize other features of proteins, such as post-translational modifications or interacting partners (Ke et al. ). Other research methods seek an ample readout of the molecular interaction dynamics in a sample, such as DNA-DNA, DNA-RNA, DNA-protein, and/or protein-protein—collectively called interactomics (Salas et al. ). A recent protein-protein interaction assay, Affinity Capture of Polyribosomes followed by RNA sequencing (ACAPseq) captures and sequences the polyribosomes of nascent proteins that bind to a bait protein to detect protein interactions (Peng et al. ). Thus, this approach may be very useful to assess changes in protein interactions for a candidate adaptive variant that alters a specific protein domain. Changes on genome-wide protein interactions with DNA, as well as epigenetic histone and DNA modifications, can be assessed with chromatin immunoprecipitation followed by sequencing (ChIP-seq) (Raha et al. ). One may wish to assess genome-wide changes in such interactions if the candidate adaptive variant affects the activity of a known chromatin modifier or a transcription factor, for example. There are also recently optimized single-cell ChIP-seq pipelines available that offer better resolution of the heterogeneity of chromatin states across cell-types (Grosselin et al. ).

Candidate adaptive variants (especially deletions, duplications, inversions, and translocations) may disrupt or re-organize topologically-associated domains (TADs)—domains that are proposed to partition the genome into regulatory units wherein several enhancers and promoters interact (Szabo et al. ). Chromatin conformation capture methods, such as Hi-C, evaluate spatial organization of chromatin in the cell and can be useful for understanding genomic changes that alter TAD structures (Lieberman-Aiden et al. ). Pairing findings of TAD disruption or re-organization with changes in expression can thus offer substantial insight into the mechanism of action of adaptive alleles. In general, there are limitations to be considered for each omics approach, in terms of method efficacy, batch effects, bioinformatics, and interpretation of results. Often, these results are hypothesis-generating and require additional follow-up experiments using specific functional assays. The most robust arguments for putative functional roles of candidate adaptive alleles will build on ***data*** from several model systems and experiments to generate sufficient biological readouts for confirmation and validation. Thorough and systematic functional validation work is crucial for informing adaptive hypotheses and models of human evolution.

Conclusion

Selection mapping can be informative for the broader scope of human biology, health, and disease when combined with association, fine-mapping, and functional analyses. Given the complexity and diversity of human genetic variation, environmental and cultural conditions, and gene-culture-environment interactions across geographicallydefined human populations through time, it is crucial for scientists to increase the number of selection mapping studies in non-European and admixed populations in order to better understand how natural selection shapes human biology across varying ancestral genomic backgrounds (Bentley et al. , ; Popejoy and Fullerton ; Sirugo et al. ). It is imperative to note that scientific bias in human genomic sciences is not limited to which populations are being studied. Greater efforts must also be made to increase representation within the community of scientific leaders who study human genetic variation beyond westernized scientists to include individuals from under-represented, vulnerable, and indigenous populations (Claw et al. ; Jackson et al. ). A more representative, global map of functional variants under natural selection in humans will have translational value for variant annotation in clinical disease cohorts, which are currently barraged with hundreds of variants of unknown significance from whole genome and whole exome sequencing ***data***. In addition, given the limited sensitivity of current genotype–phenotype methods to polygenic traits or rare variants, selection mapping can enhance the power of these analyses to detect causal variants. Nonetheless, limitations of current selection detection methods need to be overcome to inform the genetics of complex traits, and include improving both statistical inference methods and theory to better model complex soft selective sweeps. Moving forward, inclusion of additional global populations, particularly those with unique adaptive histories, to the growing database of selection maps will provide a fruitful source for phenotypic and disease mapping. Pairing selection mapping with association analysis has been useful for fine mapping causal variants of several traits in humans and other species. Beyond genotype–phenotype mapping, genome-wide selection mapping has the potential to enrich epigenetic, transcriptomic, proteomic, and interactomic research by pointing to functional factors that are evolutionarily conserved or adaptable.

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**Notes**

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HINA Digest

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**Length:** 12334 words

**Body**

Zagreb,Hrvatska27 February 2020 (Hina) -

**Third case of coronavirus reported in Croatia**

ZAGREB, Feb 26 (Hina) - The Dr. Fran Mihaljevic hospital for infectious diseases in Zagreb has confirmed a third case ofnovelcoronavirus infection andthe patient has been hospitalised in Rijeka, the national civil protection crisis team said on Wednesday afternoon.

The patient is a man who works in Parma, Italy, a press release said.

Health MinisterVili Beros said earlier in the day that so far 87 samples hadbeen tested for the coronavirus and that another eight werebeing tested.

The second case of coronavirus infection was confirmed in the night between Tuesday and Wednesday. The person was in close contact with the person identified as the firstcase,and a third person who was in contact has initially tested negative, the head of the Fran Mihaljevic hospital, Alemka Markotic, said on Wednesday.

The persons infected are exhibiting mild symptoms, they receive the necessary medication and no complications are expected, Markotic told a press conference at the national civil protection headquarters.

"We have started to administer an antiviraldrug that is otherwise used in HIV cases because it might be effective," she added.

Media say that the second person to contract the coronavirus in Croatia is the brother of the young man who tested positive on Tuesday.The young man works with the Ericsson Nikola Tesla company in Zagreb. Last week he had been to Milan, Italy with his girlfriendto watch a Champions League match; she tested negative.

"This is just the beginning, and we havesufficient medical supplies. I repeat, this disease doesn't pose a significant threat, it's like the common flu. More than 80 percent of the patients have mild symptoms," Minister Beros said, calling on the public to follow instructions from medical authorities.

**HEP confirms second person diagnosed with coronavirus their employee**

State-owned power provider HEP confirmed that the second person diagnosed with the novel coronavirus in Croatia is their employee.

"We can confirm that one of the persons confirmed to be infected with the coronavirus is our employee posted at HEP Group headquarters in Zagreb. He was not at work yesterday, and about 15 employees assumed to have been in close contact with him have been notified today not to come to work or have been sent home," HEP said in response to a query from Hina.

The company said that the necessary measures had been taken at the headquarters to protect the safety and health of the employees and visitors in line with instructions from the national coronavirus crisis management team.

**PM urges citizens not to panic about coronavirus or stock up**

ZAGREB, Feb26(Hina) - Prime Minister Andrej Plenkovic asked citizens on Wednesday not to panic about coronavirus orbuy lots of provisions because "at this moment everything is as it should be."

"Any panic, going on big shopping trips, stocking up, should stop. We are not in that kind of situation or atthat stage at all. The government will be 100% transparent in real timeas it isdiscovered that someone is positive or not, and we will inform the public. Everything we know, the public will know," Plenkovic told reporters.

Although the spread of coronavirus is a kind of external shock, a new circumstancewhose effect on the economyno one can fully estimate, the government will do everything so that life goes on normally, he added.

"All services have raised their readiness," he said, adding that quarantine premises were also being provided. "Everything at this moment is as it should be. There's no need to raiseexcessive panic or do something outof the ordinary."

**FinMin: Difficult to estimate economic impact of epidemic**

Finance Minister Zdravko Maric saidit was difficult to estimate how the epidemic would impact the Croatian economy due to a lack of key ***data***.

He told reporters the government would do its utmost to reduce the potential impact as much as possible, adding thatthe impact on tourist arrivals from Italy and other European countries should be taken into consideration.

Maric did not rule out additional state budget allocations to cover the costs of fighting coronavirus.

**Minister: Situation in schools normal**

Science and Education Minister Blazenka Divjak told reporterseverything was under control in schools with regard to coronavirus and that the situation was normal. Recommendations to cancel trips to Italy and abide by hygiene standards in schools remainin force, she added.

**Minister says county civil protection teams activated**

ZAGREB, Feb26(Hina) - After thenational Civil Protection Crisis Team was set up due to the outbreak of the coronavirus in Croatia, county-level crisis teams will be activated today, Minister of the Interior Davor Bozinovic, who chairs the national crisis team, said on Wednesday.

After meeting with heads of county crisis teams, Bozinovic told reporters that they discussed the organisation of work of local medical institutions and facilities to be used for isolation.

"They were informed about procedures used by the border police, including the sanitary service on border crossings. Medical professionals must be in charge of the situation, and they, including all other services at the county level, are implementing recommendations by epidemiologists," said the minister.

Health Minister Vili Beros said the current epidemiological situation in the country was still stable.

"We have instructed all hospitals and medical institutions about the possibility of banning visits...We have to organise better and reduce queues in waiting rooms," said Beros.

**Electronic Media Council calls for responsible, accurate reporting**

The Electronic Media Council on Wednesday called on all electronic media in Croatia to report about the coronavirus in a responsible, accurate and cautious way.

Unconfirmed reports about the coronavirus that have appeared on some web portals can contribute to the spreading of fear, which could result in panic, the Council said, calling on the media to follow official sources on the coronavirus, notably the National Civil Protection Team, the Croatian Public Health Institute and the Health Ministry.

It also advised the media against using the term "Wuhan virus", "Chinese virus" or other similar expressions that could appear in local contexts, citing World Health Organisation guidelines that advise against using geographic terms when naming diseases to prevent stigmatisation.

**Foreign ministry advises against travel to Italy**

ZAGREB, Feb 26(Hina) - The Ministry of Foreign and European Affairs on Wednesday issued a notice saying that considering the outbreak of corona virus, it advisescitizens to avoid travelling to Italy unless absolutely necessary and not to travel at all to the Lombardy, Veneto, Emilia Romagna, Piedmontand Lazio regions.

A twelfth victim infected with coronavirus died in Italyon Wednesday, while the number of those diagnosed with the disease stands at 374.

The most cases of infection have been reported in Lombardy, Veneto, Emilia Romagna, Piedmontand Lazio.

The ministry also recommends that travel to China, South Korea, Japan and Iran be avoided unless absolutely necessary.

The Health Ministry and Croatian PublicHealth Institute have launched a special website where they will be posting the latest updates regarding the disease. The address of thewebsite is [*www.hzjz.hr/medunarodna-istrazivanja/koronavirus-najnoviji-podatci/*](http://www.hzjz.hr/medunarodna-istrazivanja/koronavirus-najnoviji-podatci/)

More information regarding the developments in Italy can be found also at[*www.protezionecivile.gov.it/home*](http://www.protezionecivile.gov.it/home) and   [*www.salute.gov.it*](http://www.salute.gov.it).

North Macedonia's health ministry today confirmed the first case of the novel coronavirus infection in a woman who recently returned from Italy.

**Education ministry on coronavirus protective measures**

ZAGREB, Feb26 (Hina) - The Ministry of Science and Education on Wednesday issued recommendations on protective measures against coronavirus to all educational institutions, notingthat classes should be held and the curricular reform proceed asplanned.

Minister Blazenka Divjak saidthat the ministry was following the situation closely and that it would report on possible new circumstances and measures in a timely manner.

It is essential to delay until further notice all organised student excursions to affected areasas well as events such as sports competitions involving children from affected areas, she said.

The necessary hygienic measures, that is, general measures of protection according to recommendations by the Croatian Institute for Public Health (HZJZ) must be ensured in all schools.

Active health monitoring and self-isolation on the grounds of a border sanitary inspector's decisionlasts for 14 days after leaving affected areas, that is, China, South Korea, and the Italian regions of Lombardy and Veneto.

Active health monitoring of healthy children and students who arrive from affected areas and show no symptoms of the disease always consists of self-isolation.

Children and students who arrive from affected areas and show some of the respiratory disease symptoms should be treated as infected persons until infection is ruled out through microbiological diagnostics, which means that their hospitalisation is necessary.

Children and students who are undergoing active health monitoring in self-isolation do not attend classes in educational institutions for the duration of the measure.

Travel and events for students and children within Croatia are still possible, provided that children with respiratory symptoms do not take part, and outdoor activities are encouraged, says the ministry.

The ministry emphasisesthat the situation could change quickly with regardto the epidemiological situation, and that one should follow the HZJZ and Ministry of Health websites, where updates on coronavirus as well as preventive measures are published daily.

**Croatia Airlines flying to all its European destinations**

ZAGREB, Feb 26 (Hina) - Croatia Airlines is flying to all its European destinations according to schedule, and is following developments surrounding the coronavirus outbreak and taking the necessary measures, the national flag carrier said in a statement on Wednesday.

The company said that since January 23 it has been following recommendations by Croatian and international authorities regarding the coronavirus situation to ensure the health safety of its passengers, crews and other employees.

The company is in close contact with all the airports used by its aircraft to coordinate actions and procedures in the event that people infected with the virus use its flights.

Staff who come into direct contact with passengers on a daily basis have been issued with protective equipment.

**HUP director says coronavirus a potential risk to national economy**

ZAGREB, Feb 26 (Hina) - The director-general of the Croatian Employers' Association (HUP), Davor Majetic, said on Wednesday that the coronavirus could be a potential risk to the national economy.

"It certainly can be a potential risk if companies start closing down and movement restrictions are imposed. That would certainly have a great impact on consumption and the operation of some companies," Majetic told reporters ahead of a meeting of the government's Council for the Adoption of the Euro.

"Things are not harmless at all" and it is yet to be seen how the situation will unfold and to what extent restrictions will be imposed, as some other countries have done, he added.

"It is a fact that the virus will certainly do no good to the economy," Majetic concluded.

**HGK: Companies and stores prepared for coronavirus outbreak**

ZAGREB, Feb 26 (Hina) - The Croatian Chamber of Commerce (HGK) said on Wednesdaythat Croatian companies have prepared and adapted to the situation following the spread of the new coronavirusand there shouldbe no major problems with business operations and goods supply.

"In contact with Croatian companies we have noticedthat they have already carried out certain adaptations in their business operations and are closely watching how the situation is developing," HGK told Hina.

"If the current situation does not last for a prolonged period, we do not expect any problems," HGK said.

As far as supplies for local stores are concerned, retail outlets have prepared themselves, despite the fact that stores have noticed a somewhat higher turnover,it added.

"It is not possible at the moment to estimate how much the situation with COVID-19 will affect Croatia's economy, but we can say for certain that there will be some consequences," HGK said.

HGK added that companies have not reported any significant problems in doing business with Italy and China but that the situation could take a turn for the worse if the current measures remain in force or are stepped up.

There has not been any indication that commodities are lacking and it is expected that Chinese partners will resume their operations and reopentransport. Until then companies are adapting their business to the circumstances at hand.

HGK warned that if the crisis in Italy, as one of Croatia's most significant trading partners, escalates and business operations and other activities are suspended, it couldcause problems for Croatian companies.

"From the perspective of cross-border servicesand having in mind that Croatia's services exports in the first three quarters of 2019 generated a revenue of €1.06 billion, closing the borders or if Italy's economic growth slows down, that could affect Croatian companies intelecommunications, construction, personal services, commercial services and trade. In addition to affecting Croatian exporters, the crisis could cause problems for companies in tourism and logistics, particularly thosethat operate on Italy's transit route in the wood sector, clothing industry and energy - our key economic branches when it comes to exports to Italy," HGK estimated.

**Chamber of *Agriculture* against coronavirus panic, for working on self-sufficiency**

ZAGREB, Feb26(Hina) - The Croatian Chamber of ***Agriculture*** (HPK) said on Wednesday there was no need to panic over the appearance of coronavirus in Croatia, that it was necessary to work on self-sufficiency and that Croatia needed a clear strategy to increase the production of food and ***agricultural*** products.

Croatia is undertaking all prevention measures in line with recommendations from the Public Health Institute, the Health Ministry and the World Health Organisation, the HPK said in a press release, adding that hygienic and sanitary measures had been stepped up in the supply chain, shops and offices.

The HPK said it was incorrect that contact with farm animals was prohibited, adding that such misinformation in the media caused fear among farmers and producers. It called on the relevant authorities to explain how coronavirus impacts farmers' work and contact with farm animals.

**Croatia needs strategy to increase production of food and *agricultural* products**

The HPK said that because of the spread of coronavirus, more and more world companies warned that production could drop and supply chains be disrupted.

Although some retail chains have reported a higher turnover, the HPK believes there will be no major disruption in the food supply in Croatia.

However, it said, the appearance of coronavirus and the potential danger of a pandemic are another warning that Croatia urgently needs a clear and strong strategy to increase the production of food and ***agricultural*** products "because we depend on imports."

The HPK has been warning for years that it is a matter of national security if domestic production is below 50% of the self-sufficiency level andthat there is a shortage of food stockpiles, the press release said.

**EC: Croatia continues to make progress but not fast enough**

ZAGREB, Feb26(Hina) - After five years of economic recovery, Croatia's GDP in 2019 reached the pre-crisis level but compared to the European average, Croatia did not convergefrom 2008 to 2018, reads a report the European Commission published on Wednesday.

The report also notes that Croatia has continued making progress in correcting macroeconomic imbalances but that they are still present.

As part of its European Semester Winter package, the EC published reports on the overall economic and social progress in each member state and an analysis of the macroeconomic situation inthe countries with macroeconomic imbalances or excessive macroeconomic imbalances.

The report on Croatia has 79 pages, including annexes.

The EC notes that a stable economic growth in the last five years, combined with a careful macrofiscal stabilisation policy has made it possible for the country to gradually reduce the high levels of public, private and foreign debt, which in turn hasreducedthe economy's vulnerability.

The unemploymentrate has continued to fall, thereby raising thedisposable income of households. However, in2018, Croatia’s GDP per capita relative to the EUaverage was still at the same level as ten yearsearlier, meaning that there was no convergence at all.

GDP per capita, measured by the purchasing power, in 2018 was 63% of the European average, the same as in the pre-crisis 2008. Moreover, Croatia has fallen behind even more in relation to more advanced comparable countries of Central and Eastern Europe, which have left it behind. Despite a stable growth, a relatively low growth potential will continue to be an obstacle to catching up with other EU countries.

Participation in the labour market andlabour productivity remain low, and the businessenvironment and the public administration areinsufficiently supportive of faster economicconvergence. Implementation of policy measuresaddressing these weaknesses is proceeding at anuneven pace.

"Addressing structural weaknesses with lastingeffect would enable Croatia to converge fasterto the rest of the EU," the EC stresses.

Croatia has made limited progress inaddressing the 2019 country-specificrecommendations and, just as in 2019, it has macroeconomic balances. In 2019 Croatia left the category of countries with excessive macroeconomic imbalances to enter the category of countries with macroeconomic imbalances.

Since the start of the European Semester in2014, 57% of all country-specificrecommendations addressed to Croatia haverecorded at least 'some progress'. 'Limited'or 'no progress'has been made in the remaining43% of the recommendations.

Implementation of the reform agenda hasproceeded at an uneven pace in different policyareas.

Most progress has been made on fiscalpolicy and labour market. There has been somebacktracking on pensions after elements of the reform designed to increase the statutory retirement age were suspended as demanded bytrade unions, the EC says.

In 2019 Croatia saw limited progress in the implementation of the EC recommendations.

Certain progress was recorded in the implementation of the curricular reform and the management of state agencies.

Certain progress was made with the adoption of a new set of active employment measures.

In 2019 agreements on some key rail transport projects were signed, which contributed to progress on sustainable transport.

Certain progress has been made in court proceedings byexpanding electroniccommunication in courts and reducing backlogs.

As regards the business environment, improvement has been achieved by introducing a number of measures designed to reduce administrative obligations and liberalising services.

Progress has beenlimited in other areas, such as reinforcing the budgetary framework, improving the socialprotection system, reforming wage settingframeworks, improving corporate governance

and intensifying the divestment of shares andstakes in state-owned enterprises, and in theprevention and sanctioning of corruption.

**Macroeconomic imbalances**

Croatia has been making progress on macroeconomic indicators but it still has macroeconomic imbalances. In 2019 it exited the category of excessive macroeconomic imbalances.

Public debt remains high, but is falling rapidly.Public finances have improved andCroatia recorded its first fiscalsurplus in 2017, and its second in 2018, despite anon-negligible materialisation of contingentliabilities.

Thankspartially to improvements in public debtmanagement, debt is being refinanced at recordlow and predominantly fixed rates, with extendedmaturities.

The improvements in public financeswere recognised by Fitch and S&P agencies asthey upgraded Croatia's long-term sovereign creditrating to investment grade.

Improvements have been recorded also in household debt.

The consolidated corporate andhousehold debt levels for the third quarter of 2019are estimated at 58.4% and 34.3% of GDPrespectively, some 24 and 8 percentage pointsbelow the peak registered in 2010.

Although the current account surplus isshrinking, it is still helping to curb externalimbalances.

After peaking at 3.3% of GDP in2017, the current account surplus narrowed to1.9% of GDP in 2018, as the increase in imports ofgoods turned the trade balance negative.

Thecurrent account surplus rebounded in the first threequarters of 2019 to 2.2% of GDP largely dueto growing tourist receipts.

Low potential growth remains an obstacle toCroatia catching up with the rest of the EUmore rapidly, says the EC.

After reaching a low point in 2010,potential output growth has since increasedsignificantly, estimated at 2.1% in 2019.Althoughthis is higher than the EU average, it is the lowestamong peer countries.

The labour contribution to potential growth turned positive in 2019, due to agradual recovery of employment, though itremains one of the lowest among peers.Demographic trends and a chronically low activityrate are a drag on labour contribution to growth forfuture years.

"Significant structural reforms will be necessaryto increase Croatia's relatively low potentialgrowth," the EC notes.

Potential growth is projected to remainthe lowest among Croatia's peers throughout the2019-2021 period.

Despite improvements in the labour market, increasing the labour contribution to potential growth will require raising the low activity rate, which will be difficult, notably because of the demographic challenges in the country.

Productivity growth is still limited due to poor allocative efficiency, complex business environment and public sector inefficiency, the EC says.

As for tax policy, the EC says thatCroatia’s taxation system is strongly skewedtowards indirect taxation and is Croatia is among the member states which ***collect*** the least revenuefrom direct taxes.

This is partly a consequence ofvery low property taxes, which are considered tobe among the most growth-friendly taxes.

The lowshare of direct taxation is also a reflection of successive cuts in thepersonal income tax implemented over the past four years.

Aimed at reducing the tax burden on labour,the cuts have resulted in more than half of personsin employment not being liable for any personalincome tax.

Still, Croatia ranks around the EUaverage when it comes to revenue from socialcontributions in proportion to GDP, despite havingthe third lowest employment rate in the EU.

At thesame time, Croatia ***collects*** the highest share ofVAT revenue in proportion to GDP of all EUmember states.

In cooperation with Croatia, the EC has prepared a special annex on the health system, which says that despite the strong increase in revenue from health contributions, the healthcare sector continues toaccumulate arrears.

The revenue of theCroatian Health Insurance Fund (CHIF) is estimated to have increasedby 11% (year-on-year) in 2019.In spite of this, payment arrears tosuppliers of goods and services are estimated to have grown by over 15%.Furthermore, expenditure isexpected to grow strongly in 2020 on the back of wage increases in the sector agreed in September 2019 andthe Supreme Court ruling from December 2019 which upheld doctors'claims on unpaid overtime.

Arrears are mostly generated in hospitals, particularly those owned by counties.

Faced with the prospect of suppliers suspending deliveries, the central governmentsettles such arrears through ad hoc financial recovery programmes. There have been 12 such interventionssince 2000, ranging from 0.1 to 0.6 per cent of GDP in a given year, the EC says.

With regard to the fight against corruption and organised crime, the EC says that control and sanctionmechanisms are weak, notably at local level.

Although there isa considerable number of investigations andindictments in cases related to organised crime andcorruption, the inefficiencies of the justice system,such as lengthy court proceedings, often impedeclosure.Official ***statistics*** also show that asignificant proportion of corruption offences arerecorded at local level.

The Law on Local andRegional Self-Governance, which gives electedlocal officials considerable discretion in decision-making without subjecting them to assetdeclarations or other forms of oversight, remains aconcern.

The discretionary powers to decide ondisposing of assets and finances of up to HRK 1million and to appoint board members of publiclocal companies create scope for corruption, the EC says.

With regard to environmental sustainability, the EC notes that there is still a long way to go in the transition from a linear to a circular economy in Croatia. Besides some isolated initiatives,Croatia has no comprehensive circular economystrategy, it says.

Despite some progress, shifting waste fromlandfilling towards recycling remains a priority.

In Croatia, 25% of municipal wastewas recycled in 2018 -a big improvement from4% in 2010, but still substantially below the EUaverage of 47%. Landfilling of municipal wasteremains high at 66% (EU average 22%).

A continued strong effort would help Croatia toconverge to the EU average and ultimatelycontribute to achieving the European target of zeropollution, the EC says.

The EC also notes that air pollution has a significant impact on people's health, that sewage systems are underdeveloped and that thewater supply networks face high leakage rates.

As for greenhouse gas emissions, Croatia will have no problem meeting the EU targets for the period until 2020 but it will need additional measures to meet the targets set for the period until 2030.

The share of renewable energy sources is 28%, but in traffic it is very low, standing at a mere 3.9% in 2018, one of the lowest rates in the EU, the EC says.

**Plenkovic: EC report encouragement to gov't to continue reforms**

ZAGREB, Feb26 (Hina) - The Croatiangovernment on Wednesday welcomed the European Commission's report on Croatia aspart of the European Semester 2020, in which positive economic indicators have been recognised, and Prime Minister Andrej Plenkovic said the report would encouragethe government to continue working on reforms.

The government welcomes the EC report, which recognises positive economic indicators, especially efforts in the area of public finance and fiscal consolidation, the government said in a press release.

After the ECestablished in its last year's report that Croatia did not record excessive macroeconomic imbalances, for the first time since they were recorded in 2014, this year again the EC put Croatia among EU member states with stable economies.

In addition, rating agencies increased Croatia's credit rating to investment level, thus acknowledging responsible public finance management and the reform efforts which improve the business environment, the press release said.

"The government's approach, which is based on fiscal consolidation, structural reforms, and investments, has already resulted in an increase in disposable household income and in unburdening of the economy. The goal of all ongoing reforms is to continue boosting Croatia's competitiveness and increasing the standard of living of our citizens. The report encourages the government to continue working on reforms in all areas," said Prime Minister Plenkovic.

Croatian economy continued to grow in 2019 with aprojected rate of 3% of GDP, and 2.6% and 2.3% ofGDP in 2020 and 2021, which is twice the EU average growth rate in the period considered. Structural reforms, some of which were launched in 2019 and 2020, contributeto attaining long-term sustainable and higher economic growth rates. The European Commission's estimates on Croatia's economic growth are encouraging, and are even more optimistic than the government's," it was stated in the press release.

It was also emphasised that progress was recorded in all 14 areas for which recommendations had been given.

In the coming period, the government will focus on achieving full implementation of the National Reform Programme 2019, on which the assessment of progress in the implementation of recommendations is based,and especially on reforms of the public administration andhealthand judicial systems. Drawing up the National Reform Programme 2020 is also a priority, as is the implementation of measures within the Action plan for joining the Exchange Rate Mechanism II, which the Croatian government plans to finish by the end of May this year, the press release says.

**FinMin: We need to focus on structural measures and reforms**

ZAGREB, Feb 26 (Hina) - Finance Minister Zdravko Maric on Wednesday said that the European Commission's report onmacroeconomic imbalances shows that Croatia's economic growth and economic indicators have a sound basis but that it is necessary to focus on the implementation of structural measures and reforms.

"Croatia has recorded limited progress and stands alongside 14 member states. The remaining 13 have recorded certain progress," Maric said.

The European Commission on Wednesday published country reports analysing each member state's key socio-economic challenges and the level of progress made.

Maric considers that the most important thing is that the EC has recorded that Croatia's economic growth is stable.

"However, the thing that we all have to focus on is the implementation of structural measures and reforms because both monetary and fiscal policies have yielded and will continue to yield results thuscontributingto economic growth and its sustainability," he said.

The focus now is on structural challenges, and the EC reports identifies what has been done and what still needs to be done, said Maric.

He reiterated that the key to ensuringa sustainable economic growth and impacting growth potential was implementation of reforms inpublic administration, health system andjudiciary, dealing with the issue of demography, etc.

The government's current National Reform Programme contains 100 measures and so far one-third have been implemented, underscored Maric.

We still have until April and we expect that as far as fulfilling the measures is concerned, we will certainly surpass last year's level of just under 60%, he added.

After five years of economic recovery, Croatia's GDP last year reached its pre-crisis level, however, the EC's report notes that Croatia’s GDP per capita relative to the EUaverage was still at the same level as ten yearsearlier,Maricadded.

The EC also notes that "Croatia further reduced its external imbalances ...but remainsbelow prudential levels,"said Maric.

The EC on Wednesday published its European Semester Winter Package withreports on overall economic and social progress made in each EU member state andan analysis of the macroeconomic situation in countries with macroeconomic imbalances or excessivemacroeconomic imbalances.

**FinMin: Almost half the measures to join ERM II fulfilled**

ZAGREB, Feb 26 (Hina) - Finance Minister Zdravko Maric said on Wednesday that Croatia has fulfilled almost half of the 19 measures in six different categoriesrequired to adopt the euro and join the Exchange Rate Mechanism (ERM II).

Early in July 2019 Croatia sent a letter of intent to join ERM II, along with an action plan containing reform measures that need to be implemented by May this year when the European Central Bank (ECB) is expected to deliver its decision on Croatia joining the banking union, i.e.on establishingclose cooperation with the Croatian National Bank (HNB).

The fourth meeting of the National Council for the Adoption of the Euroas legal tender inCroatia was held on Wednesday. Speaking to the press after the meeting, Maric said that currently almost half of the 19 measures in 6 different areas that Croatia committed to have been fulfilled. Six have been met entirely, three partially and the remaining nine are underway. He expects that all the remaining measures will have been fulfilledbefore the end of Croatia's presidency of the EU, or even earlier.

After that, depending on the results of the analysis of the quality of the portfolio, further talks will be held with European institutions regarding the next steps in the ERM II process, added Maric.

The measures implemented include the law on credit institutions,rules onthe register of beneficial owners, amendments to the law on institutions, the law on the rights and duties of state officials, and so on. Among the laws that still need to be adopted are those relatingto unassessed construction land, which is currently in procedure, and tenders for the sale of shares in about 90 state-owned companies.

HNB Governor Boris Vujcic said that the quality of Croatian banks was being examined as one of the conditions for the ECB's decision on close cooperation and Croatia's admission to the banking union.

He said that so far five Croatian banks selected by the ECBhad been subjected to a stress test, and an examination of the quality of bank assets was now underway and should be completed soon, said Vujcic.

**Plenkovic: Croatia is already highly euroised**

According to a government press release, Prime Minister Andrej Plenkovic said that adoption of the euro as legal tender and joining the Schengen area were the two objectives of Croatia's deeper integration with the European Union.

Meeting the criteria for the adoption ofthe euro as well as formacroeconomic and fiscal stability is one of Croatia's key objectives, he underscored.

"In 2017, during the term of this government, Croatia exitedthe excessivedeficit procedure and last year we were assessed as no longer recording macroeconomic imbalances," he said and added that Croatia used this status and sent a letter of intent to join ERM II, which precedes the introduction of the euro.

Plenkovic said that Croatia is the smallest EU member state that is currently not in the euro area.

About 61% of loans in Croatia are foreign currency loans or those pegged to a foreign currency and 51% of deposits are in euro or in kuna indexed to the euro.

"The message is that Croatia is already a highly euroised country," added Plenkovic.

About 56% of Croatia's commodity exports go to euro-area countries and 66% of spending by foreign tourists is generated by those from countries in the euro area, he said.

**Croatia issues HRK 15 bn bond in 3 tranches**

ZAGREB, Feb 26 (Hina) - Croatia has issued a HRK 15 billion bond in three tranches with different maturities at apondered interest rate of around one percent, Finance Minister Zdravko Maric announced on Wednesday.

A HRK 5 billion bond was issued with a maturity of five years, a HRK 4 billion bond indexed to the euro will mature in 14 years, while a €800 million bond was issued with the longest maturity yet, of 20 years.

This makes a total of HRK 15 billion (€2.013bn) which will be used to refinance bondsthat mature next week, Maric told reporters after a meeting of the national council for the adoption of the euro.

He recalled that two domestic bonds would mature on March 5, one worth €1 billion and the otherHRK 5 billion (€676m), or a total of HRK 12.5 billion (€1.69m) which were issued in 2010 atinterest rates of 6.75% and 6.5% respectively.

He expressed satisfaction with this issue, noting that the yields for the HRK 5 billion, HRK 4 billion and €800 million bonds are 0.38%, 1.12% and 1.28% respectively.

The pondered interest rate is about one percent, said Maric, noting that this has led to significant savings in interest considering that the bonds that are maturing now have an interest rate of more than 6%.

He said that talks had already been conducted with the domestic financial industry, banks, pension funds, insurance companies, investment funds and all those who traditionally invest in Croatian bonds.

**HNB governor: Banks with inadequate money laundering alert system to be fined**

ZAGREB, Feb 26 (Hina) - Croatian National Bank (HNB) Governor Boris Vujcic told reporters on Wednesdaythat banks that do not havean adequate system to check for and warn of money laundering are subject to financial penalties that are imposed by courts.

Vujcic made the statement when asked by reporters about the consequences for the banking system if it is revealed that money laundering has occurredin a particular bank.

"Hypothetically speaking, in that case measures are taken to change, that is, improvethe banksystem thatsignalises money laundering. Penalties in cases of inadequate systems are financial and they are generally delivered bythe courts," Vujcic explained.

The Nacional weekly on Tuesday carried a feature headlined"Zagrebacka Banka chief Zivaljic removed after the biggest scandal in its history," reporting that the "HNBuncovered huge oversights in operations, numerous suspicious transfers of Russian money and huge payments without any checks, so Zivaljic had to go on command responsibility." The extent of the affair is still being established and everything is being monitored by the Finance Ministry, Nacional reported.

**Financial markets trying to forecast effects of COVID-19**

Asked to comment on the possible effects of the coronavirus on the capital markets, Vujcic said that it was odd that markets fell just when China announced that the climax of the epidemic had passed. Markets are evidently trying to forecast what will happen in case of a pandemic, he added.

Most stock exchangeshave recorded sharp falls and market stabilisation dependson when news regarding COVID-19 will be better, analysts have said.

The Zagreb Stock Exchange Crobex index on Monday plunged by 4.9%, which is its largest daily drop since 2009. On Tuesday it fell by anadditional 1.37%, however, it rebounded a little on Wednesday.

**First step taken towards establishing Intelligence College in Europe**

ZAGREB, Feb 26 (Hina) - Twenty-three countries, meeting at a conference in Zagreb on Wednesday,signed a letter of intent to establish the Intelligence College in Europe.

"The Intelligence College is a tool for cooperation, and cooperation is the only way for Europe to remain safe and prosperous," said the Director of Croatia's Security and Intelligence Agency (SOA), Danijel Markic.

"A safe, stable and prosperous Europe is our common goal," he said, adding that the aim of this initiative was to become "a bridge towards other communities."

The initiative aims to ensure dialogue between the European intelligence community, decision makers and the academic community.

Markic said that it was necessary to find a better way of communicating at a strategic level because of the diversity of intelligence services. Some are internal or external, with police powers or without them, and SOA is a hybrid service.

Prime Minister Andrej Plenkovic described the Intelligence College as "a very good form of cooperation which is more open than is usual in the intelligence community." He added that it would not be "operational cooperation", but that the College would deal with "strategic issues, communication and training."

The Intelligence College will not function as a platform for the exchange of security and intelligence ***data***. It will be based in Paris, and conferences and seminars will be held in countries that join it.

Thirty countries, including all 27 EU member states, the United Kingdom, Norway and Switzerland, have been offered to participate in the initiative. To date, 22 EU member states and the UK have given the green light to the Intelligence College, while EU members Bulgaria, Slovakia, Poland, Luxembourg and Greece have not yet joined in. Plenkovic believes that "the other countries will join with time."

Ranko Ostojic, the chairman of the parliamentary Committee on Home Affairs and National Security, stressed the importance of intelligence services and their cooperation with other actors, stressing that "whoever is in control of information also controls the situation."

"You see what's going on with the new epidemic which may turn into a pandemic. Professional, experienced people who possess information can be of great help to decision makers," he said.

The idea to establish the Intelligence College was floated by French President Emmanuel Macron in a speech at the Sorbonne in September 2017, when he expressed the need to establish a kind of European intelligence academy where EU intelligence communities would converge through training, education and exchange.

**PM says parliamentary majority stable, will see term through**

ZAGREB, Feb26(Hina) - Prime Minister Andrej Plenkovic said on Wednesday the parliamentary majority was stable despite disputes over the population census law and Sunday work, and that he was confident it would see its term through.

"It's not an issue which would destabilise the majority. I think the matter was agreed to last week already. Tomorrow I will convene the parliamentary majority and we'll discuss that too," he told reporterswho asked him if he had talked with ethnic minority MPs about the census law after the rejection of their amendments to it.

Plenkovic said the parliamentary majority could not be destabilised by the debate on Sunday work either. The Croatian People's Party, the coalition partner of hisHDZ, is againstbanning it.

"Despite everything, no matter how much someone tries, it won't happen. The term will be carried out until the end as it should," he said, adding that those advocating a snap election should know that "political stability is necessary for Croatia and its economy, institutions, democracy, employment, salary growth in the public and state sectors, higher pensions. Those who don't understand that are politically illiterate and irresponsible."

Plenkovic also commented on the resignation of Chief State Prosecutor Drazen Jelenic after it was discovered that he is a member of a Masonic organisation, saying Jelenic did his job fairly and professionally.

He would not comment on possible disciplinary procedures against Jelenic. He said it was important to him that the integrity of the State Prosecutor's Office remainbeyond question and that this was why he told Jelenic that it would be appropriate for him to resign. Plenkovic said it was common sense for someone tosay they werea member of an organisation, notably when taking one of the most important positions in the judicial system.

"I don't think Jelenic did anything illegal or that he compromised his work. He worked professionally and by the law, but this circumstance brought him into an untenable situation in that position."

Plenkovic also said that he had not talked with President Zoran Milanovic yet about extending the term of Security and Intelligence Agency (SOA) chiefDaniel Markic, which expires in May. "We'll talk. Markic has my full confidence. If he wants to continue to run SOA, he will."

**HDZ whip: I'm sure we will find common ground with minorities on census bill**

ZAGREB, Feb 26 (Hina) - Croatian Democratic Union (HDZ) whip Branko Bacic said on Wednesday that he wasconvinced that before the vote in parliament on Friday, he would find common ground with minority MPs on the population census bill, adding that he would conduct talks with them later in the day.

The government has already voiced its opinion on the amendments to the bill, the first of which relates to including representatives of ethnic minorities as census takers in those regions where they are more represented. That amendmenthas pretty much been accepted, however, it will not be regulated by this law but by instructions to beissued by the statebureau of ***statistics*** to its county branches, said Bacic.

As far as the possibility of having more than one native language, the government has rejected that amendment, he added.

Bacic explained that he hadexamined the way the last two censuses were conducted and thatnothing would change with regard tothe acquired level of ethnic minority rights.

"In 2011, census takers were also selected from ethnic minorities. That has been the practice so far, however, we did not specify it in the bill because membership of a minority or a majority ethnic group is not the only criterion for the selection ofcensus takers. Wewill determine the final position on the matter at a meeting with minority representatives today," said Bacic.

In response to announcements by Serb MP Milorad Pupovac that he will insist on both amendments, Bacic reiterated that that will be discussed at today's meeting.

"All previous censuses were conducted in the same way we intend to conduct the next one, the only difference nowbeing the possibility for citizens to complete the census form online, which is why the law is being amended," Bacic explained.

Asked whether parliament could be blocked and whether ethnic minority MPs might cause a lack of a quorum as they did last Friday, Bacic said that sometimes HDZ MPs were opposed to certain laws yet they were adopted anyway.

"It is important that thelaw is adopted by the ruling majority as it is necessary for conducting the census. I think that the absence of minority MPs and lack of a quorum was due tothe way some colleagues in the Opposition behaved and their inappropriate statements about minority MPs," said Bacic.

**Procedure was adhered to**

"I think that the procedure with the law was respected. The law was up for public consultation for 30 days and anyone could have given their opinion on it. I heard about the amendments only during the debate (in parliament). Just one day before the vote on the bill was to be taken. I believe that by Friday we will find a common language," said Bacic.

Reporters were interested in more detail concerning former chief state prosecutor Drazen Jelenic and his membership of a Masonic lodge.

"After Mr Jelenic resigned, he cannot conduct any office and particularly not at such a high level as deputy chief state prosecutor, and be a member of an organisationor association that is in conflict of interest with his fundamental duty," Bacic told reporters in parliament.

"We first have to dismiss Mr Jelenic and I believe we will do that on Friday...Mr Jelenic has to say whether he is a Mason or not before becoming a deputy chief state prosecutor," concluded Bacic commenting on Justice Minister Drazen Bosnjakovic'sstatement that no disciplinary measures would be launched against Jelenic.

**Justice Committee endorses motion to relieve Chief State Attorney**

ZAGREB, Feb 26 (Hina) - The Croatian Parliament's Justice Committee on Wednesday unanimously endorsed a motion to relieve Drazen Jelenic of his duties as Chief State Attorney, after it was revealed that he is a member of a Masonic lodge.

Pedja Grbin (SDP) proposed during a brief discussion that this rare situation be used to "rectify certain things that are not functioning in the system." He suggested that candidates for the post of Chief State Attorney should be vetted.

His second proposal concerned membership of associations. "Last week the minister expressed his doubts about whether the Chief State Attorney can become a deputy to the Chief State Attorney" considering his membership of a secretive organisation, Grbin said, adding that the law was clear about membership of political parties but not about membership of associations.

Justice Minister Drazen Bosnjakovic said that they would analyse the proposal. He noted that background checks were made at all levels of government except for the Supreme Court President and the Chief State Attorney.

He said it was unacceptable for any judge or state attorney at any level to be a member of any organisation whose operation was not transparent. "That's unacceptable ... because we don't know if he has found himself in a situation that he has to pay back his debts or is under obligation to someone," Bosnjakovic said, adding that he agreed that these things should be discussed during the amendment process.

MP Stevo Culej of the ruling Croatian Democratic Union (HDZ) recalled that in 2012 the SDP-led government under Prime Minister Zoran Milanovic had suspended security vetting.

Parliament will discuss the motion today and is expected to vote on it on Friday.

**Opposition wants background checks for candidates for chief state prosecutor**

ZAGREB, Feb26(Hina) - Opposition MPs said during a debate on Chief State Prosecutor Drazen Jelenic's dismissal on Wednesday that they doubted anything would change with the new chief state prosecutor unless background checks were introduced for candidates.

They also calledfor a probe into MPs' and government members' possible membership of secret organisations.

In thedebate on Jelenic's resignation, which ensued after it was revealed that he is a member of a Masonic lodge, Social Democrat Pedja Grbin said that the Act on the Office of the Chief State Prosecutor shouldbe amended to restore background checks for candidates, which, he said, were not carried out at the time when Jelenic was appointed.

"We do not have criteria for defining a person's membership of an organisationthat is incompatible with the office of the chief state prosecutor," said Grbin, calling for the adoption of amendments that would specify those criteria.

Bridge MP Nikola Grmoja asked if disciplinary proceedings would be launched against Jelenic for failing to disclose his membership of a Masonic lodge to his superior.

He suggested asking MPs and government members to state if they are members of Masonic and other secretive organisations as well as adopting amendments that would envisage criminal liability for withholding such information from the relevant parliamentary committee.

Hrvoje Zekanovic of HRAST and Marin Skibola of the Independent Youth List said they did not understand why Jelenic had to go.

"The reasons for dismissing the chief state prosecutor are not clear," said Skibola, while Zekanovic said that one should check if the organisation of which Jelenic was a member worked against Croatia.

He also called for investigating how many members of Masonic lodges sat in the parliament and government, claiming that this was not being done "because it would reveal that many MPs are members of secret organisations."

GLAS MP Vesna Pusic said that Jelenic was being dismissed for wrong reasons.

He was biased and unprofessional, that is why he should be replaced, not because he isa member of a legal organisation, she said.

Explaining the government's proposal to relieve Jelenic of duty, Justice Minister Drazen Bosnjakovic said that his membership in "an organisation" had become an obstacle to his actions in a specific case.

As for independent MP Marko Vucetic's request that Jelenic's be prosecuted if as a Mason he had violated the law, Bosnjakovic said that there was no evidence that the chief state prosecutor had acted unlawfully.

"There has been a loss of trust in a specificcase. A person who does not enjoy the public's trust cannot hold the office of the chief state prosecutor. To be the chief state prosecutor means to be independent and autonomous," the minister said.

**SDP MP wonders what gov't is hiding by not publishing GRECO report**

Social Democrat Zeljko Jovanovic used the debate on Jelenic to askBosnjakovic why he was hiding from the public a report by the Council of Europe anti-corruption body GRECO.

He explained that he was referring to a report on the prevention of the conflict of interest in executive authorities.

The report was published at the end of last year and according to unofficial information, it has not been published in Croatia because it has not been translated, Jovanovic said, adding that he believed the government was hiding GRECO'scriticism over its obstruction of the work of the Conflict of Interest Commission.

"You are incapable of translating a few pages. Are you hiding that you have been criticised for obstruction (of the Conflict of Interest Commission's work)?" asked the SDP MP.

**Discussion on SDP-sponsored abortion bill adjourned again**

ZAGREB, Feb 27 (Hina) - The Croatian parliament adjourned discussion on the Social Democratic Party (SDP)-sponsored bill on medical termination of pregnancy on Wednesday evening for the second time in a row after SDP MPs walked out angered by the fact that the government again had not stated its position on the bill or sent a representative to the debate.

"We understand that the government cannot give its opinion until the HDZ (Croatian Democratic Union) has completed internal elections in the party. That's why we will wait so that we have an interlocutor with a clear position," said the head of the SDP group in parliament, Arsen Bauk, after which the party's lawmakers left the chamber and the session was adjourned.

Discussion on the bill, which aims to ensure that abortion in Croatia is legal, accessible and free of charge, opened on February 5 but was adjourned because of the government's failure to state its opinion.

**AmCham: Business environment in Croatia better, but country lags behind other countries in region**

ZAGREB, Feb26(Hina) - Business conditions in Croatia are better compared to last year, but Croatia lags behind other countries in the region, show the results of anAmerican Chamber (AmCham) Croatia survey on the business environment in Croatia,presented on Wednesday.

"Although a significant number of respondents rated their business experience in Croatia as average (43%), when compared to 2018, there is an increase ofpositive business experience in Croatia, which was 49% in 2019, as well as a decrease ofthe negative experience. Also, 52% of the respondents have noticed improvement ofbusiness conditions in the last five years," AmCham Croatia Executive Director Andrea Doko Jelusic said while presenting the survey, which was conducted on a sample of 111 board members of domestic and international companies in Croatia, from 16 December2019 to 13 February 2020.

The survey shows that 67% of the respondents assessed their business results in 2019 as positive, while 55%reported an increase in the number of employees.

"Indications for the future are also positive. Around80% of the companies plan to expand their business in Croatia, while only 2% plan a possible reduction of business," said Doko Jelinic, adding thataround 71% of the companies planned to hire new employees in the next three years.

However, the survey shows that, despite progress, Croatia is lagging behind other countries in the region.

"Despite certain improvements in the assessment of the business environment, comparison withother countries in Central and Eastern Europe shows that half of the respondents rated business conditions in Croatia as worse than in other countries of Central and Eastern Europe, and only 13% consideredthem better," said the AmCham Board of Governors President Ruza Tomic Fontana.

Therespondents highlighted taxation of labour,lack of adequate workforce and high business taxesas the three main limiting factors for their business in 2019.

"During the last few years, we have seen four rounds of tax reform. It has somewhat surprised us that labour taxation is again high on the list of the limiting factors for business in Croatia," said Doko Jelusic.

One has to take into account the fact that other countries have also worked on their business environment, Doko Jelusic said, mentioning that Romania and Bulgaria have labour taxation of around 10%, the Czech Republic from 20% to 23%, and Slovakia from 19% to 25%. Those countries are considerably more competitive than Croatia, which at this moment has an initialpersonal income tax rate of 24%, as well as the higher personal income tax rate of 36% on annual incomes of more than €48,000, she noted.

The respondents said the greatest disadvantages of Croatia compared to other countries in Central and Eastern Europe were the small size of the market, level of taxation and slow administration.

AmCham Croatia represents the business interests of over 250 American,Croatianand other international companies which employ over 88,000 people in Croatia.

**Croatia presents instrument of ratification of ILO convention to director-general**

ZAGREB, Feb 26 (Hina) - Croatian Foreign and European Affairs Minister Gordan GrlicRadman on Wednesday presented Guy Ryder,Director-General of the International Labour Organisation (ILO), with an instrument of ratification of the Convention on Tripartite Consultation, whereby Croatia became the 152nd ILO member to ratify the document.

"By ratifying the No. 144 Convention on Tripartite Consultation to promote the implementation of international labour standard from 1976,Croatia has become the 152nd ILO member state to ratify theconvention," the Ministry of Foreign and European Affairs has said.

Upon presenting the instrument of ratification, MinisterGrlic Radman underscored that the act of ratification confirmedCroatia's commitment to ILO's fundamental values, social dialogue, ahigh level ofprotection of workers' rights, workers' right to association and ***collective*** bargaining, to health and a safe work environmentand to a family life, the ministry said in a press release.

The minister added that with theact of ratification, Croatia was joining in the commemoration of the 100th anniversary of ILO.

The Tripartite Consultation Convention is one of the main governing conventions that emphasises the importance of inclusion of social partners in all phases of ILO's work. The convention obligesmember states to implement consultation procedures between the government and representative associations of employers and employees on matters that relateto ILO activities in a manner that is in accordance with national practices.

The convention will enter into force in Croatia on 26 February 2021.

**€5.2m for port infrastructure projects in Primorje-Gorski Kotar and Istria counties**

ZAGREB, Feb 26 (Hina) - Several agreements, worth a total of HRK 38.7 million (€5.20m), were signed on Wednesday to co-finance port infrastructure projects inPrimorje-Gorski Kotar and Istria counties.

The agreements were signed by Minister of the Sea, Transport and Infrastructure Oleg Butkovic and local government authorities.

More than HRK 800 million (€108m) is being invested in ports along the entire Croatian coast, Minister Butkovic said. This is a sort of renaissance for the people who live off the sea and next to it and will contribute to the entire economy, he added.

Butkovic said that Croatia has €110 million at its disposal from the EUCompetitiveness and Cohesion programme and that more than 15 projects have already been agreed to and 28 identified.

New agreements will be signed soon for the remaining projects, which meansthat the absorption rate will be 100%, he concluded.

**Hanfa, GFSC sign alternative investment funds agreement**

ZAGREB, Feb26(Hina) -The Croatian Financial Services Supervisory Agency (Hanfa) and theGuernsey Financial Services Commission (GFSC)have signed a European Securities and Markets Authority (ESMA) agreement of understanding in the management of alternative investment funds, Hanfa said on Wednesday.

The agreement was signed by Hanfa President of the Board Ante Zigman and GFSC Director General William Mason.

Zigman said this was the second agreement of understanding fromtheAlternative Investment Fund Managers Directive which Hanfa has signed with a supervisory body outside the European Union and that it represented a further step in stimulating cross-border investment.

"Our cooperation will contribute to better consumer protection, to stimulating market and financial integrity and to the further strengthening of confidence in the stability of the financial system. We will continue to act towards expanding Hanfa's international cooperation with institutions in third countries," Zigman said.

**50% of youth in Croatia unaware of employment stimulation measures**

ZAGREB, Feb 26 (Hina) - Almost fifty percent of young people in Croatia are not, or are poorly informed of employment measures and 64% are unaware of self-employment measures, it was said on Wednesday at a presentation of result of a survey on youth employment measures in Croatia, conducted by the World Youth Alliance - Croatia (SSMH).

The online survey was conducted on a sample of 1,152 people aged between 18 and 30 and SSMH's Lucija Kundid presented its results.

One of the main problems faced by youth is unemploymentwhich, Kundid underscored, is the result of misinformation and lack of interest among young people in vocational careers and professions that are in short supply.

Kundid presented the draft National Employment and Self-employment Strategy which was compiled by 150 participants from seven Croatian counties. She assessedthat employment and self-employment measures for young people are not sufficiently and adequately presented to them.

Young people in Slavonia have the most negative attitude to the measures while the most positive attitude can be found among young people in the City of Zagreb.

**Croatia 4th from bottom of EU ranking in employment of youth aged between 15 and 29**

Croatia has ranked fourth from the bottom on the EU ladder regarding employment of young people aged between 15 and 29.

According to ***Eurostat***, in 2018 the unemployment rate among young people aged between 15 and 24in Croatia was 24%, placing it at the top of that unattractive ladder.

It was underscored that less than 20% of young people had used some of the employment stimulation measures and about 35% knew someone who had used those measures. About 95% of the respondents said that they had not used even one employment or self-employment stimulation measure. Almost 70% said that they would take up a job in another city and more than 40% would take a job in another country. About 40% of the respondents think that it is necessary to reduce quotas for enrollment in university courses they attend.

**Measures should bepromotedat municipal, city, county level,interdepartmentalcooperation should be strengthened**

The solution to youth unemployment is to promote measures at the municipal, city and county levels, and to strengthen interdepartmental cooperation, SSMH believes.

It was further underlined that it wasnecessary to promote examples of good practices in schools and universities so that young people can obtain information on the advantages of professions that are in short supply.

**Plenkovic, German MPs still in favour of opening negotiations with Skopje, Pristina**

ZAGREB, Feb26(Hina) - Croatian Prime Minister Andrej Plenkovic and a delegation of German parliamentarians on Wednesday again expressed support for the EU launching accession negotiations with North Macedonia and Albania, the government said in a press release.

Plenkovicmet with representatives of the Christian Democratic Union and Christian Social Union (CDU/CSU) group in the German parliament.

Plenkovic, whose country currently presides over the EU, expressed satisfaction that the subject of enlargement wasonce again high on the agenda of EU institutions, and the German MPs noted that Bundestag had strongly supported the opening of negotiations with Albania and North Macedonia already in September last year.

The officials also discussed the Conference on the Future of Europe as well as the progress of the Multiannual Financial Framework negotiations.

They also expressed satisfaction with the traditionally good political and economicrelations between Croatia and Germany, says the press release.

**USKOK indicts Pripuz and his associates for siphoning HRK 40 m from CIOS, tax fraud**

ZAGREB, Feb26(Hina) - The USKOK anti-corruption agency has indicted a co-owner of the CIOS waste management company, Petar Pripuz, his son Ante and 10 other persons for siphoningmoney from the company and tax fraud.

Without revealing theirnames, USKOK said on Wednesday that the suspects were charged with having siphoned close to HRK 40 million from CIOS anddefrauding the state budget of slightly less than HRK 5.2 million in VAT in the process.

The other indictees areMateJurisic, ZdeslavRimac, JaksaMichieli Tomic, AnteLjubicic, VesnaKnezevic, Miro Curcic, MarkicaBajic, VjekoslavKnezevic, IvanNakicand StipeBuljubasic.

Goran Pastar, who died in the meantime, had also been under investigation in this case.

Bythe time it issued the indictment, USKOK had changed the factual description of the case and reduced the financial damage caused, which was initially estimated at HRK 98 million plus 22 million of unpaid VAT.

The 12 persons are charged with a criminal conspiracy and abuse of business trust, tax and customs fraud, and incitement to or aiding and abetting in those offences.

USKOK alleges that Pripuz formed the criminal organisation on 16 January 2012 and that they committed the alleged criminal activities until April 2017.

The prosecutors believe that Pripuz devised and controlled the way metal waste purportedly entered CIOS, by using other companies to invoice thewaste.

In doing so, he was aware that those companies did not have the necessary permits for waste management, did not have workers, machines or premises to engage in waste management and were actually controlled by him. The companies were used to invoice the same waste from the original seller to the company, and the waste was in reality ***collected*** by employees and machines belonging to companies under Pripuz's control, directly from the original seller.

Payments for the invoiced waste resulted in the outflow of money from CIOS into the accounts of companies that issued the invoices. The money was then taken from the accounts in cash and used partly for the purchase of metal waste on the black market while a part of it was given back to Pripuz and his son.

Pripuz is also believed to have controlled the way the siphoned money was distributed, while Jurisic is believed to have been in charge of establishing and running the companies that were used to issue invoicesfor the sale of metal waste to one another and to Pripuz's company and using their bank accounts for payments by CIOS.

Pripuz's company paid out close to HRK 189 million based on fictitious invoices issued by four companies, of which more than HRK 168 million was paid in cash.

Of that amount, 39.8 million ended up with Pripuz and his son, while the rest was used for cash payments for the purchase of metal waste on the black market.

Pripuz's company was thus defrauded of HRK 39.8 million and the state budget of HRK 5.19 million in VAT.

USKOK has proposed confiscating Pripuz and his son's illegal gain.

Pripuz, who is standing trial for unlawful activities involving waste management in another case, dubbed Agram,was to be placed in investigative custody in early June 2017 but he was released on HRK 7.5 million bail and the investigative custody was replaced with measures of precaution. His son was released a few days later on HRK 5.5 million bail.

**Slovenia: Janez Jansa nominated PM-designate**

ZAGREB, Feb 26 (Hina) - Slovenian President Borut Pahor on Wednesday nominated Janez Jansa, the leader of the opposition Slovenian Democratic Party, as Prime Minister-designate.

Pahor confirmed this at a joint press conference with Jansa after their hour-long meeting. His decision followed the resignation of Marjan Sarec as Prime Minister last month.

"I am pleased that the period of political uncertainty after the resignation of Marjan Sarec was relatively short," Pahor told the press in the Presidential Palace, citing the importance of stability for the country.

Jansa, who is yet to be confirmed by parliament, said that the government which his party would form with another three parties as coalition partners, would be in office for two years as regular elections are scheduled for 2022.

Jansa, who had served as prime minister twice already, said that the new coalition was agreed that the new government should concentrate on priority issues. He noted that Slovenia was "condemned" to coalition governments and compromise solutions because of its election system.

Speaking of challenges facing the country, he mentioned problems in the healthcare system, environmental protection, care for the elderly, and decentralisation of government.

His nomination will be put to a vote in parliament next week, most likely on Tuesday. He will require the votes of at least 46 out of 90 members of parliament to be confirmed. If so, it will then take up to four weeks for ministerial nominees to pass vetting by parliamentary committees.

**In other news:**

**International festivalof children's theatre opens in Zagreb**

ZAGREB, Feb26(Hina) - Zar PticaTheatre ManagerDrago Utjesanovicopened on Wednesday the 20thannual international Naj, Naj, Naj Festival of children's theatre, which this year is dedicated to the fight against peer violence.

Utjesanovic said that,apart from plays, children and parents would be able to attend workshops under expert guidance.

All proceeds from festival tickets will be donated for school projects against peer violence in primary schools across Croatia. The ticket price is symbolic - HRK 10 (around €1.5).

At the festival, which lasts until 1 March, six domestic and two international plays by theatre troupes from Spain and Israel will be performed.

The Naj, Naj, Naj Festival was founded in 2001 by actress Marija Sekelez as a festival of the best children's plays from all over Croatia. Since 2007 the festival has taken on an international character, becoming an important place on the map of cultural events designed for children.

**Petrokemija nets HRK 154 mn in profit in 2019**

ZAGREB, Feb 26 (Hina) - In 2019 the Petrokemija artificial fertiliser producer increased its sales revenue by 17% to HRK 2.1 billion and generated a net profit of HRK 154 million as againsta loss of HRK 471 million in 2018, shows a financial statement released by the Kutina-based factory on Wednesday.

"In 2019, Petrokemija recorded one its best results in its history. We have shownthat we are capable of becoming a sales-oriented company and utilising the advantages of low gas prices on the European market, generatinga net profit of HRK 154 million compared to losses of HRK 471 million in 2018," CEO Davor Zmegac said in a comment on the statementreleased on the Zagreb Stock Exchange.

According to the financial statement, net profit without one-off items amounted to HRK 223 million compared to a HRK 359 million loss in 2018.

One-off expenses included the costs of severance packages of HRK 66 million as well as value adjustments for carbon dioxide emission fees of HRK 2 million for 2019 and HRK 112 million for 2018.

Sales revenue of HRK 2.1 billion, up 17% on the year, was mostly owing to a significant increase of sales on the domestic and regional markets.

The statement also notes that Petrokemija's debt at the end of 2019 amounted to HRK 397 million, which is 25% less than at the end of 2018, when the company's debt amounted to HRK 528 million.

**25th GAST food and drinks fair opens in Split**

ZAGREB, Feb 26 (Hina) - The 25th GAST fair of food, drinks and hotel and restaurant equipment opened in the Spaladium Arena in the southern coastal city of Split on Wednesday.

On that occasion, ***Agriculture*** Minister Marija Vuckovic awarded 47 grant agreements worth a total of HRK 41 million (€5.5m) as part of four measures under the Rural Development Programme 2014-2020.

The agreements relateto forestry and wood industry projects, development of small businesses, and water supply and drainage.

"In this way we promote cooperation with local government units and show that small businesses in Dalmatia are very important and that we support them," Vuckovic said.

Tonci Glavina, state secretary at the Ministry of Tourism, said that GAST promotes wineand food tourism. Citing recent research, he said that over 30 percent of tourists come to Croatia for that purpose.

The head of Split-Dalmatia County, Blazenko Boban, said that the aimis to create a symbiosis between rural areas in Split's hinterland, where high-quality food can be produced, and the tourist trade.

The four-day show features 786 brands from eight countries. The programme includes wine and food tastings and eight wine-making workshops.

**ZSE indices up 1.2% after two days of significant decline**

ZAGREB, Feb26(Hina) - The Zagreb Stock Exchange (ZSE) indices on Wednesday rose by around 1.2%, making up for some of the significant decline recorded in the previous two trading days, however, turnover was slightly lower.

The Crobex rose by 1.25% to 1,919 points, and the Crobex10by 1.18% to 1,147 points, recovering from their lowest levels since September 2019.

Among sector indices, the industrial sector index increased the most, by 4.11%, and the only one to drop was the food sector index, by0.49%.

Regular turnover reached HRK 33.34 million, around HRK 13 million less than on the previous day. Another HRK 2.02 million was generated in block trading inValamar Riviera shares, which traded at HRK 33.1 per share.

The highest turnover in regular trading was generated by the HT Telecom stock, HRK 5 million. Itclosed at HRK 178, up by 2.01%.

The Valamar Riviera stock turned over HRK 4 millionand it closed at HRK 34 per share, up 1.49%.

Ericsson NikolaTesla turned over HRK 3.1 million. It closed at HRK 1,360 per share, up by 3%.

Zagrebacka Banka turned over HRK 2 million, closing at HRK 60.5, up 2.54%.

The HPB bank was the biggest winner among the more liquid stocks, with aprice increase of 8.11% to HRK 600 per share. The price of Privredna Banka sharesrose by 7.29%to HRK 1,030 per share.

The price of the FTB Turizam stock dropped by 3.6% to HRK 1,600 per share.

Of the 52 stocks traded today, 31 went up in price, 16dropped, and five were stable compared to the previous day.

(€1 = HRK 7.45)

**THIS BULLETIN INCLUDES ITEMS RELEASED BY 0830 HRS THURSDAY.**

(Hina) rml

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**Body**

Zagreb,Hrvatska15 December 2020 (Hina) - Croatia's coronavirus update: 2,360 new cases, 73 deaths, 3,195 recoveries ZAGREB, Dec 15(Hina) - In the last 24 hours, of 8,748 coronavirus tests performed in Croatia, 2,360 or 27% have returned positive, and there have been 73 COVID-related fatalities bringing the death toll to 2,778, the country's COVID-19 crisis management team reported on Tuesday. There are currently 21,861 active cases, and of them 2,897 are receiving hospital treatment, including 304 patients placed on ventilators. As many as 51,108 people are self isolating. Since 25 February, when Croatia confirmed the first case of infection with the novel virus, 179,718 people have caught coronavirus, and of them155,079 have recovered.So far, 896,828 tests have been conducted. Coronavirus outbreak strongly impacting children's lives, online conference told ZAGREB, Dec 15 (Hina) - Since the coronavirus outbreak has had a strong impact on children's lives, they should be additionally protected and assisted in overcoming the present circumstances more resilient and readier for life, an online conference was told on Tuesday.

The conference on the protection of children in time of the COVID-19 epidemic was organised by the Ombudsman for Children and involved healthcare, education and welfare professionals as well as over 300 teachers, social workers and young people from the Ombudsman's network of young advisers. The conference focused on education, mental health and children in institutions in time of the pandemic. Ombudsman for Children Helenca Pirnat Dragicevic said that society should not reconcile itself to the fact that some children cannot exercise their right to education just because their parents cannot afford a computer and an internet connection or because they cannot get support for the education of their children with developmental disabilities. She called on the schools and the education authorities to take greater account of children's opinions because they can contribute to better solutions, and to plan for more effective protection measures to cover every child in need. The deputy director of the Croatian Public Health Institute, Ivana Pavic Simetin, said that school children are not coronavirus super-spreaders. She addedthat staying in school is more important for younger children and that remote learning has proved to be less appropriate a solution for them than it is for adolescents. Pavic Simetin said that a big challenge is how to ensure appropriate education for children and young people with developmental disabilities given that they cannot be left home alone and learn on their own. She said that they need an interaction between their education and therapy process and their teacher's support in class. JL: Every second doctor, 3 in 5 nurses intend to get COVID-19 vaccine ZAGREB, Dec15 (Hina) - A survey on the intent of hospital doctors andnurses to get vaccinated against COVID-19 shows that 50% of the physicians polledand 60% of the nurses say they will be vaccinated, the Jutarnji List daily said on Tuesday. Fewer than 50% of doctors at Zagreb's University Hospital Centre said they would be vaccinated, and more than 60% of its nurses have signed their approval for inoculation. KB Sveti Duh, another hospital in Zagreb, has a different situation with more doctors being ready for COVID-19 jabs. Half of the medical staff at Zagreb's KBC Sestre Milosrdnice hospital say they are going to be vaccinated against the novel virus. The survey, launched last week, has been conducted since then. The Croatian Institute of Public Health (HZJZ) said in its comment to thenewspaper that the figures about willingness to be vaccinated would rise when initial batches of vaccinationwere delivered to Croatia. However, the figures about a low turnout of medical professionals for flu shots donot instilhope, the newspaper says. The ratio of willingness to accept vaccination and hesitancy among healthcare workers in Croatia is similar to the situation in other countries. For instance, in Great Britain, the rollout ofthe Pfizer-BionTech vaccination has started, and similar surveys have shown that 4 in 10 employees in health institutions are ready to be vaccinated. Intent to get vaccinated in old-age care homes varies across counties When it comes to surveys conducted in retirement homes in Croatia, the biggest hesitance to vaccination has been shown in coastal areas. In Split-Dalmatia County, a mere 29% ofstaff in the homes covered by the survey seemwilling to be vaccinated. However, as many as two-thirds of residents said they would be vaccinated. Only 13% of care home workers in Sibenik-Knin County and a quarter of workers in Istria haveshown readiness. In the northern county of Medjimurje, as many as 68% of employees in old-age care homes said they would be vaccinated, JL says. VL: Croats to get disaster alerts via text messages ZAGREB, Dec 15 (Hina) - Fires, flood and quake text warnings will go directly to mobile phones in danger areas, owing to a crisis management system, worth 48 million kuna, which will be procured by the Ministry of the Interior, the Vecernji List newspaper reported on Tuesday. Thus, citizens can expect to receive emergency alerts on their mobile phones in the event of fire, flooding, earthquake, epidemic, migrant crisis, radiological and nuclear disaster, industrial and traffic accidents. This will be one of the options for early warning, the daily says. The new system will facilitate the provision of timely information to citizens and participants in the civil protection system. Such information will also be sent to firefighting services, the HAK automobile club, public institutions, hotels, camp sites, national parks and so on. The system should be operational by 1 September 2022, according to the daily. National anti-cancer strategy unanimously adopted by parliament ZAGREB, Dec 15 (Hina) -The Croatian parliament on Tuesday unanimously adopted the National Anti-Cancer Strategy for the period until 2030, with the aim of advancing the comprehensive monitoring, prevention and treatment of malignant diseases. The document, which received the support of 127 lawmakers, contains unified measures for primary, secondary and tertiary prevention as well as for optimising health care for oncology patients. Cancer is the leading public health problem in Croatia, as well as in the entire European Union. An estimated 170,000 people in Croatia have suffered or are suffering from cancer. The number of people with cancer in the world and in Croatia is constantly growing. The World Health Organisation estimates that the number of new cases in the world will increase from 18 million in 2018 to 29.5 million in 2040, while the number of cancer-related deaths could increase from 9.5 million to 16.4 million a year. Next to cardiovascular diseases, cancer is the second most common cause of death in Croatia,accounting for 27% of fatalities in 2018. Cancer is the leading cause of death in people younger then 65 and is the cause of 50% of deaths in women and 35% in men. The majority of lawmakersalso adopted a report on the implementation of the Declaration onthe status of the Croats in Bosnia and Herzegovina for 2019, which was presented to the Sabor last week by the foreign ministry. Parafiscal levies reduced ZAGREB, Dec15(Hina) - Parliament on Tuesday amended the law on tourist board membership fees, reducing the rate for their calculation and paymentas of January 1. The Tax Administration will be authorised to change the monthly membership fee advance due to a significant drop in business, and to arrange the calculation of the lump membership fee forpeople providing hospitality services at home or for family farms. Parliament also amended the law on European Economic Areacitizens and members of their families, regulating residence registration as well asthe issue of new residence documentsfor UK citizens and members of their familiesgiven that, under the Brexit deal, December 31 marks the end of the transitional period during which EU law applied to the UK. Currently 747 UK citizens have temporary residence in Croatia, while 356 have permanent residence. Loan for completion of motorway on Pan-European Corridor Vc Parliament also adopted a law ratifying a guarantee agreement between Croatia and the European Bank for Reconstruction and Development for financing the completion of the CorridorVc motorway. The €55 million loanwill be used to build a 17.5-kilometre-longsection between Halasica bridge and Beli Manastir and a 5-km section between Beli Manastir and the Hungarian borer. The repayment period is 15 years, including three years' grace, at variable interest and 6-month EURIBOR plus 1% margin. Fewer deputy mayors to be elected in next local election ZAGREB, Dec 15 (Hina) - During the next local election in May 2021,Croatswill elect 568 fewer deputy mayors than there are now and about 10% fewer councillors which, for example means that the Zagreb City Assembly will have 47 councillors instead of the current 51, the parliament decided on Tuesday. Lawmakersadopted amendments to the law on local and regional government (77 yeas, 55 nays), the law on local elections (78 yeas, 47 nays, 3 abstentions) and on the City of Zagreb (78 yeas, 51 nays). Even though the government originally proposed to reduce the number of deputy mayors by 618, the final law will mean that568 deputy mayoral posts will no longer exist after an amendment was lodged by the ruling Croatian Democratic Union (HDZ) caucus stipulating that cities with more than 10,000 residents can have a deputy mayor, while the previous threshold was more than 35,000 residents as initially proposed. However, smaller towns will be allowed to appoint an acting deputy who can replace mayors during longer absences. That decision can be changed during the term in office. Almost half a billion kuna to be saved in four years The law also includes a provision that ethnic minority lawmakers insisted on, whereby mayors can appoint theirdeputyfrom an ethnic minority or Croatiandeputy in municipalities with a larger ethnic minority population. Fewer deputy mayors, fewer councillors and limiting the amount of their salaries will lead to a saving of HRK 115 million kuna a year, Justice and Public Administration Minister, Ivan Malenica has said and in four years at the end of this government's term that saving could amount to almost half a billion kuna. Two opposition parties -- Bridge and the Homeland Movement --regretted that the government, that is, the Ministry of Justice and Public Administration, failed to introduce some novelties and the originally announced reforms. "What we have been witnessing in the past is a farce as far as reforms are concerned, because by the time the government, parliament, public consultation is completed, we no longer even have the 'r' of reforms," Bridge leader Bozo Petrov said calling out Minister Malenicafor 'giving in' and returning deputy mayors. You could have saved on salaries, which now account for one-fifth of their revenue, cut them by 15%and in that way done away with those looking only to feather their nests, said Petrov. Miroslav Skoro of the Homeland Movement recalled that a few days ago the ministry presented a wish list, but in the meantime these "amendments appeared," which sends everything back to square one. The public should know that the ruling coalition as it is now cannot implement reforms because the government is compelled to make concessions and Croatia will hibernate and stagnate for the next three years, said Skoro. New IDs to be valid for 5 years under amended Identity Card Act ZAGREB, Dec15 (Hina) - The Croatian parliament on Tuesday amended the Identity Card Act, whereby the new identity card will contain biometric identifiers in the form of a facial image and two fingerprints and will be valid for five years. The exception to this rule are ID cards issued to persons aged 70 and above, which will have a validity of 40 years. Identity cards without a validity period which do not meet the minimum security standards will no longer be valid. The amended law makes it possible for a parent, as their child's legal representative, to apply for and ***collect*** their child's identity card, and it also regulates the obligation to obtain an identity card for a person who has turned 16 and has been allowed by a court of law to marryand who has permanent residence in Croatia. Technical prerequisites are also being created for the use of electronic functionalities of the ID card on mobile phones and tablets and not just computers. Citizens will be able to use their new identity cards instead of passports and will be able to use them in all countries and not just the EU, officials of the Ministry of the Interior have said. The amended law was supported by 124 MPs. Parliament rejects three Opposition motions ZAGREB, Dec 15 (Hina) - The parliament on Tuesday rejected three Opposition motions - a motion to establish an inquiry commission forpossible political influence on investigations into graft cases, an interpellation on the government's management of the corona crisis and Bridge's conclusion onthe COVID-19 crisis managementteam. The motion to establish an inquiry commission was tabledby 40 opposition lawmakers after information leaks in the Janaf corruption scandal, with the aim of investigating any influence by political bodies in obstructing investigations, loopholes in legislation and in the institutional framework in the fight against corruption as well as omissions in the security and judicial systems. During the vote, 76 MPs rejected the interpellation onthe health system's preparations for the extraordinary circumstances caused by the coronavirus epidemic. The motion for the interpellationwas proposed by by 16 opposition MPs who called for an investigation into the government's responsibility for the crisis in the health and hospital system. Theconclusion moved by the Bridge party calling for the government to submit a monthly report to the parliament on the activities of the COVID-19 crisis management team, the measures adopted and the results achieved, was also rejected. Two Opposition parties criticise subsidised housing loans ZAGREB, Dec 15(Hina) - MP Katarina Peovic of the Workers' Front said on Tuesday, in a comment on amendments to the Law on Housing Loan Subsidies, that subsidised housing loans, intended for young families, led to a rise in the prices of flats and favoured the construction sector, real estate dealers and banks. "Finance Minister Zdravko Maric would probably admit himself that those loans increaseprices of flats and that subsidies should be defined in a different way," Peovic said. She said that an analysis by the central bank showed that subsidised housing loansmade prices of flats several times higher than the amount of the average subsidy. Theamendments should not have been sent to parliament for discussion under fast-track procedure and remarks given during the public consultation should have been taken into account so as to announce, much more in advance, dates when such loans can be applied for or make them available throughout the year so that applicants are given more than just a short period of time during which they have to find a flat and agree to a high price as otherwise they could lose the subsidy, she said. Peovic said that her party would submit an amendment to make it possible to take out subsidised housing loans throughout the year or announce the period when housing loan subsidies can be applied for a year in advance. She also noted that the 3% tax rate on one's first property should be abolished and called for encouragingcommunity housing and government-subsidised housing construction in such a way to enable long-term or even life-long apartment rental. Theconstruction of new housing blocks should be accompanied with the construction of adequate infrastructure, she noted. At a separate news conference, Marija Selak Raspudic of the Bridge party alsocriticised the Law on Housing Loan Subsidies, sayingit ensured a profit to banks and flat vendors. Peovic to continue as MP outside parliamentary club Peovic also said that after the break-up of the coalition between the Workers' Front andthe We Can! party, she would continue working as the soleMP of her party but that her party would use all available means to fight for the disenfranchised majority, which, she said, was done in a better way through parliamentary committees. Peovic said that it was too early to speak of the Workers' Front's support for the possiblecandidacy of WeCan! leader Tomislav Tomasevic for Zagreb Mayor, adding thatsince it was no longer part of the green-left parliamentary bloc, the Workers' Front was yet to decide how to participate in local elections in Zagreb, set for May 2021. Opposition: Subsidised housing loans increasing real estate prices ZAGREB, Dec 15 (Hina) - While Croatian Democratic Union (HDZ) MPs en masse commended the continuation of subsidised housing loans, the parliamentary opposition insisted that these loans, particularly because of their periodic nature, resulted higher real estate prices. Loans provided by the APN government real estate agency lead to hikes in prices of housing intended for young families. This has been confirmed by the governor of the Croatian National Bank (HNB), MP Katarina Peovic of the Workers' Front (RF) said during a debate in parliament on amendments to the law on housing subsidies. She was interested in why the government did not agree to provide housing subsidies throughout the year so that a "balloon" would not be created and families would not be given a time frame within which to find an appropriate flat and agree to a hiked-up price or else forfeit the subsidy. MP Tomislav Tomasevic (We Can) underlined the periodic nature of the subsidies which hikes up prices. He too referred to the a statement by HNB Governor Boris Vujcic. MP Marko Milanovic Litre (Sovereignists) asked when the government was going to stop meddling in the free market. Prices rising only in urban areas Former construction minister Predrag Stromar (HNS) said that real estate prices were increasing only in urban areas and nowhere else. Incumbent Construction Minister Darko Horvat said that he was prepared to sit at the table when the critics presented concrete numbers. "It is difficult to respond to off-the-cuff claims, without precise numbers. Allow us to advertise public calls for applications for subsidies based on our analyses," said Horvat Some opposition MPs think it's necessary to adopt strategy first, then law HDZ MPs commended the subsidies, underscoring that they have resolved the housing problem for 17,000 families and that 2,400 children were born in them. The number of applications for subsidies speaks about what the people think about this measure which has had a positive effect on the construction sector, HDZ MP Damir Habijan said. The opposition's criticism is redundant, said HDZ whip Branko Bacic, underscoring that in the six years since the subsidised housing law has been in force 20,000 flats have been sold while two and a half times fewer flats have been sold under the POS government subsidised housing programme in 18 years. 20,000 flats sold Minister Horvat explained that subsidies are just one of the ways of resolving housing issues for young people, recalling that that measure was introduced in 2011. He described the proposed measures as a response to citizens' interest, adding that sufficient funds have been secured in the budget for the next three years and that the next call for applications would be advertised in the spring next year. The legislative amendments mean that someone who has already received a subsidised housing loan cannot apply again and that they will have to reside in the property purchased for at least two years after the subsidised measures expire. Subsidies will not have to be repaid if the property concerned is sold in order to purchase a bigger flat or house or to build a new house. The average age of people who have been granted subsidised loans since the programme was introduced in 2017 is 33 years and the average monthly loan repayment amounts to HRK 2,800. Only citizens younger than 45 who do not own any real estate are eligible for subsidised housing loans. The subsidised loans are approved for the purchase of a flat or house and can be subsidised for real estate with a maximum of €1,500 per square metres or a maximum loan of €100,000. The loan repayment maturity cannot be less than 15 years. Scientists ask gov't to prolong public consultation on climate plan ZAGREB, Dec 15 (Hina) - The Scientists for Climate Croatia initiative asked the government on Tuesday to extend from four to 30 days a public consultation on the Integrated National Energy and Climate Plan. The government put the 2021-30 plan to public consultation at the end of last week but the four-day duration is "extremely inappropriate" for a "strategic document" directly tied to the signing of the Paris Agreement which would have a long-term impact on society, the initiative said. By setting such a short deadline, the government is deliberately preventing a substantial public consultation which should enhance the plan and include scientists and the civil sector in the creation of public policies, the initiative said, adding that under the law the minimum duration of public consultations was 30 days. The initiative appealed to the government to prolong the public consultation so that a better development document can be created because, it said, "climate change, the loss of biodiversity and the pandemic are already globally affecting the integrity of the eco-systems and the well-being of human communities." An effective and systematic climate policy includes the real decarbonisation of the energy sector, and there is no room for further development of either existing or potential production facilities for the extraction and exploitation of fossil fuels until 2035. Over €1m for digitalisation, creation of new cultural and educational content ZAGREB, Dec 15 (Hina) - The Ministry of Culture and Media has secured over HRK 8 million (€1.09m) for projects of arts organisations, professional cultural associations and independent artists affected by the coronavirus pandemic. A total of HRK 8,189,193 has been secured based on a public call for digitalisation programmes and the creation of new cultural and educational content. The money will be used to finance digital productions of the existing art forms by using new technologies to create new content and make it more widely available in the present epidemiological circumstances. The public call was open from 30 October to 20 November. A total of 401 applications were submitted and funds were approved for 279 programmes. HTZ launches virtual tour of Croatia's winter beauties, customs ZAGREB, Dec 15 (Hina) - The Croatian National TouristBoard (HTZ) has launched a new campaign, called "Croatia Full of Magic", inviting tourists to take an online tour, in the current time of travel restrictions caused by the coronavirus pandemic, of Croatia's winter beauties and customs. The communication platform "Croatia Full of Magic" was launched on Facebook, Instagram and Twitter to maintain Croatia's presence and visibility on the most important tourist-generating markets. The campaign, to last until mid-January 2021, will attempt to bring Croatia closer to tourists as a top-of-mind destination which they will soon be able to visit again or for the first time. The campaign also includes the possibility for foreign and domestic followers of the three social networks to win a tour of Croatia in 2021, the HTZ said. The campaign features photographs of attractive winter scenery and video materials presenting Croatian destinations, cultural and historical heritage and tourist services, as well as Croatian holiday food traditions, HTZ director Kristjan Stanicic said, adding that the campaign also included prizes for followers. Renovation project to restore Zagreb's Europa Cinema to original state ZAGREB, Dec15(Hina) - A renovation project which aims to restore Zagreb's cult Europa Cinema to its original state was presented on Tuesday, but city officials could not say how much the renovation would cost or when it wouldend. The Europa Cinema is an unavoidable place on Zagreb'scultural map and a symbol of cultural continuitywhich the brothers Mueller, owners of a brickyard and film buffs, opened in 1925 under the name Balkan Palace as one of their four movie palaces, it was said. Culture and Information Centre director Petar Bujas said Europa would continue to show films which would otherwise not be commercially distributed and that it would be open to neglected genres. He also announced an interdisciplinary project which wouldvalorise Europa's contribution to Croatian cinema as well as the role of film in the Croatian arts, saying the movie theatre would also be educational and open to global trends. Architect Alan Braunof the Zagreb Faculty of Architecture, an expert on the renovation of cultural assets, said Europa would be restored to its original state and have 400 seats. Mayor Milan Bandic said Europa was one of four cinemas he had saved from privatisation and that it would be turned into a modern cultural institution. Sanja Jerkovic of the City Department for Strategic Planning and Development said it wasnot possible yet to estimate the actual cost of the renovation or when it would be completed. Braun expects works to wrap up by 2022. Ex-JANAF CEO and Velika Gorica mayor released from custody ZAGREB, Dec 15(Hina) - Former JANAF oil pipeline operator CEO Dragan Kovacevic and another suspectin the JANAF corruption scandal, the HDZ mayor of Velika Gorica,Drazen Barisic, were released from custody on Tuesday. The town of Velika Gorica, just south of Zagreb, told Hina that Barisic's letter of resignation was received today and that his duties would be taken over by his deputy Kresimir Ackar. Byresigning from his post Barisic met the last condition for his release since he was remanded in custody due to the risk of witness tampering as well as the risk of repeating the crime he is suspected of. Kovacevic: I will prove my innocence in court Leaving Zagreb's Remetinec prison, Kovacevic told reporters that he had not stolen "a single penny" and that he would prove his innocence in court. "I come from a relatively wealthy Slavonian family, I didn'tgrow up poor. This is not an easy thing to go through when you know that you are not responsible, but I will prove my innocence in court," Kovacevic said. Speaking of what the media have described as his club in Zagreb's Slovenska Street, which was frequented bynumerous state officials and business people, Kovacevic said that it was not a club but an association called "Slavonska ravnica" (Slavonian plain), where people hailing from Slavonia used to gather. "It is a room measuring25-30 square metres whose visitors brought food with them. Everyone went there, your colleagues as well, it was a place for socialising, it was not an elite club," Kovacevic told reporters, adding that nobody had brought money to the facility. President was telling the truth Kovacevic also dismissed media reports that before his arrest he had thrown his mobilephone into the Sava River, stressing that he could not have even imagined that he would be arrested. He explained that the million euros found in his garage was the money of his business partners intended for the purchase of 250 hectares of land in Slavonia. "I was supposed to go to Slavonia and exchange the foreign currency... In order to buy such land, you must buy a lot of small plots from a large number of people for €1,000 or so," Kovacevic said. Asked about the nature of his relationship with President Zoran Milanovic, Kovacevic said that their relationship was correct and that "the President spoke the truth." He added that he would continue his legal battle to prove his innocence. "In Croatia, success is the biggest sin. I had to be destroyed because I was a successful manager who carried out reforms," said Kovacevic. The Social Democrat mayor of Nova Gradiska and member of parliament, Vinko Grgic, will remain in custody and a decision on his possible release will be made on Wednesday. Along with him, also in custody is the lead suspect in this case, Elektrocentar company owner Kreso Petek, who was placed in custody due to the risk of witness tampering and repeating the crime he is suspected of. Zagreb County Court is expected to decide on Petek's custody on Thursday. Investigators suspect influence peddling, bribery, unlawful preferential treatment,abuse of office USKOK believes that Kovacevic took bribes from Petek, who allegedly also bribed Barisic and Grgic to make sure they awarded his company jobs worth millions of kuna. The investigation covers 14 people suspected of influence peddling, bribery, unlawful preferential treatment, abuse of office and aiding and abetting the commission of those crimes. The investigation was expanded to charge Kovacevic with having been tipped off that he would be arrested and with using the time until his arrest to hide €4.5 million withGoran Puklin, who claims that the money is his. After the investigation was expanded to include Puklin, his wife Mirela Aleric Puklin asked to be relieved as Zagreb County Deputy Prosecutor. HGK taking legal action against entrepreneurs' rep over sexist remark ZAGREB, Dec15(Hina) - The Croatian Chamber of Commerce (HGK) said on Tuesday it was taking legal action against Hrvoje Bujas, president of the Voice of Entrepreneurs NGO, over his callingthe HGK an institution for employing female lovers which, the HKG added, insulted all womenworking there. The HGK said in a press release that following Bujas's statements in a Croatian Television talk show on Sunday, it was forced to respond and defend all its employees. Bujas's statement that the HGK is an institution for employing female lovers "insults all HGK female employees who do their job responsibly. Many are highly qualified experts with years of experience in the private sector, yet Mr Bujas dares to publicly and baselessly insult and call them out." The HGK said it was proud that more than 75% of its employees were women, calling this "our great strength." The Chamber said it reported Bujas's "extremely tasteless verbal outburst" to the gender equality ombudspersonand that it was considering further legal action over Sunday's insults "as well as the other defamatory things he has said." Ombudsperson: Bujas's approach is discriminatory and sexist Gender Equality Ombudsperson Visnja Ljubicic used this case to once again point to the social responsibility of public figures for their public statements, calling Bujas's sexist. She said that under the Gender Equality Act, a criticism of someone's work must not be based on an insulting, belittling or humiliating depiction of a person on gender grounds. "Mr Bujas, explaining his negative view of the HKG as an institution, said among other things that the women in the HGK were employed because they weresomeone's lover, which insults, belittles and humiliates all female HGK employees on gender grounds," she said. Instead of a well-reasoned criticism of the institution's work, to which he is entitled, Bujas implied that the women working in the HGKare not qualified for their jobs but were hired only because of their sexual relations, Ljubicic added. Under the Gender Equality Act, such a sexist approach is discriminatory as gender is being taken as a relevant and the only basis for the evaluation, in this case devaluation, of someone's work, skills or accomplishments, she said. UGP says Chamber of Commerce trying to dodge responsibility ZAGREB, Dec15(Hina) - The Voice of Entrepreneurs (UGP)has said that unlike the Croatian Chamber of Commerce (HGK) it truly is a platform supporting women in the public and private sectors and that the HGK's plan to sue its leader Hrvoje Bujas over his calling the HGK an institution for employing female lovers would set a precedent. The HGKsaid earlier in the day it was taking legal action against the leader of the UGP association over his calling the HGK, in an interview with Croatian Television,an institution for employing female lovers which, the HGK added, insulted all women working there. In a comment on the HGK's reaction, the UGP said that if the HGK believedthere were grounds for launching legal action against it, it should do so. "We believe it will definitely set a precedent in Croatia because the HGK will sue Bujas using the money which he, just like other businesses that are members of the UGP,have paid to the HGK as membership fees," said the association. It noted that it was one of the few associations in the country truly supportingwomen's entrepreneurship. "Unlike the HGK, we have a committee onwomen's entrepreneurship which follows ***statistics***, identifies obstacles, and proposes measures for the development of women's entrepreneurship. The committee is just one of the projects we have launchedto support business women," said the UGP, noting that three in four of its employees were women and that the HGK leadership was the only one to blame for the HGK's bad image. It called for making public ***data*** on HGK president Luka Burilovic's salary and the HGK's position on the issue of membership fees, which, it said, was a huge burden on many businesses that were members of the HGK. Petrol to put Ljubac wind park into operation in 2021 ZAGREB, Dec 15(Hina) - Slovenia's energy company Petrol Grup said on Tuesday that it planned to put the Ljubac wind park near the Croatian town of Knin into operation in 2021. In 2019, Petrol and the German Nordex Group signed an agreement on the construction of the Ljubac wind park in the Dalmatian hinterland, and the construction started this spring. The nine-turbine wind park has the powerof 30 megawatts. It is expected to produce 96 gigawatt-hours of electricity annually, which can meet the needs of 20,000 households. Three companies hold lion's share of Croatia's confectionery market ZAGREB, Dec15 (Hina) - TheKras, Kandit and Zvecevo companies make up 97% of the confectionery industry in Croatia, according todata presented by the Financial Agency (Fina). In 2019, there were 22 enterprisesin the industry ofcocoa, chocolate and candy products, or two more than in 2018. The 22 enterprises employed 2,338 workers or 4.1% more on the year. In 2019, the total revenues of those businesses amounted to HRK 1.29 billion, or 7.5% less than in 2018. Their expenditures fell2.8% to HRK 1.293 billion. The profit made by profitable businesses in thatbranch totalled HRK 9.8 million, while the losses of loss-making enterprises amounted to HRK 16.4 million. As a result, the net loss of HRK 6.5 million on aggregate was registered in Croatia's industry of cocoa, chocolate and candy products last year, according to Fina's ***statistics***. Their exports totalled HRK 517.2 million in 2019, down 1.7% from 2018. The average monthly take-home pay per employee in the confectionery industry was HRK 6,097, a rise of 1.5% from 2018. Kras, one of the three flagship companies, had revenues in the amount of HRK 890.7 million and employed 1,527 workers in 2019. The average monthly wage in that company was HRK 7,203. The Zagreb-based factory wrapped up 2019 with HRK 7.5 million in the black. Kandit, based in Osijek, reported HRK 264.8 million in revenues, and HRK 1.7 million in net profit for 2019. Zvecevo, headquartered in the western Slavonian city of Pozega, had HRK 93.9 million in revenues and reporteda loss of HRK 15 million. ***Agricultural*** and food export-import coverage increases ZAGREB, Dec15(Hina) - In the first nine months of 2020, the export-import ratio of ***agricultural*** and food products reached69%, up 8.11 percentage points on the yearas a result of higher exports and lower imports, the ***Agriculture*** Ministry said on Tuesday. Citing State Bureau of ***Statistics*** ***data***, the ministry said the export of ***agricultural*** and food products in said period totalled €1.7 billion, up 5% from the first nine months of 2019, while imports totalled €2.5 billion, down 7.3%. The resulting deficit was €758.8 million, down 26.6% on the year. ***Agricultural*** and food products accounted for 15.86% of total commodityexports and 14.56% of imports in the first nine months of 2020, and the most exported of those products were cereals (€205.4 million). The EU market accounted for 65.83% of Croatia's exports and86.16% of imports of ***agricultural*** and food products.Central European Free Trade Agreement countries were second with 24.65% of exports and 7.83% of imports. The biggest export market in the first nine months of 2020 for those products was Italy, where Croatia exported €300.8 million worth of goods, which accountedfor 17.76% of all ***agricultural*** and food exports, up 21.9% on the year. Croatia imported €263 million worth of those products from Italy, down 16.6%, resulting in a €37.6 million surplus. The ***Agriculture*** Ministry said Germany was one of Croatia's most important trade partners, being the country from whichCroatia has been importing the mostsince 2013 and among the top five for Croatianexports in the past four years. The ministry recalled that in January Germany chose Croatia as the partner country for the Green Week international fair in Berlin, which featured 50 Croatian exhibitors and registered over 400,000 visitors. That participation contributed to the export of €127.2 million worth of ***agricultural*** and food products to Germany in the first nine months of 2020, up 13% on the year, as well as the import of€365.9 million worth, down 5%, whereby the deficit was reduced by 12%. Croatia second last in EU for consumption and GDP per capita ZAGREB, Dec 15 (Hina) -In 2019 Croatia remained secondlast among the EU 27 for Actual Individual Consumption (AIC) and GDP per capita, ***Eurostat*** ***data*** released on Tuesday indicate. AICper capita expressed in Purchasing Power Standards (PPS) puts Croatia 34% below the EU average, ***Eurostat*** reported, confirming its June forecast. Hungary was ahead of Croatia with an AIC per capita of 33%, while Bulgaria was at the bottom of the list with an AIC level of 42% below the EU average. AIC per capita of more than 25% below the EU average was also registered inLatvia andSlovakia. Romania registered the highestincrease, bringing it on par withPoland,'only' 21% below the EU average. In 2018Romania was 26% below the EU average and in 2017 it was 30% below that average. AIC in Portugal, the Czech Republic, Malta and Slovenia was between 10% and 20% below the EU average. In Italy, Ireland, Cyprus,Lithuania and Spain, the levels were 10% or less below the EU average. Nine countries above EU average Only nine EU member states had a purchasing power that was above the EU average in 2019 and once again PPS varied between member states. The highest level in the EU wasrecorded in Luxembourg, 35% above the EU average, ahead of Germany (22% above). They were followed byAustria, Denmark, Belgium, the Netherlands, Finland, France and Sweden with levels of 9% to 18% above theEU average. GDP per capita continues to varyacross EU member states Gross Domestic Product (GDP) per capita, a measure of economic activity, also shows substantial differencesbetween the EU member states, ***Eurostat*** said. Luxembourgonce again toppedthe list for GDP expressed in PPS, two and a half times higher than the EU average. Croatia once again found itself secondlast according to GDP per capita, at 35% below the EU average. In 2018 it was 36% below the EU average. Bulgaria again ranked last at 47% below the EU average. Dayton Accords negotiators meet 25 years on ZAGREB, Dec 15 (Hina) - Dayton Accords negotiators from Europe and the U.S. on Tuesday took part in a conference on the occasion of the peace agreement's 25th anniversary, recalling the key events that ended the war in Bosnia and Herzegovina. The "25 Years of the Dayton-Paris Peace Agreement" conference was organised by the Croatian Foreign Ministry and the Croatian Academy of Sciences and Arts. Mate Granic, Croatia's foreign minister in 1995, recalled all the failed plans to find a solution to the conflict in BiH which had been proposed by Lord Owen, Portuguese diplomat Jos\xC3 Cutileiro and Norwegian negotiator Thorvald Stoltenberg. The conflict in BiH was ended with the Dayton Accords, officially signed in Paris on 14 December 1995. Granic said the breakthrough in the search for a solution occurred when Croatia's then ambassador in Geneva Miomir Zuzul organised a meeting with Charles Redman, special U.S. envoy for BiH. "The working dinner on how to stop the war between Croats and Bosniaks, how to establish the Federation, lasted five hours," he said, referring to the Croat-Bosniak Federation entity. The U.S. got involved in the peace process in January 1994. The Washington Agreement, the basis for ending the Croat-Bosniak conflict, was signed the following March. Granic recalled his meeting with Pope John Paul II in February that year, saying the pope strongly supported the U.S. peace initiative and that this had a "big influence" on then Croatian president Franjo Tudjman. As an important event after the July 1995 Srebrenica tragedy, Granic highlighted the Split Declaration which made it possible for Croatian troops to help Bosniaks in fighting against "Slobodan Milosevic's aggression." Recalling the signing of the Dayton Accords, Haris Silajdzic, chairman of the BiH Presidency at the time, said "this model and organisation of the state and the community was imposed by brutal military force and genocide." Former ambassador Zuzul told the conference that "Dayton was a success because it succeeded in stopping a bloody war." Richard Holbrooke, the architect of the Dayton Accords, replaced Redman as a mediator in the negotiations in summer 1994. His deputy, Ambassador Christopher Hill, said Holbrooke, who died ten years ago, was a difficult man but that this made him suitable for mediating. 25 years later Silajdzic said he hoped BiH would become a full member of NATO "as soon as possible." His comment came after Russian Foreign Minister Sergey Lavrov on Monday brought BiH's NATO membership into question. Silajdzic said the part of the Dayton Accords on the return of displaced persons had not been implemented. He said "the time has come, for the sake of future generations, to ensure civic democracy and prosperity in BiH." Granic said BiH should continue on the EU path and underlined the importance of changing the Electoral Law. General Wesley Clark, the U.S. military representative in the Dayton negotiations, said he hoped the new U.S. administration would increase its presence in BiH. U.S. President-elect Joe Biden wrote on Monday that 25 years after the signing of the Dayton Accords it was time for a fully-functioning and stable BiH. "On this day, we celebrate the efforts of the peacemakers, even as we mourn the loss of approximately 100,000 lives and the displacement of millions more," he wrote, adding that it was important that Dayton "reaffirmed (BiH's) sovereignty, territorial integrity, and independence." Plenkovic: It's a mistake to ignore part of Dayton Accords on equality of peoples ZAGREB, Dec15(Hina) - Ignoring the legitimate representation of the three constituent peoples in Bosnia and Herzegovina as defined by the Dayton Peace Accords "would be a serious mistake," Croatian Prime Minister Andrej Plenkovic said on Tuesday at a conference on the occasion of the accords' 25th anniversary. Speaking at the "25 Years of the Dayton-Paris Peace Agreement" conference, he said its Annex4 stipulates legitimate representation for the three peoples in BiH institutions, which "was decisive for the successful conclusion" of the Agreement. "Overlooking this crucial part of the Agreement or, worse, deliberately ignoring it, would be a serious mistake," Plenkovic said at the start of the conference in which the participants in the negotiations on the Agreement, signed on 14 December 1995, will also take part. Plenkovic said a "false dilemma" was being imposed today between a Dayton-based BiH and a BiH "of all its citizens, going beyond ethnic boundaries." "The principle of equality of the three constituent peoples, and the principle of equality of all citizens, do not exclude each other," he said, adding that insisting on equality "is not backward nationalism" but "sound constitutionalism." Plenkovic said nothing could justify the practice seen three times already, in the 2006, 2010 and 2018 elections, to eliminate through outvoting the political representation of Croats in BiH, which "does not contribute to the cohesiveness of the country and the normal functioning of its institutions." He saidthe equality of the three peoples existed from the very start od BiH's statehood, recalling that the 1992 referendum on its independence sawa 63.7% turnout and 99.7% of the voters in favour, and that it describedthe countryas "a state of equal citizens, the peoples of Bosnia and Herzegovina - Muslims, Serbs, Croats and members of peoplesliving there." Revising Dayton? Plenkovic went on to say that there was universal consensus that the Dayton-Paris Agreement ended the war in BiH but that there was a differenceof opinion onits success in achieving a functioning BiH. In this context, he welcomed today's international conference. He said a revision of the Agreement was "open for debate" but that "any change...must come from within,"from citizens, political parties and institutions. He once again called for changing the Electoral Law without further delay, calling it "an investment in the political stability of the country" that was also important for Europe. Plenkovic said BiH'sstability was of "strategic importance" for Croatia, which he said wasthe "staunchest supporter and best advocate"of BiH's EU path, knowing what that "would bring to a country which has already suffered too much." Unification on EU path EU High Representative for Foreign Affairs and Security Policy Josep Borrell said in a video message that the path to EU integration had helped his country, Spain, to overcome divisions in society after a civil war and 40 years of dictatorship. The EU helped on that path, it can help BiH too as well as all of Europe, he said. Difficult but necessary reforms await BiH, he said, adding that its politicians must create an environment which advocated cooperation and reconciliationinstead of undermining them. He urged politicians in BiH to avoid the temptation of identity politics. Three panels The international conference, organised by the Croatian Foreign Ministry and the Croatian Academy of Sciences and Arts, will have three panels attended by participants in the Dayton negotiations, EU and BiH political representatives, and legal and scientific experts. French Foreign MinisterJean-Yves Le Drian and Russian Foreign Minister SergeyLavrov are expected to address viavideo. Croatian Foreign Minister Gordan Grlic Radman said ahead of the conference that its goal was to "mark the historic achievement and offer views on what the peace agreement meant a quarter of a century ago and what it means for BiH's present and future." He said the agreement "recalls the importance of responsible leadership in difficult times" and that it wasone of the biggest achievements of international peace-building. Bosnia Croat leader assures Lavrov it's necessary to amend Dayton Accords ZAGREB, Dec 15(Hina) - The deputy speaker of Bosnia and Herzegovina's upper house of parliament', Dragan Covic, on Monday held talks with the visiting Russian Foreign Minister Sergey Lavrov on the state of affairs in Bosnia and Herzegovina and on efforts to solve the country's internal issues, reads a press release issued by the parliament. Covic, who headsthe Croatian Democratic Union of Bosnia and Herzegovina (HDZ BiH) party,informed Lavrov that "it is imperative that the Dayton Accords should be amended" and that changing of the agreement would also providea safeguardfor equality in the future. Political dialogue cannot function without legitimate representatives of the three constituent peoples and without consensus, Covic said. Commenting on the 25th anniversary of the signing of the Dayton Peace Accordsin Paris, Covic and Lavrovreaffirmed their commitment to the preservation of peace and stability in Bosnia and Herzegovina alongside protectingthe currentConstitutionaland legal order in the country. Before meeting Covic, Lavrov held talks with Bosnian Serb leader Milorad Dodik in East Sarajevo. The two politicians condemned the engagement of Western countries in the implementation of reforms in Bosnia and Herzegovina and called for shutting down the Office of the international community's HighRepresentative (ORH) in Sarajevo.The also strongly criticised NATO. The press release after the Covic-Lavrov meeting made no mention of those topics. Lavrov continues his official visit to Bosnia on Tuesday. BiH Presidency members Komsic and Dzaferovic refuse to meet with Lavrov ZAGREB, Dec 15(Hina) - The Bosniak and Croat members of Bosnia and Herzegovina's tripartite Presidency, Sefik Dzaferovic and Zeljko Komsicrespectively, have refused to meet with visiting Russian Foreign Minister SergeyLavrov, their offices confirmed on Tuesday. Dzaferovic and Komsic as well as the incumbent Serb chairman of the ***collective*** state presidency, Milorad Dodik, were to have held a joint meeting with the Russian officialwho arrived in Bosnia and Herzegovina for an official visit on Monday. Immediately upon his arrival, Lavrov met with Dodik and other officials of the country's Serb entity in East Sarajevo, and after their talks the two officials sent messages condemning efforts by Western countries to encourage reforms in Bosnia and Herzegovina, describing them as attempts to change the Dayton peace agreement and interfere in the country's internal affairs. Lavrov also called for closing down as soon as possible the Office of the international community's High Representative (OHR) in the countryand supported actions by the Serb entity aimed at preventing the country from joining NATO. Later on Tuesday, Dzaferovic and Komsic accused the Russian minister of showing disrespect for the sovereignty of their country and of trying to undermine itsstrategic commitment to joining the European Union and NATO. Komsic told a news conference in Sarajevothat the messages sent from the meetings Lavrov had held in Bosnia were problematic. Dzaferovic added that no pressure exerted by Moscow could deter Bosnia from its plans to join the EU and NATO. Lavrov claims Russia respects BiH, opposes revision of Dayton accords ZAGREB, Dec 15 (Hina) - Russian Foreign Minister SergeyLavrov has said that Russia's policy towards Bosnia is clear and consistent, based on the view that the country's stability is connected with respect for the Dayton Accords and internal dialogue as a way of seeking solutions, without external interference. Lavrov made the statement at a news conference he held in Sarajevo on Tuesday with Bosnia and Herzegovina Foreign Minister Bisera Turkovic. The two agreed on a planfor bilateral diplomatic consultations for the next two years. The talks between the two ministers were overshadowed bya scandal caused by Lavrov's statements made on Monday, in which he brought into question the possibility of Bosnia and Herzegovina's accession to NATO and called for urgently shutting down the Office of the High Representative (OHR) in the country. This prompted Bosnia and Herzegovina (BiH) Presidency members Zeljko Komsic and Sefik Dzaferovic to refuse to meet with Lavrov so he met in the Presidency offices only with Milorad Dodik, the incumbent Serb chairman of the BiH Presidency with whom he had already held separate talks in East Sarajevo on Monday. Lavrov made no special comment on the scandal that cast a shadowon his visit to Bosnia and Herzegovina, repeating only at the news conference that Russia respectedBosnia and Herzegovina's sovereignty,calledfor the consistent implementation of the Dayton agreement and opposedits possible revision. He noted that it was Moscow's view that the only solution for Bosnia and Herzegovina was internal dialogue and agreement based on compromise. Despite Komsic's and Dzaferovic's objections, Lavrov repeated his statement of Monday that the role of the High Representative in Bosnia and Herzegovina had been exhausted and that his term should end while Bosnia and Herzegovina should continue functioning as an independent country. Turkovic, too, avoided a direct comment on the messages to Russia sent by Dzaferovic's and Komsic'sboycott of Lavrov. She said that her meeting with the Russian minister was "constructive and open" and that they established that the two countries' relations were good and that there was room for their improvement, notably on the economic front. "I hope... there will be improvement in the coming period," she said. Turkovic added that Bosnia and Herzegovina welcomed Russia's commitment to respectingBosnia and Herzegovina's territorial integrity and sovereignty as defined by the Dayton peace agreement and expected Russia to help in its progress "based on documents supported at the state level by elected representatives." "We should respect one another and respect the Dayton agreement," she said, recalling that the Dayton agreement guaranteed equal rights for all BiH citizens regardless of their place of residence, as well as respect for all court rulings on the entireBiH territory. Using diplomatic language, she said that the reason for current problems in the country were "three different views" of the country's future, including its path to Euro-Atlantic associations, and addedthat the only solution to that was compromise. In that context she mentioned problems regarding integration with NATO and the future of the OHR, for which, she stressed, a middle-road policy was required with which all peoples in Bosnia and Herzegovina would be satisfied. By meeting with Turkovic Lavrov ended his two-day official visit to Bosnia and Herzegovina and left for Belgrade, the next stop of his regional tour. Lavrov: Dzaferovic and Komsic are following someone's orders ZAGREB, Dec 15 (Hina) - Russian Foreign Minister Sergei Lavrov said during a visit to Belgrade on Tuesday that the Bosniak and Croat representatives on Bosnia and Herzegovina's state presidency, who refused to meet with him earlier in the day, were not autonomous in their decision making and were obviously following someone's orders. The politicians who made that decision probably do not represent the interests of the majority of their voters but the interests of foreign forces which are not interested in the development of Russian-Bosnian and Russian-Serbian relations or in the Western Balkan countries exercising their right to mutually beneficial cooperation with all foreign partners, Lavrov told a joint press conference with Serbian President Aleksandar Vucic. The Bosniak and Croat members of the Bosnia and Herzegovina Presidency, Sefik Dzaferovic and Zeljko Komsic, refused to meet with the Russian foreign minister on Tuesday after he questioned Bosnia and Herzegovina's bid to join NATO and called for the urgent closure of the Office of the High Representative. Dzaferovic and Komsic accused Lavrov of not respecting their country's sovereignty and questioning its strategic policies. Lavrov said that this incident was not relevant for Russia's position on the development of relations with the peoples of Bosnia and Herzegovina. Lavrov and Vucic said that Russia and Serbia were agreed on honouring the principles of the Dayton peace agreement on the equality of the three constituent peoples and the existence of two entities within Bosnia and Herzegovina. They also agreed that Serbia and Russia had a high level of bilateral political and economic relations and understanding for the principles of regional cooperation. Hojs hints at possible traffic jams at Slovenia-Croatia border ZAGREB, Dec15 (Hina) - Interconnectinginformation systems of the countriesin the passport-free Schengen Area, which envisages additional checks on third countries' citizens at the Schengen external bordersmaycause delays in traffic at Slovenia-Croatia border, Slovenian Interior Minister Ales Hojs said on Monday. Hojs made this statement after a virtual conference of the European Union member-states interior ministers who discussed, among other things, the better connecting of the information already available, in particular by implementing the interoperability of EU information systems. Alsoestablishing an upgraded acquis on cross-border police cooperation including, for example, adequate powers for cross-border surveillance and hot pursuit was also on the ministerial meeting's agenda. During the virtual meeting, a proposal made by Croatia and Slovenia that additional checks should be conducted at the external border of the European Union was not accepted. This prompted Hojs to say the current application of the new system of surveillance could cause delays at the Slovenia-Croatia border since Croatia has not yet been admitted to the Schengen Area. The system of interoperability requires taking fingerprints and other procedures, which will undoubtedly hold back the traffic on the Croatian side of the border. There was a mention of a possibility of designating special lanes for passengers from third countries, but this would not be possible to implement everywhere on the ground, the Slovenian minister said. The deadline for establishing interoperability has been shifted to May 2022. Slovenia: 1,524 new COVID cases, 44 deaths, restrictions to be temporarily eased ZAGREB, Dec 15 (Hina) - In the past 24 hours Slovenia has registered 1,524 new cases of coronavirus out of 5,637 tests, and there have been 44 COVID-related fatalities, thegovernment reported on Tuesday. That number is on average the same as last week and the epidemiologicalsituation in the country is still difficult. However, the government has decided to slightly ease some restrictions for aweek, until December 23 after which Sloveniawill once again go into lockdown overthe Christmas and New Year holidays. With the latest 44 deaths the death toll now stands at 2,151, the government said. The situation in hospitals is still difficult with a growing number of patients requiring hospitalisation. Currently there are 1,284 patients in hospital treatment, 204 patients are in intensive care units while 127 patients were discharged in the past 24 hours. The latest government decision means that public transport will be running again but to a limited capacity. Some services will once again be allowed for the next eight days such as hairdressers and pedicure salons. Further restrictions on movement will continue to apply in only 4 of 12 statistical regions. Prime Minister Janez Jansa said in parliament on Monday that the first 5,000 doses of Pfizer-BioNTech vaccines would arrive in Slovenia at the end of the year as part of a joint European Commission procurement. Bosnia confirms over 800 new coronavirus cases, 47 deaths ZAGREB, Dec 15 (Hina) - Bosnia and Herzegovina has recorded slightly over 800 new cases of coronavirus and 47 deaths in the past 24 hours, the country's health institutions confirmed on Tuesday, adding that there were indications of the epidemic gradually subsiding. The numbers released on Tuesday confirm the trend of a gradual decrease inthe daily number of people infected, noticeable since the end of last week, while at the same time the number of deaths remains relatively high. In the past 24 hours more than 3,200swabs were taken. Since the outbreak of the epidemic in the country in March, more than 101,000 cases of the virus have been identified and almost 3,400 people have died as a consequence. The epidemiological situation is not uniform across the country because the weekly incidence rate of new cases per 100,000 people varies. In the Bosnian-Croat Federation entity, itis about 230, while in some cantons, like Herzegovina-Neretva Canton, the incidence rate is above 500. Serbia registers 53 new coronavirus deaths, record 9,320 hospitalised cases ZAGREB, Dec 15 (Hina) - Serbia has registered5,884 new cases of coronavirus and 53 COVID-related deaths in the past 24 hours with a record number of hospitalised people, the country's healthauthorities said on Tuesday. There are currently 9,320 hospitalised COVID patients, the most yet, while 312 patients are on ventilators. Since the start of the epidemic in early March, a total of 2,065,445 tests have been conducted, with 18,989 taken in the past 24 hours,and277,248 have returned positive. The death toll has reached 2,433, and the fatality rate is 0.88%. President Aleksandar Vucic announced earlier in the day that the first quantity of "at least two vaccines" against COVID-19 would arrive before the year's end, expressing hopethat there would be three. He added that the decision on vaccination depended on health authorities. "Vaccinations will begin in January at the latest, while I believe that could be in December already. In any case we will be ahead of the majority of others," Vucic told reporters. He said that Serbia had ordered 340,000 doses of Pfizer's vaccine and that their delivery was expected in January or February next year. However, he saidSerbia would receive "its initial quantities along with one or two other countries in Europe, before the end of the year." "We are testing the Russian vaccination and we are waiting for the vaccination in China to be registered. We spokewith the Moderna company but they cannot deliver before the end of next year," said Vucic. DSHV to join Novi Sad city government ZAGREB, Dec15 (Hina) - The Democratic Alliance of Vojvodina Croats (DSHV) will join the city administration of Novi Sad, the party has said, noting that seven of its members willjoin the working bodies of the capital city of the northern Serbian province of Vojvodina,which is run by the Serbian Progressive Party (SNS). Attorney Ankica Jukic-Mandic has been nominated for the post of a special adviser to Novi Sad Mayor Milos Vucevic on issues concerning the Croat community, while Novi Sad attorney Goran Krncevic has been nominated for the post of assistant head of one of the city departments. Five more DSHV representatives have been nominated for posts in the working bodies of the Novi Sad City Assembly. Negotiations on the inclusion of the Croat minority in the bodies of the Vojvodina capital started in November 2019 and have been stepped up after a recent address bySerbian President Aleksandar Vucic on their participation in the work of Vojvodina's and Serbia's representative bodies. Before cooperation was agreed with the city of Novi Sad, the Croat minoritywas given two seats in the provincial assembly. DSHV leaders had been pointing for years toCroat minority representatives being excluded from decision-making processes in Serbia, notably with regard to issues concerning their status. They had called on the Serbian leadership to secure for the Croat minority guaranteed seats in executive and state bodies in line with the model applied to the Serb minority in Croatia. Kosovo moves to form energy bloc with Albania ZAGREB, Dec 15 (Hina) - Kosovo announced on Tuesday it had separated its energy system from Serbia's and connected it to the Albanian electricity grid, describing it as a major achievement for its national sovereignty in the area of energy, while Serbia claimedKosovo's power installations remained part of its energy system. The transition period ended on December 14 and the Kosovo network system operator KOSTT has begun to operate as an independent energy entity within the European energy network, media in Pristina said. This basically means that KOSTT covers the entire territory of Kosovo, including the Serb-majority north which is controlled by Serbia. Kosovo's power transmission system was connected to Albania's system on Monday, forming the Kosovo-Albania energy bloc. However, Serbian transmission system operator EMS said that the Valac transformer susbstation in northern Kosovo remained part of Serbia's power transmission system, rejecting reports that workers had abandoned that installation as untrue.EMS said it was not handing over its transformer substation. Pundits say that Serbia can no longer distribute electricity to the Valac substation without consulting KOSTT because it has no right to do so under European electricity network rules. In other news: Zagreb hospital first in SE Europe to treat until recently incurable eye diseases ZAGREB, Dec 15(Hina) - Zagreb's Sveti DuhHospital is the only hospital in this part of Europe that uses genetherapy to treat until recently incurable inheritedeye diseases that cause vision loss, which makes Croatia one of only six countries in the world that use such therapy in ophthalmology. The hospital, which last year became an associate centre of the World Health Organisation, is the first regional centre of excellence to implement gene therapy in the treatment of inherited retinal dystrophyand patients from some 15 countries, of whom more than one-third are from EU countries, are expected to gravitate to it, the hospital said last Saturday. The final diagnosis, for which this method of treatment gives what until recently were unimaginable results, is done by genetic testing, and the first patients received therapy this past summer. Owing to its status of a certified centre of excellence treating retinal dystrophy with gene therapy, the Sveti Duh Hospital has made Croatia the first country in east and southeast Europe and the sixth country in the world, after the USA, the UK, Germany, France and Israel, where this innovative method of treatment of retinitis pigmentosa and Leber congenital amaurosis, inherited diseases that causevision loss, is used. In patients with these diseases, the application of the available genetherapy stops the progression of the disease and can resultin significant improvement of vision, said hospital director Mladen Busic. It is estimated that up to 1,000 people in Croatia suffer from inherited retinal dystrophyand genetic testing is necessary to identify those suitable for the innovative therapeutic solution. The cost of testing is fully covered by the Croatian Health Insurance Institute (HZZO) as are the costs of treatment for all patients in whom inherited retinal dystrophy is caused by the mutation of the RPE65 gene. Croatia is the first country in the world that has made this possible for its insurees, the hospital said. Central bank releases HRK 980m into system ZAGREB, Dec 15 (Hina) - The Croatian National Bank intervened on the foreign currency market on Tuesday for the first time since March, buying €130 million from banks to maintain the kuna-euro exchange rate. The euros were bought at the rate of HRK 7.536038 for €1, whereby HRK 980 million was released into the financial system. This was the central bank's sixth intervention this year. The previous one took place at the end of March, when it sold more than €618 million to banks, drawing HRK 4.7 billion from the system. The first foreign currency market intervention this year occurred on March 9, at the onset of the COVID-19 crisis, followed by others on March 12, 13, 16 and 31 in which almost HRK 2.25 billion was sold to banks in efforts to cushion the weakening of the kuna. ZSE indices down for third consecutive day ZAGREB, Dec 15(Hina) - The main Zagreb Stock Exchange (ZSE) indices fell for the third consecutive trading day on Tuesday, with the Crobex declining by 0.76% to 1,724 points and the Crobex10 by 0.61% to 1,075 points. The two indices have lost more than 2% of their value in the last three trading days. Turnover at the close of the trading session reached HRK 4.6 million, about 600,000 less than on Monday. An additional HRK 14.92 million was generated by a block transaction with the stock of the HT telecommunications company at HRK 179 per share. None of the stocks passed the turnover mark of one million kuna. The highest turnover, of HRK 774,000, was generated by the stock of power transmission equipment manufacturer Dalekovod. It closed at HRK 6.94 per share, down 3.6%. A total of 34 stocks traded today, with six of them registering share price increases, 18 recording price decreases and 10 remaining stable in price. (€1 = HRK 7.538972) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2100 HOURS TUESDAY. (Hina) vm Masthead Brief News Bulletin is published by the Croatian News Agency HINA Marulićev trg 1610 000 ZagrebCroatia web:[*www.hina.hr*](http://www.hina.hr) mail: [*hina@hina.hr*](mailto:hina@hina.hr) phone: (+385 1) 48 08 660; fax (+385 1) 48 08 822 Publisher: Branka Gabriela Valentić, DirectorEditor in Chief: Serđo Obratov Bulletin Editor: Marija Šestan

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[***Dietary condition and feeding practices of children aged 6–23 months in Ethiopia: analysis of 2005–2016 demographic and health survey***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:671W-P2C1-JCWX-C1TM-00000-00&context=1516831)

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**Body**

Introduction

Sufficient nutrition is necessary for children growth and development. However, children undernourishment remains a serious problem worldwide. Malnutrition reflects poor social and economic development, and results in stumbled growth, developmental delay, and death []. Addressing the issue of children under-nutrition has been regarded as a key priority. It remains at the top of the global agenda as noted by the second United Nation’s Sustainable Development Goal, “Zero Hunger” []. Stunting (low height-for-age) is a signal of chronic malnutrition that reveals a failure to obtain sufficient nutrition over an extensive period, and is affected by recurrent and persistent disease []. The height-for-age Z-score (HAZ) characterises the continuing effects of undernutrition in a population and is not responsive to interim alterations in food intake []. Ethiopia loses about 5 billion USD or 17% of GDP in education, health, and productivity due to children under-nutrition [, ].

Similar to stunting, children’ anaemia is also a serious public health problem with adverse health impacts on the community and the economic development of a country [].

The prevalence of anaemia among Ethiopian children declined from 53% in 2005 to 44% in 2011, but increased to 57% in 2016 []. Anaemia prevalence varies in other African countries too, with 86% in Sudan, 78.4% in Ghana, >72% in Togo, 66.7% in Cameroon, and >50% in the Gambia [–]. The initial 1000 days from conception is considered as the “critical window” for the development of good growth, health, behavioural and cognitive progression []. The feeding practices in “critical window” were proposed by WHO, with the use of eight IYCF core indicators: (1) early initiation of breastfeeding, (2) exclusive breastfeeding for six months, (3) continued breastfeeding up to one year, (4) introduction of solid semi-solid or soft foods, (5) MMF, (6) MDD, (7) MAD, (8) utilisation of iron-rich foods []. Ethiopia has established a National Strategy for IYCF practices since 2002 []. However, few researches have been conducted to explore the association between IYCF practices and the dietary condition of anaemia and stunting. Therefore, this study was performed to determine the relationship, using ***data*** from the 2005–2016 Ethiopia Demographic and Health Surveys (EDHS).

Material and methods

***Data***

The ***data*** used in the present study was from three nationwide EDHS (2005, 2011, 2016). Detail techniques have been illustrated elsewhere [, , ]. In the 2011 and 2016 EDHS, all children in all chosen households were included in the measurement. In the 2005 survey, children were conscripted for analysis only in a randomly selected subsample from half of the recruited households. Hence, the number of children with weight and height measurements is much smaller in the 2005 survey than in the other two EDHS. Children file (KR file) were selected from each of the three EDHS ***data***. From 32,156 children aged 0–59 month, we selected 5638 children with age between 6 and 23 months and all participants gave informed consent. Information on health service records was found in three different mechanisms in the EDHS: written records (including the infant immunisation card and other health cards), mothers’ verbal reports, and health facility records. Consent was obtained from mothers prior to communicating the health facilities and confirming children records. The objective of getting information at the health facility was to counterpart the information gathered by mother’s recall [].

We used WHO anthropometric nutritional survey software for boys and girls. Values are based on WHO standards. For each indicator all children are comprised in the assessment with a plausible z-score (described based on survey options). Percentages below median based on weight-dependent indicators are defined as < −3 SD and < −2 SD. %<−2SD includes %<−3SD. The USAID-DHS Program was providing approval and access to the 2005–2016 EDHS.

Variables

Dependent variables

Stunting and anaemia were considered as dependent variables. Stunting was computed from HAZ via the WHO Child Growth Standards []. Anaemia was described based on the 2016 EDHS definitions []. Children with HAZ under minus two (−2SD) standard deviation from the norm of the reference population were regarded as stunted. In our study, we excluded missing and biologically implausible values such as those less than (−6SD) or higher than (+6SD) [].

Independent variable

Six IYCF indicators was used to evaluate children’s feeding practices, and acted as independent variables, including currently breastfeeding, introduction of solid, semi-solid or soft foods, MMF, MDD, MAD, and use of iron-rich foods. These independent variables were re-coded based on the information about meals provided to the children within the previous 24 h before the interview according to IYCF core indicators strategies [].

Covariates

The socio-demographic and maternal characteristics were extracted and adjusted as potential confounders.

Statistical analysis

Complex samples frequency tables were used to show the background characteristics, the prevalence of stunting, anaemia, and the IYCF practices. Multivariable logistic regression was performed to estimate the odd ratios (ORs) and 95% confidence intervals (CIs) of stunting and anaemia with IYCF practices. Multicollinearity was checked among the IYCF practices, showing that MDD and MAD were highly correlated (r = 0.73).

For the 2005–2016 EDHS, the survey sample is representative at the national and regional levels, and for rural and urban areas. In order to get ***statistics*** that are representative of Ethiopia, the distribution of the women in the sample needs to be weighted so that it looks like reliable distribution in the country. Women from a small region, like Harari, should only contribute a small amount to the national total. Women from a large region, like Oromiya, should contribute much more. Therefore, EDHS statisticians mathematically calculate a “weight” which is used to adjust the number of women from each region so that each region’s contribution to the total is proportional to the actual population of the region []. We adjusted for each analysis that used a hypothesis testing for the design effect using a predefined parameter ascertained as a function of the primary sampling unit (PSU), strata, and sampling weights. We considered sampling weight for complex frequency and percentage evaluations for adjusting representativeness and non-responsiveness. All CI were computed using standard error, which was estimated by survey ***data*** analysis SPSS command adjusting for study design effect and non-responses. We executed all analyses on IBM SPSS (v. 22, IBM Corporation North Castle Drive Armonk, NY, USA), and p value < 0.05 was set as a statistical significance.

Results

Dietary conditions and presence of IYCF practices among children aged 6–23 months (2005–2016)

Table illustrates the presence of IYCF practices and dietary conditions from 2005–2016. From 2005 to 2016, The prevalence of breastfeeding and MMF in children aged 6–23 months decreased from 95 to 90% and 58 to 45%, respectively. However, the other IYCF practices declined from 2005 to 2011, but increased in 2016. Details were showed in Fig .

The prevalence of infant young children feeding practices and dietary condition among children aged 6–23 months (2005–2016 demographic and health survey).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| IYCF practice | 2005 (%) | 95% CI | 2011 (%) | 95% CI | 2016 (%) | 95% CI |
| Currently breastfeeding | 94.5 | [92.1, 96.3] | 93.5 | [91.7, 94.9] | 89.5 | [87.2, 91.5] |
| Introduction of solid, semi-solid or soft foods | 17.5 | [13.7, 22.2] | 9.8 | [7.9, 12.1] | 84.6 | [82.0, 86.8] |
| Consumption of iron-rich foods | 14.5 | [11.5, 18.1] | 13.5 | [11.3, 16.0] | 22.7 | [19.7, 26.1] |
| Minimum meal frequency | 58.2 | [53.8, 62.5] | 47.8 | [44.8, 50.7] | 44.9 | [41.4, 48.4] |
| Minimum dietary diversity | 9.8 | [7.4, 13.0] | 5.0 | [4.0, 6.3] | 21.4 | [18.6, 24.6] |
| Minimum acceptable diet | 8.7 | [6.4, 11.8] | 4.7 | [3.7, 5.9] | 12.6 | [10.3, 15.2] |
| Nutritional status |  |  |  |  |  |  |
| Stunted | 49.0 | [44.5, 53.5] | 38.6 | [35.6, 41.6] | 31.9 | [28.9, 35.0] |
| Anaemic | 25.9 | [22.2, 29.9] | 16.1 | [14.1, 18.4] | 28.9 | [25.8, 32.2] |

Table reveals the prevalence of IYCF practices and dietary condition from 2005–2016: Apart from breastfeeding, the average prevalence of other IYCF practices was low, with less than one-fifth of children getting MDD, MAD, and consumed iron-rich foods. Only half of the children getting sufficient meal frequency and about one-third of children have the introduction of solid, semi-solid, and soft foods. Among children aged 6–23 months stunting was consistently decreased from 49 to 32% from 2005 to 2016 and anaemia also gradually declined from 26 to 16% in 2005–2011, but raised to 29% in 2016.

Trends of IYCF practices from 2005 to 2016.

A trend analysis from 2005 to 2016 shows breastfeeding and MMF in children aged 6–23 months was decreased from 95 to 90% and 58 to 45% respectively. Meanwhile, the other IYCF practices declined from 2005 to 2011; However, they raised in 2016.

Prevalence of stunting by child, socio-demographic and maternal characteristics, and IYCF practices

As shown in Table and Fig. , the prevalence of stunting in children aged 6–23 months decreased consistently from 49 in 2005 to 32% in 2016. Table presents the prevalence of stunting by IYCF practices. In 2005, stunting was more frequent in children who have not consumed iron-rich foods than those who have (45% versus 4%). From 2005 to 2016, stunting significantly decreased in children who have received MDD in comparison with those who have not (3% versus 47% in 2005, 1% versus 37% in 2011, and 5% versus 27% in 2016). In 2005, stunting was more common in children who did not meet MAD compared with those who did (47% versus 2%). The other IYCF practices were not significantly related to the prevalence of stunting.

Stunting and anaemia status from 2005 to 2016 EDHS.

As shown in Fig. 2, the prevalence of anaemia among children aged 6–23 months reduced from 26 to 16% (2005–2011), but it increased to 29% in 2016 whereas stunting was consistently decreased from 49% (2005) to 32% (2016).

Prevalence of stunting and anaemia by infant young children feeding practices (2005–2016 demographic and health survey).

|  | **2005** | | | | | | **2011** | | | | | | **2016** | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **IYCF practice** | **Anaemic** | | | **Stunting** | | | **Anaemic** | | | **Stunting** | | | **Anaemic** | | | **Stunting** | | |
| **%** | **95% CI** | ***P*** | **%** | **95% CI** | ***p*** | **%** | **95% CI** | ***p*** | **%** | **95% CI** | ***p*** | **%** | **95% CI** | ***p*** | **%** | **95% CI** | ***p*** |
| Breast feeding |  | 0.29 |  | 0.01\*\* |  | 0.54 |  | 0.11 |  | 0.06 |  | 0.55 |  |  |  |  |  |  |
| No | 1.9 | [0.9, 3.8] |  | 1.3 | [0.6, 2.7] |  | 1.2 | [0.8, 1.8] |  | 2.1 | [1.4, 2.9] |  | 4.0 | [2.6, 6.1] |  | 3.6 | [2.6, 5.0] |  |
| Yes | 24.0 | [20.4, 28.0] |  | 47.7 | [43.1, 52.4] |  | 14.9 | [13.0, 17.2] |  | 36.5 | [33.5, 39.6] |  | 24.9 | [22.0, 28.0] |  | 28.3 | [25.5, 31.3] |  |
| Introduction of solid, semi-solid or soft foods |  | 0.22 |  | 0.97 |  | 0.67 |  | 0.53 |  | 0.68 |  | 0.24 |  |  |  |  |  |  |
| No | 20.4 | [16.7, 24.7] |  | 40.4 | [36.3, 44.7] |  | 14.7 | [12.7, 16.9] |  | 35.0 | [32.0, 38.2] |  | 4.7 | [3.5, 6.1] |  | 5.5 | [4.2, 7.3] |  |
| Yes | 5.5 | [3.7, 8.0] |  | 8.6 | [5.9, 12.3] |  | 1.5 | [0.9, 2.3] |  | 3.6 | [2.6, 4.8] |  | 24.2 | [21.3, 27.4] |  | 26.4 | [23.7, 29.3] |  |
| Consumption of Iron rich foods |  | 0.04\* |  |  | 0.01\*\*\* |  |  | 0.83 |  |  | 0.64 |  |  | 0.12 |  |  | 0.07 |  |
| No | 20.9 | [17.7, 24.5] |  | 44.6 | [40.1, 49.2] |  | 14.0 | [12.1, 16.2 |  | 33.6 | [30.7, 36.7] |  | 23.4 | [20.4, 26.7] |  | 25.8 | [23.0, 28.8] |  |
| Yes | 5.0 | [3.5, 7.2] |  | 4.4 | [3.1, 6.3] |  | 2.1 | [1.4, 3.1] |  | 5.0 | [3.8, 6.5] |  | 5.5 | [4.0, 7.4] |  | 6.1 | [4.7, 7.8] |  |
| Minimum dietary diversity |  | 0.11 |  |  | 0.01\*\*\* |  |  | 0.24 |  |  | 0.03\* |  |  | 0.17 |  |  | 0.01\* |  |
| No | 22.5 | [19.0, 26.4] |  | 46.5 | [42.0, 51.1] |  | 15.1 | [13.2, 17.2] |  | 37.2 | [34.3, 40.3] |  | 23.5 | [20.6, 26.6] |  | 26.7 | [23.8, 29.9] |  |
| Yes | 3.4 | [2.2, 5.2] |  | 2.5 | [1.5, 4.1] |  | 1.1 | [0.6, 1.8] |  | 1.3 | [0.8, 2.1] |  | 5.4 | [4.2, 7.0] |  | 5.2 | [3.9, 6.8] |  |
| Minimum meal frequency |  | 0.61 |  | 0.49 |  | 0.07 |  | 0.03\* |  | 0.97 |  | 0.15 |  |  |  |  |  |  |
| No | 10.3 | [8.0, 13.2] |  | 21.2 | [17.8, 25.1] |  | 9.5 | [8.0, 11.1] |  | 18.7 | [16.4, 21.2] |  | 15.9 | [13.5, 18.7] |  | 16.5 | [14.1, 19.2] |  |
| Yes | 15.6 | [12.6, 19.0] |  | 27.8 | [24.2, 31.8] |  | 6.7 | [5.2, 8.5] |  | 19.9 | [17.8, 22.2] |  | 12.9 | [11.0, 15.2] |  | 15.4 | [13.2, 17.9] |  |
| Minimum acceptable diet |  | 0.09 |  | 0.01\*\*\* |  | 0.15 |  | 0.07 |  | 0.73 |  | 0.17 |  |  |  |  |  |  |
| No | 22.8 | [19.3, 26.7] |  | 46.9 | [42.3, 51.5] |  | 15.1 | [13.2, 17.2] |  | 37.3 | [34.3, 40.3] |  | 25.4 | [22.5, 28.5] |  | 28.6 | [25.5, 31.8] |  |
| Yes | 3.1 | [2.0, 4.9] |  | 2.1 | [1.2, 3.8] |  | 1.1 | [0.6, 1.8] |  | 1.3 | [0.8, 2.0] |  | 3.5 | [2.5, 4.8] |  | 3.3 | [2.3, 4.8] |  |

Table shows prevalence of anaemia and stunting by IYCF practices (2005–2016 EDHS): In 2005, stunting was more frequent in children who have not consumed iron-rich foods in comparison with those who consumed iron-rich foods (45% versus 4%). From 2005 to 2016, stunting was significantly decreased in children who were received MDD in comparison with those who were not received MDD (3% versus 47% in 2005, 1% versus 37% in 2011 and 5% versus 27% in 2016). In 2005, stunting was more common in children who were not satisfied MAD in comparison with those who were satisfied MAD (47% versus 2%). In 2005, the prevalence of anaemia was severe in children who had not consumed iron-rich foods in comparison with those who had consumed iron-rich foods (21% versus 5%). Other IYCF practices were not significantly associated with anaemia.

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001.

Prevalence of anaemia by child, socio-demographic and maternal characteristics, and IYCF practices

Anaemia prevalence in children aged 6–23 months declined from 26 to 16% (2005–2011), but raised to 29% in 2016 (Table and Fig. ). IYCF practices and prevalence of anaemia were shown in Table . In 2005, the prevalence of anaemia was higher in children who had not consumed iron-rich foods than those who have (21% versus 5%). Other IYCF practices were not significantly associated with anaemia.

Multiple logistic regressions: stunting

Table shows the results of the multivariable logistic regression for stunting. Among the covariates, male children had higher odds of stunting than female children, with OR 1.47 (95% CI: 1.07, 2.02) in 2005 and OR 1.50 (95% CI: 1.26, 1.80) in 2011. Size at birth was a key indicator of the dietary condition of children, and children’s perceived birth size was a significant predictor of stunting. The prevalence of stunting was higher in children who were very small at birth than children who were small, average, or larger at birth. The children with very large perceived birth size were 48% (95% CI: 0.39, 0.70) in 2011 and 53% (95% CI: 0.33, 0.66) in 2016 less likely to be stunted than children with very small perceived birth size. Stunting ascended with the age of a child in a dose-response manner. Children aged 12–17 months and 18–23 months had higher odds of stunning than children aged 6–11 months. Regarding socio-demographic and maternal characteristics, children with higher educated mother were less likely to be stunned than those with a non-educated mother, with OR 0.26 (95% CI: 0.07, 0.92) in 2011 and OR 0.42 (95% CI: 0.19, 0.94) in 2016.

Association between infant young children feeding practices and dietary status (stunting and anaemia) among children aged 6–23 months adjusting for covariates (2005–2016 demographic and health survey).

| **Characteristics** | **2005** | | | | **2011** | | | | **2016** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Anaemia** | | **Stunting** | | **Anaemia** | | **Stunting** | | **Anaemia** | | **Stunting** | |
| **AOR** | **95% CI** | **AOR** | **95% CI** | **AOR** | **95% CI** | **AOR** | **95% CI** | **AOR** | **95% CI** | **AOR** | **95% CI** |
| IYCF variables |  |  |  |  |  |  |  |  |  |  |  |  |
| Currently breastfed | 0.57 | 0.32?1.04 | 1.41 | 0.79?2.52 | 0.55\*\*\* | 0.40?0.76 | 0.91 | 0.67?1.22 | 0.54\*\*\* | 0.42?0.70 | 1.02 | 0.77?1.36 |
| Introduction of solid, semi-solid or soft foods | 1.53 | 0.98?2.37 | 0.99 | 0.65?1.49 | 1.00 | 0.73?1.36 | 0.79 | 0.61?1.03 | 0.87 | 0.66?1.15 | 0.96 | 0.73?1.28 |
| Consumption of Iron-rich foods | 1.42 | 0.85?2.35 | 0.65 | 0.41?1.04 | 0.91 | 0.66?1.25 | 1.13 | 0.87?1.46 | 0.85 | 0.65?1.11 | 0.91 | 0.70?1.19 |
| Minimum dietary diversity | 0.36 | 0.08?1.68 | 0.36 | 0.10?1.38 | 0.82 | 0.29?2.33 | 0.40 | 0.13?1.20 | 0.67 | 0.43?1.04 | 0.76 | 0.49?1.19 |
| Minimum meal frequency | 0.86 | 0.60?1.23 | 0.86 | 0.63?1.19 | 0.72\*\* | 0.57?0.89 | 1.46\*\*\* | 1.22?1.75 | 1.02 | 0.81?1.28 | 1.18 | 0.93?1.49 |
| Minimum acceptable diet | 1.66 | 0.31?8.89 | 2.25 | 0.53?9.51 | 2.26 | 0.75?6.84 | 1.53 | 0.48?4.91 | 0.97 | 0.57?1.65 | 0.77 | 0.45?1.31 |
| Child?s characteristics |  |  |  |  |  |  |  |  |  |  |  |  |
| When child put to breast | Reference = none |  |  |  |  |  |  |  |  |  |  |  |
| Immediately | 0.89 | 0.50?1.60 | 0.84 | 0.49?1.44 | 0.71\* | 0.53?0.95 | 0.85 | 0.65?1.11 | 1.13 | 0.71?1.79 | 1.18 | 0.72?1.92 |
| Within first hour | 0.00 | 0.0?0.0 | 0.35 | 0.03?3.56 | 0.84 | 0.41?1.74 | 0.84 | 0.42?1.67 | 0.81 | 0.42?1.57 | 1.07 | 0.54?2.11 |
| Hours: 1 | 0.90 | 0.45?1.77 | 0.82 | 0.44?1.54 | 0.56\*\*\* | 0.40?0.78 | 0.89 | 0.66?1.19 | 1.26 | 0.77?2.06 | 1.60 | 0.95?2.69 |
| Days: 1 | 1.36 | 0.49?3.76 | 1.10 | 0.41?2.93 | 0.83 | 0.52?1.31 | 0.91 | 0.60?1.40 | 1.80 | 0.87?3.72 | 0.96 | 0.43?2.19 |
| Sex of child (Male) | 1.25 | 0.89?1.76 | 1.47\* | 1.07?2.02 | 1.02 | 0.83?1.25 | 1.50\*\*\* | 1.26?1.80 | 0.82\* | 0.68?0.99 | 1.18 | 0.97?1.44 |
| Perceived birth size | Reference = very small |  |  |  |  |  |  |  |  |  |  |  |
| Smaller than average | 0.87 | 0.43?1.77 | 1.01 | 0.53?1.91 | 1.06 | 0.72?1.55 | 0.74 | 0.53?1.03 | 0.70 | 0.48?1.01 | 0.92 | 0.64?1.34 |
| Average | 0.96 | 0.62?1.51 | 0.68 | 0.45?1.03 | 0.88 | 0.68?1.13 | 0.71\*\* | 0.57?0.88 | 0.72\*\* | 0.56?0.92 | 0.74\* | 0.57?0.97 |
| Larger than average | 0.87 | 0.46?1.66 | 0.68 | 0.38?1.22 | 1.25 | 0.88?1.76 | 0.58\*\*\* | 0.43?0.80 | 0.72\* | 0.51?1.00 | 0.69\* | 0.48?0.98 |
| Very large | 0.94 | 0.56?1.59 | 0.62 | 0.38?1.01 | 0.93 | 0.67?1.30 | 0.52\*\*\* | 0.39?0.70 | 0.74 | 0.54?1.01 | 0.47\*\*\* | 0.33?0.66 |
| Diarrhoea | 1.12 | 0.76?1.64 | 1.21 | 0.85?1.74 | 1.10 | 0.86?1.40 | 1.10 | 0.89?1.37 | 0.97 | 0.76?1.25 | 1.17 | 0.89?1.52 |
| Fever | 0.95 | 0.62?1.44 | 1.10 | 0.75?1.61 | 0.93 | 0.73?1.19 | 1.08 | 0.88?1.33 | 0.93 | 0.72?1.19 | 1.05 | 0.80?1.36 |
| Vitamin A | 1.45\* | 1.03?2.04 | 0.94 | 0.69?1.28 | 0.66\*\*\* | 0.54?0.82 | 1.01 | 0.84?1.21 | 1.10 | 0.91?1.33 | 1.00 | 0.82?1.22 |
| De-worming | 0.60 | 0.22?1.64 | 0.43 | 0.17?1.07 | 1.26 | 0.92?1.71 | 0.85 | 0.65?1.12 | 0.85 | 0.61?1.20 | 0.55\*\* | 0.38?0.81 |
| Age of child | Reference = 6?11 months |  |  |  |  |  |  |  |  |  |  |  |
| 12?17 months | 1.23 | 0.80?1.88 | 2.05\*\*\* | 1.39?3.05 | 1.06 | 0.84?1.34 | 2.54\*\*\* | 2.04?3.17 | 0.88 | 0.70?1.11 | 2.73\*\*\* | 2.04?3.64 |
| 18?23 months | 1.26 | 0.80?1.99 | 3.62\*\*\* | 2.36?5.54 | 0.94 | 0.72?1.22 | 4.30\*\*\* | 3.40?5.44 | 0.88 | 0.69?1.12 | 5.80\*\*\* | 4.31?7.82 |
| Socio-demographic & maternal characteristics |  |  |  |  |  |  |  |  |  |  |  |  |
| Maternal age (years) | Reference = 15?19 years |  |  |  |  |  |  |  |  |  |  |  |
| 20?29 | 0.64 | 0.32?1.27 | 0.97 | 0.49?1.90 | 1.41 | 0.90?2.22 | 1.33 | 0.92?1.93 | 1.07 | 0.66?1.73 | 0.55\* | 0.35?0.87 |
| 30?39 | 0.78 | 0.38?1.60 | 1.00 | 0.49?2.01 | 1.21 | 0.75?1.94 | 1.29 | 0.88?1.91 | 1.21 | 0.76?1.92 | 0.70 | 0.46?1.09 |
| 40?49 | 0.51 | 0.19?1.36 | 1.69 | 0.69?4.17 | 1.59 | 0.87?2.89 | 1.62 | 0.98?2.68 | 1.34 | 0.74?2.43 | 0.81 | 0.46?1.44 |
| Residence | Reference = urban |  |  |  |  |  |  |  |  |  |  |  |
| Rural | 1.97 | 0.89?4.37 | 1.81 | 0.88?3.73 | 1.00 | 0.68?1.47 | 1.35 | 0.95?1.93 | 1.58\* | 1.08?2.31 | 1.05 | 0.72?1.54 |
| Education | Reference = no education |  |  |  |  |  |  |  |  |  |  |  |
| Primary | 1.08 | 0.66?1.76 | 0.86 | 0.55?1.35 | 1.08 | 0.83?1.41 | 0.87 | 0.69?1.08 | 1.21 | 0.95?1.56 | 0.98 | 0.77?1.26 |
| Secondary | 0.53 | 0.20?1.39 | 0.35\* | 0.14?0.84 | 0.67 | 0.31?1.45 | 0.76 | 0.41?1.39 | 1.31 | 0.83?2.07 | 0.94 | 0.59?1.50 |
| Higher | 0.66 | 0.07?6.47 | 0.58 | 0.10?3.28 | 0.69 | 0.22?2.17 | 0.26\* | 0.07?0.92 | 1.98\* | 1.06?3.68 | 0.42\* | 0.19?0.94 |
| Religion | Reference = Christian |  |  |  |  |  |  |  |  |  |  |  |
| Muslim | 1.30 | 0.80?2.13 | 1.20 | 0.77?1.86 | 1.43\* | 1.03?1.97 | 1.25 | 0.96?1.63 | 1.15 | 0.85?1.55 | 1.18 | 0.88?1.59 |
| Traditional & Others | 1.12 | 0.29?4.29 | 0.67 | 0.21?2.15 | 1.36 | 0.67?2.78 | 1.02 | 0.55?1.90 | 1.09 | 0.53?2.26 | 1.81 | 0.91?3.59 |
| Wealth index | Reference = poor |  |  |  |  |  |  |  |  |  |  |  |
| Middle | 0.79 | 0.47?1.33 | 0.89 | 0.57?1.40 | 0.96 | 0.71?1.30 | 1.00 | 0.78?1.29 | 0.88 | 0.66?1.18 | 0.60\*\*\* | 0.44?0.81 |
| Rich | 1.47 | 0.92?2.33 | 1.02 | 0.67?1.58 | 0.81 | 0.61?1.09 | 0.83 | 0.65?1.06 | 0.54\*\*\* | 0.40?0.73 | 0.55\*\*\* | 0.41?0.73 |
| Occupation | Reference = not working |  |  |  |  |  |  |  |  |  |  |  |
| Working | 1.05 | 0.70?1.58 | 1.27 | 0.87?1.84 | 1.22 | 0.96?1.55 | 1.26\* | 1.03?1.54 | 0.90 | 0.71?1.15 | 1.15 | 0.91?1.45 |
| marital status | Reference = single/widowed |  |  |  |  |  |  |  |  |  |  |  |
| Married | 0.49\* | 0.26?0.93 | 1.00 | 0.53?1.89 | 0.90 | 0.63?1.27 | 0.73\* | 0.55?0.97 | 1.25 | 0.81?1.93 | 0.79 | 0.53?1.18 |
| Number of ANC visits | Reference = none |  |  |  |  |  |  |  |  |  |  |  |
| 1?3 times | 0.58\* | 0.34?0.99 | 0.98 | 0.62?1.54 | 1.07 | 0.82?1.40 | 0.86 | 0.69?1.08 | 1.09 | 0.83?1.43 | 1.03 | 0.78?1.35 |
| ?4 times | 0.68 | 0.37?1.23 | 0.88 | 0.52?1.49 | 0.76 | 0.53?1.08 | 0.65\*\* | 0.48?0.88 | 1.13 | 0.84?1.53 | 0.88 | 0.65?1.19 |
| Height | Reference < 150 cm |  |  |  |  |  |  |  |  |  |  |  |
| 150?159 cm | 1.22 | 0.67?2.20 | 0.69 | 0.41?1.16 | 1.05 | 0.73?1.51 | 0.61\*\*\* | 0.46?0.81 | 0.99 | 0.70?1.39 | 0.69\* | 0.51?0.95 |
| ?160 cm | 1.16 | 0.61?2.18 | 0.34\*\*\* | 0.19?0.59 | 1.07 | 0.73?1.56 | 0.35\*\*\* | 0.26-.48 | 1.06 | 0.74?1.52 | 0.48\*\*\* | 0.34?0.67 |
| Region | Reference = tigray |  |  |  |  |  |  |  |  |  |  |  |
| Afar | 2.32 | 0.76?6.93 | 0.49 | 0.17?1.43 | 3.48\*\*\* | 1.96?6.17 | 0.44\*\*\* | 0.28?0.70 | 1.68\* | 1.01?2.81 | 0.80 | 0.48?1.34 |
| Amhara | 0.72 | 0.36?1.43 | 2.07\* | 1.06?4.03 | 1.53 | 0.93?2.52 | 0.68\* | 0.48?0.97 | 0.83 | 0.55?1.26 | 1.48 | 1.00?2.19 |
| Oromia | 0.50\* | 0.25?0.99 | 0.60 | 0.32?1.11 | 1.29 | 0.78?2.14 | 0.30\*\*\* | 0.21?0.44 | 0.88 | 0.57?1.36 | 0.77 | 0.50?1.18 |
| Somali | 1.94 | 0.66?5.67 | 1.19 | 0.42?3.35 | 5.41\*\*\* | 3.00?9.78 | 0.22\*\*\* | 0.13?0.37 | 3.90\*\*\* | 2.32?6.54 | 0.51\* | 0.30?0.86 |
| Benishangul | 0.41\* | 0.17?1.00 | 0.51 | 0.24?1.11 | 1.29 | 0.74?2.25 | 0.40\*\*\* | 0.27?0.61 | 0.55\* | 0.34?0.91 | 0.70 | 0.44?1.11 |
| SNNPR | 0.48\* | 0.25?0.92 | 0.62 | 0.34?1.12 | 1.01 | 0.61?1.67 | 0.32\*\*\* | 0.23?0.45 | 0.80 | 0.53?1.20 | 0.84 | 0.56?1.26 |
| Gambela | 1.25 | 0.50?3.12 | 1.01 | 0.41?2.46 | 2.13\*\* | 1.24?3.67 | 0.34\*\*\* | 0.22?0.53 | 1.04 | 0.64?1.69 | 0.75 | 0.45?1.24 |
| Harari | 0.59 | 0.22?1.60 | 0.45 | 0.17?1.17 | 1.85 | 0.98?3.58 | 0.18\*\*\* | 0.10?0.32 | 1.18 | 0.66?2.11 | 0.61 | 0.33?1.13 |
| Addis Ababa | 0.61 | 0.16?2.38 | 0.53 | 0.16?1.69 | 0.76 | 0.27?2.17 | 0.32\*\* | 0.15?0.65 | 0.56 | 0.28?1.14 | 0.50 | 0.25?1.03 |
| Dire Dawa | 0.32 | 0.06?1.70 | 1.15 | 0.32?4.16 | 3.62\*\*\* | 1.99?6.60 | 0.31\*\*\* | 0.18?0.51 | 1.51 | 0.85?2.66 | 1.07 | 0.61?1.90 |
| During pregnancy, iron tablets |  |  |  |  |  |  |  |  |  |  |  |  |
| Yes | 0.76 | 0.41?1.40 | 1.17 | 0.71?1.95 | .94 | 0.72?1.24 | 0.93 | 0.74?1.18 | 0.77\* | 0.61?0.97 | 0.81 | 0.64?1.03 |

Table Association between IYCF practices and dietary status (anaemia and stunting) among children aged 6–23 months adjusting for covariates (2005–2016): It demonstrates outcomes of adjusted multiple logistic regressions for anaemia and stunting. Stunting is more frequent in mothers who were not educated, working, short height, not antenatal care (ANC) visit during pregnancy, put their child to breast lately, rural areas, poor family, higher child age, male child, and children of small birth size. Whereas anaemia is more recurrent in mothers who were not taken iron tablets during pregnancy, did not visit ANC, live in rural areas, poor family, uneducated, not married, not working, female sex and children put to breast lately.

\*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001.

The odds of stunting in children from rich and middle-income families were 45% (95% CI: 0.41, 0.73) and 40% (95% CI: 0.44, 0.81) lower than those from low-income families, respectively. Children with a working mother had higher odds of stunting than children with a non-working mother (OR = 1.26; 95% CI: 1.03, 1.54) in 2011. Children with a married mother were 27% (95% CI: 0.55, 0.97) less likely to be stunted than children with a widowed or divorced mother in 2011. Children with mothers having Antenatal care (ANC) visits at least four times during pregnancy were 35% (95% CI: 0.48, 0.88) less likely to be stunned than children with mothers have no ANC visits at all in 2011. In 2011 and 2016, children with mothers whose height was larger than or equal to 150 cm had lower odds of stunting in comparison with children with mothers whose height lower than 150 cm (OR = 0.61; 95% CI: 0.46, 0.81 for mother’s height 150–159 cm) (OR = 0.35; 95% CI: 0.26, 0.48 for mother’s height ≥160 cm) (OR = 0.69; 95% CI: 0.51, 0.95 for mother’s height 150–159 cm) (OR = 0.48; 95% CI: 0.34, 0.67 for mother’s height ≥160 cm), respectively.

Multiple logistic regressions: anaemia

Table presents the results of the multivariable logistic regression for anaemia. In 2011 and 2016, the odds of anaemia in currently breastfeeding children were 45% (95% CI: 0.40, 0.76) and 46% (95% CI: 0.42, 0.70) lesser than those not breastfeeding now, respectively. The odds of anaemia in children who obtained MMF was 28% (95% CI: 0.57, 0.89 less than those who did not achieve MMF in 2011. Detailed are shown in Table .

Gender prevalence of stunting among children aged 6–23 months in Ethiopia (2005–2016) Demographic and Health Survey

The prevalence of stunting decreased in both gender from 2005 to 2016, with males decreasing from 48.1 to 29.7%, and females from 39.3 to 27.4%. Gender prevalence of stunting among children aged 6–23 months in Ethiopia was described in detail in Table , and categorised into three sets: gender combined, males and females. The mean height-for-age of both genders aged 6–23 months subsequently decreased from −1.54 to −1.30, then −1.01 from 2005–2016, respectively. The mean height-for-age of male and female children aged 6–23 months reduced from −1.78, −1.41 then −1.09 (for males) and from −1.32, −1.19 then −0.94 (for females) from 2005–2016, respectively.

World Health Organization global database on child growth and malnutrition of stunting (Length/height-for-age) children aged 6–23 months in Ethiopia.

|  | **2005** | | | | | | **2011** | | | | | **2016** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Set 1: Gender combined** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Age groups** | ***N*** | **Length/height-for-age %** | | | | ***N*** | **Length/height-for-age %** | | | | ***N*** | **Length/height-for-age %** | | | |
| **% < ?3SD** | **% < ?2SD** | **Mean** | **SD** | **% < ?3SD** | **% < ?2SD** | **Mean** | **SD** | **% < ?3SD** | **% < ?2SD** | **Mean** | **SD** |
| Total (6?23) | 779 | 23.4 | 43.6 | ?1.54 | 1.97 | 2474 | 16.6 | 35.4 | ?1.30 | 1.80 | 2209 | 11.4 | 28.5 | ?1.01 | 1.76 |
| (6?11) | 210 | 12.3 | 27.1 | ?0.79 | 1.97 | 883 | 8.6 | 19.6 | ?0.60 | 1.74 | 589 | 4.4 | 12.3 | ?0.20 | 1.66 |
| (12?23) | 569 | 27.6 | 49.8 | ?1.82 | 1.90 | 1591 | 21.0 | 44.2 | ?1.69 | 1.71 | 1620 | 14.0 | 34.5 | ?1.31 | 1.70 |
| Set 2: Males |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total (6?23) | 380 | 27.3 | 48.1 | ?1.78 | 1.92 | 1253 | 19.4 | 39.6 | ?1.41 | 1.85 | 1100 | 12.7 | 29.7 | ?1.09 | 1.79 |
| (6?11) | 101 | 15.2 | 29.3 | ?1.01 | 1.90 | 433 | 10.6 | 20.4 | ?0.68 | 1.78 | 299 | 4.1 | 12.5 | ?0.23 | 1.71 |
| (12?23) | 279 | 31.9 | 55.1 | ?2.06 | 1.85 | 820 | 24.0 | 49.7 | ?1.80 | 1.77 | 801 | 15.9 | 36.1 | ?1.40 | 1.71 |
| Set 3: Females |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total (6?23) | 399 | 19.6 | 39.3 | ?1.32 | 2.00 | 1221 | 13.7 | 31.1 | ?1.19 | 1.73 | 1109 | 10.2 | 27.4 | ?0.94 | 1.72 |
| (6?11) | 109 | 9.6 | 25.0 | ?0.59 | 2.01 | 450 | 6.8 | 18.8 | ?0.53 | 1.71 | 290 | 4.8 | 12.1 | ?0.16 | 1.61 |
| (12?23) | 290 | 23.4 | 44.7 | ?1.59 | 1.92 | 771 | 17.7 | 38.3 | ?1.57 | 1.63 | 819 | 12.1 | 32.9 | ?1.22 | 1.67 |

Table shows gender prevalence of stunting among children aged 6–23 months in Ethiopia and categorised in to three sets: gender combined, males and females. The prevalence of stunting decreased from 48.1 to 29.7% (for male children) and from 39.3 to 27.4% (for female children) from 2005 to 2016 EDHS.

A total of 837, 2518, and 2283 children aged 6–23 months were incorporated in 2005, 2011, and 2016 analysis. Supplementary Table illustrates the dates of ***data*** compilation and the number of households and children integrated into the study in each EDHS. In total, 97% children aged between 6–23 months had weight, height, and age measurements ensuring a valid HAZ. The mean HAZ for all children improved by 0.53 standard deviations between 2005 and 2016. shows the percentage distribution of children aged 6–23 months by socio-demographic & maternal and child characteristics (2005–2016 EDHS).

Discussion

This study examined the prevalence and relationship of stunting and anaemia with IYCF practices among children aged 6–23 months in Ethiopia. Chronic malnutrition like stunting can manifest after long-term nutritional deficiency, and anaemia might be related to the shortage of iron-rich foods in a region. Our results showed that stunting decreased in a prolonged trend with a 1.52% average annual reduction rate from 2005 to 2016. According to the global progress report, Ethiopia requires a 6% average annual reduction rate to achieve the World Health Assembly 2025 target of 26.8% prevalence. However, the current reduction rate is only at 2.8%, far below the expected annual reduction rate []. According to the current study, the reduction in the trend of stunting from 2005–2016 (49 to 32%) in Ethiopian children shows some improvements in chronic malnutrition. The country instituted many policies and programs to reduce the levels of stunting as part of its national development plan. Some of the significant approaches and programs included the National Nutrition Plan, the Seqota Declaration, National Food Security Strategy, Nutrition Sensitive ***Agriculture*** Strategy, the Productive Safety Net Program, and Food Safety and Quality Related Regulatory Activities []. The Seqota Declaration adopted the Sustainable Development Goal 2, intended to eradicate hunger, realise food security, improve nourishment, and encourage sustainable ***agriculture*** by 2030 []. The healthcare taskforce was also primarily responsible for improving access to rural societies. They spend 15% of their time with infants and children under age 5 []. All the above-listed efforts have brought significant influence on dietary improvement and reduction in stunting in the country []. However, the prevalence of stunting among childhood remains excessively high []. Similar results were reported in Ethiopia (27.4%), Kenya (28.2%), and northern Ghana (27.2%) [–].

Our study showed that stunting increases with age. Similarly, in previous finding stunting in kids below age 5 increased between 6–23 months, and peaked at 24–35 months; this might be due to inappropriate and inadequate feeding practices since increasing levels of children stunting by age coincides with the period at which regular complementary feeding starts []. Ethiopia is a multi-ethnic society, having more than 80 ethnics groups that practices various taboos, misconceptions, and cultural beliefs related to food consumption in pregnant women and children []. According to a belief, it is forbidden for the pregnant mother to eat flesh meat and eggs for fear of having a big baby, which may lead to delivery difficulties []. In some communities, it is a taboo to consume milk as it is believed to be the white cover over the head of the baby during delivery []. Similarly, some people believe that food should not be given to children who are affected by diarrhoea and measles []. Another cultural factor in the country that may influence childhood stunting is children and or women should usually eat food leftovers and less quality foods []. In Ethiopia, religious norms and values can also influence nutritional outcomes. For example, the Orthodox Church’s 220 days per year fasting practices whereby no animal products are consumed worsen maternal and child undernutrition []. The consumption of meat, fish, and poultry is occasional and restricted to annual holydays, new year festivities, and special occasions like weddings []. Similar results were observed in Nigeria [], Gambia [], and Ghana [], in which cultural beliefs specific to the region affects the diet given to the children despite its overall nutritional value and accessibility.

Apart from breastfeeding, the average prevalence of other IYCF practices was low, with less than one-fifth of children getting MDD, MAD, and consumed iron-rich foods. Only half of the children got sufficient meal frequency, and about one-third of the children had the introduction of solid, semi-solid, and soft foods. Figure illustrates the trend in the reduction of under-nutrition among children of 6–23 months between 2005 and 2016. Our study found that consumption of iron-rich foods, MDD, and MAD were related to stunting, which was a substitute for sufficient micronutrient concentrations of foods, was protective. Apart from these, other IYCF practices were not related to stunting. Our result concerning IYCF practices was comparable with other studies in other regions. For example, in the Sub-Saharan African Region, consistency and type of weaning food, poor quality of food and hygiene, medical facilities, micronutrient deficiencies, and frequent infections have significant association with childhood mortality []. A small proportion of women were knowledgeable about the consistency of weaning food for 6–23 month-old children in Ethiopia []. A similar result was reported by the Food and Nutrition Technical Assistant project []. Though, practice has increased, still bodybuilding foods like flesh food consumption is inadequate. This might be due to the cultural and awareness gap in the meat consumption of mothers []. Weaning food initiation at six months (recommended) and better MDD was also related to reduced odds of stunting []. A similar finding was reported in Uganda [], rural northern Ghana [], Zambia [], and Burkina Faso []. In our result, the average number of children aged 6–23 months who received the recommended MMF and MDD food groups was 50.3 and 12.1%, respectively. These essential indicators were higher than previously documented findings from Ethiopia [44 and 10.8%] [], and Niger [42 and 5%] [], but less than earlier findings from Kenya [58 and 45%], Zambia [55 and 37%], and Morocco [62 and 66%] [] for MMF and MDD, respectively. The possible reasons for the differences between studies could be the variations in religious and socio-cultural beliefs all of which can influence IYCF practices []. In addition, study settings, sample size, and differences in time of ***data*** ***collection*** among studies could also affect the results.

In our study, a higher level of educational attainment of women was significantly associated with childhood stunting. This is in line with previous related studies in Ethiopia [, ], Uganda [], Mozambique [], and Ghana []. As indicated in those studies, the reasons given include the finding that educated mother is more likely to have better awareness on optimal child care practices [], have better hygiene practices [, ], use scientifically proven feeding recommendations [], and childcare during illness [–]. Further, these mothers are more likely to use the health system [], and were more empowered to make decisions [].

Maternal ANC service attendance at health institutions was the other possible risk factor for stunting in the study area. We found that children of an ANC visited mother was less likely to be stunned compared with children of non-ANC visited mother. Similar results were revealed in Ethiopia [–] and Tanzania []. The probable reason might be due to the intense counselling on balanced diets by trained health workers during antenatal care, and awareness creation about weaning food practices []. Moreover, this counselling may affect women’s cultural and outdated beliefs and contribute to improved IYCF practices []. Therefore, substantial efforts are needed to increase the level of ANC facility utilisation and to provide nutrition counselling on IYCF practices among mothers [].

Our result showed that children of mothers who lived in rural areas were more stunned than those who stayed in urban areas. A similar finding was reported by a previous systemic review [], in which children born of mothers who lived in cities were more likely to get MDD than their rural counterparts. The probable justification for this finding is that mothers who live in downtown areas have a relatively higher awareness level on IYCF practices through easier access to mass and electronic media, which educate mothers on the importance of IYCF practices. Similar findings were depicted in Ethiopia [], Kenya [], and Tanzania [], which revealed that one of the main reasons of inappropriate IYCF practices was limited access to mass media. Thus, the accessibility of media networks (television and radio) to the environs might help mothers to get necessary information on recommended child feeding options, increase knowledge and awareness of new ideas, and can change individual’s perceptions and behaviour including those about health [, ].

Our study also found that stunting was more frequent in mothers who were working, a mother with short height, low-income families, male child, and children of small birth size. These results are consistent with a study performed in Ghana in 2011, which investigated risk factors for malnutrition and found that children’s characteristics such as age, sex, delivery size at childbirth; household characteristics such as household wealth, mother’s education, location, region, and religion, were associated with malnutrition [].

The prevalence of anaemia among children aged 6–23 months declined in the past five years by 38% from 25.9% in 2005 to 16.1% in 2011. However, it raised sharply by 80% from 16.1% in 2011 to 28.9% in 2016. This might be due to a decline in the consumption of iron-rich foods, folate, vitamin B12, or other ***nutrients***, and an increase in diseases like sickle cell disease, malaria, and intestinal worm infections []. Iron deficiency in pregnancy and infants is one of the primary causes of anaemia (~50%) in Ethiopia [, ]. According to the deworming prevention program guided by the Ministry of Health, 8–10% of children aged 6–23 months were reported to have received deworming medication []. Similarly, Habte et al. [] confirmed that childhood anaemia was enhanced as maternal anaemia level increased. This may be related to iron tablets supplementation and the nutritional status during pregnancy as most mothers in developing countries get pregnant while they were undernourished []. Measures that were taken to prevent anaemia included multi-sectoral collaborations, daily and recurrent iron and folate supplementation in pregnant and menstruating women, cereal and corn flour fortification with sodium iron ethylenediaminetetraacetic acid with malaria prevention [, ]. A similar finding was noted by Siekmans et al. [] in three African countries (Ghana, Malawi, Tanzania) on the effects of an integrated approach in reducing the child’s vulnerability to anaemia. These approaches include nutrition training, breastfeeding, sanitation promotion, micronutrient supplementation, deworming, dietary diversification, community and healthcare level training.

Low-income populations like Ethiopia, whose foods are mainly based on starchy staples were vulnerable to nutritional problems []. The weaning diets of Ethiopian infants were sub-optimal and the dietary pattern is monotonous and predominantly starchy []. Some ethno-specific solutions that should have been provided to curb the problem of stunting and anaemia in the country were the use of locally available foods rich in vitamin A (such as local cabbage, pumpkin, yam, and sweet potato), a variety of vegetable seeds, poultry stock, and fruit seedlings (papaya and peach) []. Ethiopian traditional diets, uniquely complementary foods made of plant-based food staples (mostly cereals and roots and tubers), were of low nutritional quality and need to be upgraded []. Locally practiced food processing methods can improve the ***nutrient*** bioavailability, delectableness, and suitability of weaning diet including scorching, sprouting, milling, baking, aeration, fermentation, and extrusion []. The blend of crushed essential ingredients (millet, cereals, pulses, oilseed flours) may be additionally treated by extrusion cooking []. One previous study showed that weaning diet flour with oat, flaxseed, soybean, are blended to attain excellent nutritional and sensory properties []. Another study also indicated that iron content increased with an increase in soybean and moringa proportions in formulations []. Such combinations of locally food processing technologies can therefore be employed to improve further the nutritive value and functionality of starchy plant-based food products.

One probable explanation of the result of no relationship of all IYCF practices with stunting and anaemia in our research is that the EDHS inquired about nourishing traditions in the past 24 h before the interview and took it to be the usual dietary pattern. However, it might not be representative of all children because food consumption might vary day by day [].

In summary, this study noted that stunting and anaemia among children aged 6–23 months are critical public health concerns that need urgent action. Since stunting starts in the prenatal stage, dietary support for pregnant mothers and timely and regular ANC visits should be encouraged. Further studies are warranted to inspect the effects of feeding practices such as iron supplementation and dietary teaching programs on child’s linear growth to help minimise childhood stunting and anaemia in Ethiopia.

**Acknowledgements**

We acknowledge the USAID-DHS Program for providing access to the 2005–2016 Ethiopian Demographic and Health Survey. We thank Rahel Abebe and Dr. Asfaw Negero for their contribution to the manuscript.

**Notes**

Supplementary informationThe online version of this article ([*https://doi.org/10.1038/s41430-020-00828-8*](https://doi.org/10.1038/s41430-020-00828-8)) contains supplementary material, which is available to authorized users.Publisher’s note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

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[***The Frontline: experts answer your questions on the impacts of the climate emergency - as it happened; To mark the end of The Frontline series a panel of experts answer your questions about the climate crisis and how it is affecting Australia. Ask Prof Lesley Hughes, Greg Mullins, Prof Michael Mann and Assoc Prof Donna Green your questions, and see the answers on our live blog. Email***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5YBF-B911-F021-60YB-00000-00&context=1516831) [***frontline.live@theguardian.com***](mailto:frontline.live@theguardian.com) [***or tweet #frontlinelive***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5YBF-B911-F021-60YB-00000-00&context=1516831)

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**Byline:** Naaman Zhou

**Body**

block-time published-time 4.28am GMT

And for more on the topics we covered today, read [*the whole of The frontline*](https://www.theguardian.com/environment/series/the-frontline) :

* The new fire zone

1. The taps run dry
2. The air we breathe
3. The dead sea
4. The killer heat
5. The lost harvest

Thanks to my colleagues Marni Cordell and Adam Morton for their help running the blog today, and everybody else who put The frontline together.

It's a beautiful, affecting multimedia series that looks at real people and the impacts the climate emergency is already having.

Thanks so much for reading, following and asking questions of our experts. It was a great and informative discussion, to mark a stellar project, and I hope to see you all again soon.

block-time updated-timeUpdated at 4.30am GMT

block-time published-time 4.23am GMT

Summary

I'd like to thank all our experts today for their time and incredibly detailed answers. The knowledge you have is astonishing.

Thanks to Assoc Prof Donna Green, Prof Michael Mann, Greg Mullins and Prof Lesley Hughes.

Sorry we couldn't get to all your reader questions. But we did manage to answer:

* Did our health departments make any mistakes with bushfire smoke?

1. Are we saved if we hit net zero in 2050?
2. Can our animals recover from the fires?
3. Is Indigenous fire management the answer?
4. Will community gardens save our food crops?
5. Will bushfires affect the water cycle?

block-time published-time 4.14am GMT

Are you optimistic?

Our final question for today, from Emma Coats :

When do you feel optimistic that we can keep this planet in OK shape for our kids and grandkids? Is it when you read that demand for coal will be in freefall within a decade or is it when you read that more and more people are demanding action from governments? What makes you feel optimistic?

Donna Green :

I have a (possibly unrealistic) ability to entertain the notion that people can be simultaneously incredibly smart and incredibly stupid. In the main, I suspect I am optimistic because I choose to be. I want to believe that over the long game, smart might win out over stupid.

An example of this could be seen in Australia where the markets have succeeded despite, not because of, our federal policy. We have witnessed a surge of solar and wind energy installation as a result.

Of course, that leads on to question global politics and economic systems. And, specifically, the broader question of how the capitalist system is able to reduce consumption and increase equity - which is not so easily addressed.

block-time updated-timeUpdated at 4.24am GMT

block-time published-time 4.03am GMT

How many people inhaled bushfire smoke?

Our second-last question for today, and it is a big one.

From Oskar Johnson via email:

Have we quantified the number of people exposed to smoke inhalation as a result of the fires 2019-20? What long-term health effects might there be of this inhalation?

Donna Green :

There are a number of research projects combining census ***data***, hospital admissions, health centre presentations and related ***data*** ongoing as we speak. Given the timing and nature of this kind of research, it is very early days to see any research analysis or findings from this 'summer of hell' season just passed.

Frustratingly the research timeline for academic researchers does not generally allow for quick responses. Giving a quick example, generally you have to wait for an annual timeline to submit a proposal and then wait about a year to find out whether your proposal (with a success rate of about 10%) has been funded. If it is funded, usually the research budget will get cut about 10-30%. This means research analysis response times can be frustratingly slow.

There have been some 'targeted research calls' that have a very tight turnaround. Last month the federal government announced $5m for research projects to respond to the bushfire crisis. This is a good start, however coming off the back of years of cuts to scientific research budgets there is a lot of ground to make up.

We just don't really know the long-term effects of the exposure that many Australians felt over the last summer. Populations respond differently, for example. We can't easily extrapolate from studies in, for example, heavily polluted cities in China or India, because Australians in the main are not exposed to high levels of air pollution routinely. That means that our bodies are not used to the pollution and consequently often the health impacts can be more serious.

block-time updated-timeUpdated at 4.07am GMT

block-time published-time 3.53am GMT

Via email from Rose:

How can we protect against exacerbating further health inequities ie only rich people and wealthy workplaces (and well-funded childcare centres) being able to afford high quality air purifiers?

Donna Green :

I wish I had a good answer for this. Just as we are currently seeing an increase in private jets being flown into Asia in response to Covid-19, there will always be inequality in the system.

Reducing the inequality can be carried out through policy, and policies can get encouraged via grassroots pressure, especially at the local level. I would imagine local politicians might respond favourably to requests from a small percentage of their voters demanding reasonable provisions in public buildings including childcare centres, for example. They could perhaps encourage state- or territory-level policy to be reconsidered in this respect. It is tricky though as each building is different in terms of build, age, windows, usage, existing air conditioning etc.

As important (if not more) will be real energy policy change to ensure that the kids currently in childcare centres have the best possible chance to grow up in a less climate-changed world. Given that environmental injustice already exists in Australia for air pollution and human health, attacking both the climate/energy policy angle now (as Michael Mann so eloquently discussed just before) is crucial to address future air pollution inequality.

block-time updated-timeUpdated at 4.03am GMT

block-time published-time 3.44am GMT

Is air pollution affecting mental health?

A question via comment:

Could you tell us the latest yet-to-be-published ***data*** on the effects of climate change and air pollution on mental health?

Donna Green :

I'm not privy to unpublished ***data***, but there are good, recently published systematic reviews on this topic. For example, if you search online for 'Air Pollution (Particulate Matter) Exposure and Associations with Depression, Anxiety, Bipolar, Psychosis and Suicide Risk: A Systematic Review and Meta-Analysis'. The associations between PM2.5 and ultra fines with mental health are identified in this review.

It would be likely that at the end of this year you would also start to see some more research published in this area for Australia specifically given that there was a targeted funding call of $2m to support analysis of the effect of bushfire smoke and mental health last month.

Other potentially useful places to look for this research include: Understanding how climate change and floods affect mental health and community wellbeing [*via Sydney University*](https://www.theguardian.com/environment/series/the-frontline), or some of the work of Prof Helen Berry.

block-time updated-timeUpdated at 4.04am GMT

block-time published-time 3.39am GMT

How can we cope with heat?

From Kirsty Harris:

What can citizens do in their streets and suburbs to reduce the impact of heat on their health? If part of the answer is to plant trees, what kind should we be planting, and where do we get lists of trees that will be more suitable for surviving a hotter, drier climate?

Donna Green :

Local councils are a good place to start asking about which trees are good for planting in your neighbourhood. Many have lists they can give you and they would be taking into consideration your local area and the ecosystem that the tree will (hopefully) grow up in.

Soft landscaping which has permeable surfaces and the use of native small grasses and shrubs instead of lawns is better during droughts due to the lower water needs, and the support of local birds and other critters. As we've also seen in many places recently, lots of hard surfaces increase run-off, especially during extreme rainfall, which increases flooding. To reduce these problems, now and for the near future, if you have a choice about upgrading gardens, these sorts of things could be kept in mind.

block-time updated-timeUpdated at 3.43am GMT

block-time published-time 3.35am GMT

A question from Nicola Harvey:

I'm a farmer who strongly believes in climate change and I really struggle in arguments with reactionaries (other farmers). What are the most important points to use in an argument about climate change, to really substantiate my argument on the reality of climate change as I end up very frustrated. Thank you.

Donna Green:

You are not alone! Fortunately there are a range of good websites that can provide answers to some of the more frustrating climate denier arguments. See [*John Cook's site*](https://www.theguardian.com/environment/series/the-frontline) or   [*Real Climate*](https://www.theguardian.com/environment/series/the-frontline). It's also important to realise that there are lots of similar farmers who share your frustrations and who can tailor responses appropriately.   [*Anika Molesworth*](https://www.theguardian.com/environment/series/the-frontline), if you don't already know her, provides excellent commentary.

block-time updated-timeUpdated at 3.43am GMT

block-time published-time 3.26am GMT

Via email from Tim:

What effect will all the bushfire smoke have on a foetus? I've heard that there is some disturbing evidence on this from fires in the US.

Donna Green:

Researchers have found that some of the smallest pollution particles (PM2.5 and ultrafines) can cross into the bloodstream (unlike larger PM10 particles that can get trapped in your nose hairs or mucus). These smaller particles, among others, are found in bushfire smoke. Because your blood circulates everywhere throughout all your body's systems, and in this case potentially crossing the placenta, there is concern that there would be impacts on foetuses.

Moreover, if the mother's health is compromised by inhaling bushfire smoke, that could of course indirectly affect the health and wellbeing of the baby. Research examining the associations between exposure to pollution and stillbirths, miscarriages and pre-term delivery has been ongoing worldwide. Australian researchers are currently looking for these relationships over the past summer period to see if they can see similar relationships.

block-time updated-timeUpdated at 3.34am GMT

block-time published-time 3.21am GMT

Did our health departments make any mistakes with bushfire smoke?

From Josh via email:

Did the NSW and ACT health departments respond appropriately to minimise the effects of exposure to bushfire smoke during the summer? Or should they have issued a directive that, for example, childcare centres keep children inside during the worst days?

Prof Donna Green :

We do know that there is 'no safe level' of air pollution, and that children are more susceptible than adults to air pollution, so your concerns are well founded.

Many of Australia's buildings are quite 'leaky' so staying inside can be better than outside - but not necessarily the best place to be on the very worst pollution days. This is especially true for vulnerable populations (children, for instance). In these cases, the childcare centres and schools may not have been the best places for the kids, even if they were kept inside.

It would be great if, as was recently called for, an independent national expert committee on air pollution and health was set up to develop evidence-based, accurate, practical and consistent advice on health protection against bushfire smoke. The Medical Journal of Australia has a very timely article on the need for this to happen, and quickly. See 'Bushfire smoke: urgent need for a national health protection strategy'.

block-time updated-timeUpdated at 3.23am GMT

block-time published-time 3.18am GMT

Another video answer from Michael Mann:

If you had the opportunity or power to change our behaviour, what would you impose as our first steps?

enltrWatch [*@MichaelEMann*](https://www.theguardian.com/environment/series/the-frontline) 's answer to the   [*#FrontlineLive*](https://www.theguardian.com/environment/series/the-frontline) blog question: If you had the opportunity/power to change our behaviour, what would you impose as our first steps?   [*https://t.co/BKFqyIYT1N*](https://www.theguardian.com/environment/series/the-frontline)   [*pic.twitter.com/wMGPVqyxnP*](https://www.theguardian.com/environment/series/the-frontline)

- Guardian Australia (@GuardianAus) [*March 3, 2020*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 3.12am GMT

Our first question Prof Donna Green is from Ilya via email:

Don't you think that the coronavirus pandemic is a much more serious and immediate problem than climate change, considering that it can kill millions in the near future?

Donna Green :

Climate change has already shortened the life of - and increased the sickness of - many hundreds of thousands of people over recent years. The increase in extreme weather we have locked in to our climate system is very likely to cause many more cases of sickness and death in the future from direct and indirect impacts. A great way to visualise some of these impacts to our health can be seen in [*this BMJ infographic*](https://www.theguardian.com/environment/series/the-frontline).

The Covid-19 advice does suggest that this is a serious international issue and concern. It is important to keep this response in perspective, however, and rely on factually correct sources of information, [*for example the WHO*](https://www.theguardian.com/environment/series/the-frontline), to know the scale and nature of the problem and the appropriate response.

block-time updated-timeUpdated at 3.21am GMT

block-time published-time 3.07am GMT

enltrWatch [*@MichaelEMann*](https://www.theguardian.com/environment/series/the-frontline) 's video answer to the   [*#FrontlineLive*](https://www.theguardian.com/environment/series/the-frontline) blog question: How far are we from a tipping point (point of no return) in   [*#globalwarming*](https://www.theguardian.com/environment/series/the-frontline) and   [*#climatechange*](https://www.theguardian.com/environment/series/the-frontline) ?   [*https://t.co/BKFqyIYT1N*](https://www.theguardian.com/environment/series/the-frontline)   [*pic.twitter.com/Ai19PG10Jk*](https://www.theguardian.com/environment/series/the-frontline)

- Guardian Australia (@GuardianAus) [*March 3, 2020*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 2.57am GMT

Millions of Australians have spent the summer in smoke but, as our Frontline story on this explored, nobody knows the impact of medium- to long-term exposure to bushfire smoke.

"It can affect every system in your body," Prof Donna Green told us in February. "You're not only talking about respiratory-related and heart-related problems, people are linking it to diabetes [and] dementia."

She will be online from 2pm to 3pm to answer more of your questions. Email [*frontline.live@theguardian.com*](mailto:frontline.live@theguardian.com) or tweet #frontlinelive

Related: [*The toxic air we breathe: the health crisis from Australia's bushfires*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 2.59am GMT

block-time published-time 2.53am GMT

The air

Assoc Prof Donna Green will be answering your questions from 2pm, and we've already received a few.

Prof Green is an expert on the health effects of climate change and air pollution.

When it comes to air quality, you know a day is bad when you can see the smoke, and smell it. But you may not realise how bad it is until you see the graphs.

The following graphics use the official NSW and ACT measurements of PM2.5 micrograms per cubic metre. On Australia's worst day, a maximum of 1,798.7 was registered at Wagga Wagga (7pm, 5 January). Beijing that day was [*72.5 micrograms*](https://www.theguardian.com/environment/series/the-frontline).

[*Air quality graph*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 3.00am GMT

block-time published-time 2.42am GMT

The heat

Heat can kill. That is one of the first things that doctors on the climate frontline will tell you. Indigenous communities in central Australia already know it and are feeling the brunt - as Australia heats up higher than the global average. In this chapter of Frontline, doctors told us there's clear evidence that extreme heat is already killing people prematurely.

You can ask Donna Green about this, and other health impacts.

Related: [*Killer heat: how a warming land is changing Australia forever*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 3.01am GMT

block-time published-time 2.34am GMT

What are the tipping points?

Our final text question and answer from Michael Mann - but there are more video questions to come.

From Robert McLachlan:

We've heard a lot about tipping points in the climate system. The IPCC says that irreversible destabilisation of west Antarctica has not yet set in, and there are controversies about some others like arctic methane and the Gulf Stream. What do you see as the most urgent potential tipping points to guard against and to know more about?

Michael Mann :

We could be rather close to the tipping point where we commit to the melting of most of the west Antarctic ice sheet, which alone could add another 10 feet of global sea level rise.

The recent observations of a large hole forming in the Thwaites glacier, which is sort of the "linchpin" of the west Antarctic ice sheet, adds to the concern that we are very close to this threshold. Other tipping point responses, like the slowdown of the north Atlantic "conveyor belt" ocean circulation, may already be under way. We've [*done some work in the journal Nature*](https://www.theguardian.com/environment/series/the-frontline) that suggests this possibility (see also this   [*commentary*](https://www.theguardian.com/environment/series/the-frontline) ).

Other tipping point responses - like the massive release of permafrost methane - loom with additional warming.

There are many different possible warming thresholds that trigger each of these responses, and so there is no one "tipping point". I prefer the analogy of a minefield that we are walking out on to, and the further we go the more danger we encounter. The only sensible policy is stop the forward lurch by getting off fossil fuels as quickly as possible.

block-time updated-timeUpdated at 3.03am GMT

block-time published-time 2.26am GMT

Are we saved if we hit net zero in 2050?

Another from Twitter:

enltr [*#frontlinelive*](https://www.theguardian.com/environment/series/the-frontline)Assume we have net zero CO2 emissions in 2050. What mean temperature will it be then? How much CO2 ppm in atmosphere? Will the temperature keep rising, and for how long? What are the realistic chances of reducing CO2 atmos. ppm from then on?

- Peter Smith (@arnotsmith) [*March 2, 2020*](https://www.theguardian.com/environment/series/the-frontline)

Michael Mann:

Our best scientific understanding suggests that we can keep planetary warming below 1.5C if we follow a trajectory of decarbonisation that reduces carbon emissions by a factor of two by 2030 and achieves net zero emissions by 2050.

There is of course some uncertainty in that number because there are uncertainties in climate model projections, but the uncertainty is probably only about plus or minus 0.2 degrees. CO2 levels in this scenario would probably peak at about 430 parts per million in the atmosphere (current levels are about 415 ppm) and slowly decline as the oceans and biosphere absorb some of the atmospheric CO2. Our best scientific understanding also suggests that temperatures will stabilise at roughly 1.5C and not rise further if we achieve these targets. That would probably prevent the worst climate change impacts from being realised.

block-time published-time 2.20am GMT

We're nearing the end of our questions for Michael Mann. A reminder that our final expert, Assoc Prof Donna Green, a specialist in the health effects of climate change and air pollution, will be here from 2pm. Get your questions in early.

block-time updated-timeUpdated at 2.23am GMT

block-time published-time 2.18am GMT

From Kate Ryan via email:

As large corporations drive the economy and governments are more concerned with being popular, is it up to the individual to make the hard changes required? I understand ecology and the effects of our lifestyle on the natural environment but it would seem a large part of the population has no idea of the damage caused by deforestation, acidification, pollution etc. What is the best way to deliver the message?

Michael Mann:

Individual actions are certainly important. There are things we can all do in our daily lives that decrease our environmental footprint, and save us money, make us healthier, make us feel better about ourselves and set a good example for others. But any meaningful solution to the climate crisis involves systemic change - policies that incentivise a mass shift away from fossil fuel burning and other activities that generate carbon pollution. Such policies include carbon pricing, incentives for renewables, etc. That in turn requires electing politicians who will support those policies rather than politicians who will simply do the bidding of fossil fuel interests.

block-time updated-timeUpdated at 2.19am GMT

block-time published-time 2.11am GMT

Another video answer from Greg Mullins.

enltrOn our [*#FrontlineLive*](https://www.theguardian.com/environment/series/the-frontline) blog, watch former NSW Fire & Rescue commissioner Greg Mullins talk about the truth of hazard reduction burns   [*https://t.co/BKFqyIYT1N*](https://www.theguardian.com/environment/series/the-frontline)He, along with 22 other former fire chiefs, tried to warn PM in April 2019 about the looming   [*#AustralianBushfires*](https://www.theguardian.com/environment/series/the-frontline) disaster   [*pic.twitter.com/Z9Jg3iFmqy*](https://www.theguardian.com/environment/series/the-frontline)

- Guardian Australia (@GuardianAus) [*March 3, 2020*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 2.06am GMT

Does gas emit less than coal?

From Alice Kelly via email:

Does gas have half the greenhouse emissions of coal, from extraction to use?

Michael Mann 's answer:

Technically yes but this is rather misleading ***statistic***. While natural gas (methane) produces about half as much carbon dioxide as coal per watt of power generated, there are legitimate concerns about 'fugitive emissions'. Methane is itself a potent greenhouse gas and during the process of methane recovery (often called "fracking" - hydraulic fracturing) some of the methane escapes into the atmosphere.

Since methane is a far more potent greenhouse gas than carbon dioxide on timescales of a decade or two, the leaked methane could easily offset the lower carbon dioxide emissions. Recent studies have shown both that there is a spike in the concentration of methane in the atmosphere over the past two decades (responsible for about 25% of the warming of the planet over that timeframe) and that this methane is indeed coming from natural gas extraction. Finally, investments and subsidies for natural gas crowd out investment for the true solution: renewable energy. Australia could lead the world in clean energy. It's got sun, wind, geothermal energy, etc. It's a no-brainer for Australia to move in that direction. And it's important for Australians to vote for politicians who will support the shift to renewable energy, and vote out those politicians who are instead simply doing the bidding of fossil fuel interests.

block-time updated-timeUpdated at 2.21am GMT

block-time published-time 2.00am GMT

And here's a video answer we recorded earlier today from Greg Mullins.

A question from Joshua Alexander: is there a general consensus across Australia's firefighting services that climate change is making the fire season worse?

The answer:

enltrWatch Greg Mullins's answer to this [*#FrontlineLive*](https://www.theguardian.com/environment/series/the-frontline) blog qs from Joshua Alexander, who has friends who are volunteer firefighters: Is there a general consensus across Australia's firefighter services that   [*#climatechange*](https://www.theguardian.com/environment/series/the-frontline) is making the fire season worse?   [*https://t.co/BKFqyIYT1N*](https://www.theguardian.com/environment/series/the-frontline)   [*pic.twitter.com/crvvain6Zi*](https://www.theguardian.com/environment/series/the-frontline)

- Guardian Australia (@GuardianAus) [*March 3, 2020*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 2.03am GMT

block-time published-time 1.53am GMT

Has the time for 'centrist' policy passed?

A question now from Twitter:

enltr [*@AlboMP*](https://www.theguardian.com/environment/series/the-frontline) on   [*#insiders*](https://www.theguardian.com/environment/series/the-frontline) recently ruled out a carbon tax. And Wayne Swan in an address to the party called for centrist climate policy. Is the time for centrist climate policy passed, and is a carbon tax the best tool to initiate change?   [*#frontlinelive*](https://www.theguardian.com/environment/series/the-frontline)

- ??Michael Sackier ?? (@MSackier) [*March 3, 2020*](https://www.theguardian.com/environment/series/the-frontline)

Michael Mann :

A price on carbon is an essential tool in levelling the playing field in the energy marketplace so that renewable energy - which doesn't have the same detrimental impact on our climate and environment - can compete fairly against fossil fuel energy. Subsidies for renewable energy and removing subsidies for fossil fuels (the Australian government subsidies the fossi- fuel industry to the tune of $1,000 a person) are also key tools here.

Ironically, a carbon tax is a centrist climate policy. It embraces market economics as a means of dealing with an environmental externality, and in the past conservative governments have embraced such market-based tools. It is only recently that conservatives have opposed carbon pricing.

It's also important to note that there are different ways of pricing carbon, including a carbon tax and emissions trading schemes (eg "cap and trade"). The Gillard government instituted the latter, but the Murdoch media labeled it a "carbon tax" in an effort to reduce its popularity, and the terminology stuck. The critics claimed it would increase prices but there's no evidence that it did that. It did reduce carbon emissions on the other hand. We know that pricing carbon works, and any meaningful climate policy must include carbon pricing, along with incentives for renewable energy and other policies to help decarbonise all sectors of society.

block-time updated-timeUpdated at 2.05am GMT

block-time published-time 1.44am GMT

Can our animals recover from the fires?

A question now from Shiann Broderick, an 18-year-old school striker who grew up in and lives in Nymboida in NSW and lost her house in the fires.

How long do you think it will take populations of small birds, mammals, reptiles and gastropods like native snail species to recover back into the landscape to their prior numbers after such a catastrophic fire event over such a huge area?

Michael Mann:

We hear the ***statistic*** often that a billion animals were killed by this season's bushfires. But that's only vertebrates (mammals, birds, reptiles, amphibians, fish). When you include other genera, including insects, the number rises into trillions.

This is tragic and will have long-lasting impacts on the viability of these species. Sadly some species will go extinct or become functionally extinct as a result of the bushfires. Koalas in NSW are now endangered as a result of the bushfires. If we continue to see bushfire seasons like this in years to come we will be facing more and more extinctions. This highlights the urgency of climate action, including efforts by Australia to join with, rather than oppose, the larger international efforts to act on climate.

Kangaroo Island, six weeks after the fires. Photograph: Lisa Maree Williams/Getty Images

block-time updated-timeUpdated at 1.54am GMT

block-time published-time 1.41am GMT

Another story from our series. A hotter world has a lot of flow-on effects: bushfires, crops, water and smoke. But one of the simplest is also the deadliest. Hotter temperatures kill people. As doctors and Indigenous residents of central Australia [*told us in our episode on The killer heat*](https://www.theguardian.com/environment/series/the-frontline), it hits the body at a cellular level.

[*Rising temperatures*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 1.54am GMT

block-time published-time 1.33am GMT

From Jenny Nielsen via email:

I'd like to ask Prof Mann about going from a carbon-emitting economy to a carbon-absorbing economy and specifically his thoughts on Prof Tim Flannery's suggestion that large-scale economically sustainable ocean permaculture would not only address climate change but could feed the world and de-acidify the oceans.

Could he also comment on other methods of 'drawdown' to reduce carbon in the atmosphere into the future that they'd support?

Michael Mann:

Tim is a wise man and there is merit in what he is suggesting. Carbon 'drawdown' is an important part of the climate solution and there are ways to do this both with regard to the oceans and the terrestrial biosphere.

When it comes to carbon drawdown, there are natural methods like sustainable permaculture, reforestation, regenerative ***agriculture***, etc to do this, and artificial methods (like constructing millions of synthetic 'trees' that absorb and bury carbon). In the end, however, any efforts at drawdown are futile if we continue to load the atmosphere with 50bn tonnes of carbon dioxide a year. So any meaningful climate action must focus primarily on the decarbonisation of our economy (ie moving rapidly away from fossil fuel burning to renewable energy), but carbon drawdown can certainly aid the effort.

block-time updated-timeUpdated at 1.55am GMT

block-time published-time 1.28am GMT

And a question from earlier via comment:

[*garrymwhite*](https://www.theguardian.com/environment/series/the-frontline)   [*01 March 2020 8:57pm*](https://www.theguardian.com/environment/series/the-frontline)

If every country followed Australia's current emission reduction commitments what would be the most likely increase in global temperatures?

Michael Mann:

Unfortunately, the Australian government's current commitments don't get us very far.

They involve what some consider a dubious accounting trick (trying to get "carryover credits" for somewhat meagre actions taken by Australia in response to the 1997 Kyoto Accord to reduce their current emissions reduction commitments. Indeed, the Australian negotiator helped sabotage the recent international Madrid climate meeting by insisting on this. The current government is also subsidising coal and natural gas rather than providing incentives for the renewable energy, taking Australia in the wrong direction. This is unfortunate because Australia was once a real leader when it comes to climate action. Australia was the first major industrial nation to put a price on carbon (in the form of the emissions trading scheme passed by the Gillard government) in 2011. Unfortunately it was disbanded when Tony Abbott took over as prime minister a couple years later and the current government has shown no support for pricing carbon, an essential tool in the effort to decarbonise our economy.

They are not in line with efforts to limit warming to below a dangerous 1.5C.

block-time published-time 1.24am GMT

Some thoughts from our readers below the line:

[*MarinaOlivier*](https://www.theguardian.com/environment/series/the-frontline)   [*03 March 2020 1:06am*](https://www.theguardian.com/environment/series/the-frontline)

" Climate change has reduced farm profits in Australia".

How about choosing crops that consume less water and are adapted to the region where it grows?

Cotton is a huge consumer of water in the driest continent, it is harming the Murray-Darling that large irrigators take so much to the detriment of small farming and growers.

[*jackthelad1947*](https://www.theguardian.com/environment/series/the-frontline)   [*03 March 2020 12:07am*](https://www.theguardian.com/environment/series/the-frontline)

Thanks Professor Hughes let's hope our politicians are listening.

block-time published-time 1.19am GMT

Why 2050?

Our first question for Prof Michael Mann is [*via comment*](https://www.theguardian.com/environment/series/the-frontline) :

Why do we commonly see 2050 as the year to eliminate fossil fuels and transfer to 100% clean energy rather than a more urgent date, say, in the next 10 years? It seems obvious from all the genuine literature I have read that we do not have another three decades to get our ***collective*** acts together.

Michael Mann:

If you look at the so-called carbon budget we have left to avoid warming the planet beyond a dangerous 1.5C and do the maths, there are certain benchmarks we need to achieve to stay on target. Achieving carbon neutrality by 2050 is one key benchmark (Zali Stegall, independent MP for Warringah in NSW, has a climate bill that focuses on that target).

What is also true is that we need to bring carbon emissions down by a factor of two within the next 10 years or so to stay on target. Both this near-term target and the longer-term 2050 target are important to keep in focus when it comes to policies to decarbonise our economy and avert dangerous warming.

block-time updated-timeUpdated at 1.25am GMT

block-time published-time 1.13am GMT

Thanks to Greg Mullins for his time. Again, sorry we could not get to every question. Next up, climatologist and geophysicist Prof Michael Mann.

block-time published-time 1.09am GMT

Is Indigenous fire management the answer?

Our final question for Greg Mullins is from Yindi Kalina:

Thank you with all our heart for standing up and speaking out. Can you tell me your thoughts on Indigenous fire management as a practice and does it have a role to play in managing wildfires in Australia?

Greg Mullins:

Yes! Cultural burning practices where they are still practised are incredibly sophisticated. It is NOT just a case of training firefighters to burn in a different way. Experts in this area understand their country - when animals and birds are nesting and reproducing, when certain plants are flowering and producing seeds. They use this knowledge of country to develop burning strategies that will invigorate rather than harm the environment.

The basic problem, however, is that historically our Indigenous brothers and sisters have been driven off much of their country. Therefore the deep knowledge and continuity of practice is lacking in many areas. However, there is a resurgence in this area and we need to listen to the people who understand country and can help to heal it.

The major issue though is that nobody in the past 60,000 years has experienced a climate like this or fires like this. Which means we need to work together and try new approaches, with cultural burning front and centre among the possible solutions.

block-time updated-timeUpdated at 1.17am GMT

block-time published-time 1.03am GMT

Water

12 months after Fleur Magick Dennis moved to Euchareena in regional NSW in 2017, the water was turned off.

One of the [*longest, most severe droughts*](https://www.theguardian.com/environment/series/the-frontline) in living memory is the cause - and is exacerbated by climate change. Even recent rain across the state was not enough to break it.

Read Fleur and her husband Locky's story and let our experts know if you have any questions about the future of water in a changing climate.

Greg Mullins will be here for a few more minutes, and climate scientist Michael Mann will be in soon to take over.

Related: [*A climate emergency: what happens when the taps run dry?*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 12.55am GMT

Are waterbombers the answer?

Michael McGovern asks:

Could a fleet of long-range large waterbomber aircraft deployed early after fires were detected have significantly reduced or eliminated the fires before they became uncontainable?

Greg Mullins :

Together with 22 other former fire and emergency chiefs, from April last year I tried to alert the Australian government to the seriousness of the impending bushfire threat. One of the issues we raised was that Australia's fire seasons now overlap with the US and Canada, where we source all but one of our large firefighting aircraft. Fire services had lodged a business case in 2018 for more financial support from the Australian government, but had been ignored, as had a Senate inquiry recommendation from 2016 that Australia develop its own fleet of large waterbombing aircraft.

Disclaimer: all firefighters know that aircraft on their own cannot extinguish fires. They are another tool in the arsenal. However, they give a tactical edge by reducing fire intensity near assets to allow firefighters to get close enough to save assets, and in remote areas they can hold and contain fires until specialist remote area firefighters arrive.

A study was published in the US last week showing that when aircraft are deployed early they can significantly reduce the ultimate size and duration of bushfires.

We use a range of fixed-wing aircraft and helicopters for different roles. The large air tankers generally don't drop directly on to flames - they lay retardant lines ahead of the flames to try to form a fire break. In extreme conditions and eucalypt forests these often only slow down the fires, as spotting (burning brands carried ahead of the fire front causing new fires) simply cross the retardant lines.

block-time updated-timeUpdated at 1.15am GMT

block-time published-time 12.41am GMT

enltrOn 8 September 2019, historic Binna Burra Lodge in Australia's Gold Coast hinterland was razed to the ground. About 450ha of rainforest burned around Binna Burra that day. This is the new fire zone. Hear their story in our first episode of [*#TheFrontline*](https://www.theguardian.com/environment/series/the-frontline)   [*https://t.co/ms9UEsd1S6*](https://www.theguardian.com/environment/series/the-frontline)   [*pic.twitter.com/CQ9hCw1sYT*](https://www.theguardian.com/environment/series/the-frontline)

- Guardian Australia (@GuardianAus) [*February 13, 2020*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 12.34am GMT

Robert Armstrong asks:

Having been in northern NSW for a few months, I noticed that the regrowth forests that were burned out did not have much resemblance to the old growth forests in national parks.

The regrowth forest does not have a canopy and consists of dense, thin trees of varying height. Do these forests contribute to intensifying fires? Has any research been conducted on these forests?

Greg Mullins:

I'm assuming that you mean regrowth following harvesting by forestry. The regrowth in these cases, unlike natural forests, is of a uniform age, so they are all about the same height. The danger with this is that should a high-intensity fire burn through these areas, immature trees can be killed and not regenerate.

Because I'm unsure exactly what you are referring to, I can't really comment on the intensity of fires and whether the state of regrowth contributes. However, the relationship between fuel and fire intensity is very straightforward: "available fuel" is generally considered to be leaf litter, sticks, twigs, bark, low shrubs etc that is 6mm in diameter or smaller. We weigh this to get a figure of tonnes per hectare, then can calculate fire intensity using algorithms that take into account drying, temperature, etc. If the new trees have a lot of light foliage they can contribute to fire intensity.

The issue we have faced after a 20-year drying trend overlaid by a very serious drought is that "available fuel" is probably far more than 6mm diameter fuels, with a consequential significant increase in fire intensity, convection, spotting distances, and even pyroconvective activity (fires creating their own dry thunderstorms).

block-time updated-timeUpdated at 12.37am GMT

block-time published-time 12.28am GMT

This map shows the increasing severity of bushfires if carbon emissions remain high.

Greg Mullins will be here until 12pm answering more of your questions.

[*Map of bushfire severity*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 12.25am GMT

Are we even "in control" of our fire season any more?

From Lyon Lim via email:

How can we play a role in preventing these bushfires from ever happening again? Are we even in control, and have the means to avert such intense bushfires in the next fire season? With the amount of bushfires acreage burnt, would the upcoming season be that intense again?

Greg Mullins:

Unfortunately, as my emergency service chief colleagues and I have been trying to warn the Australian government, climate change has super-charged the bushfire problem.

Australia is the driest inhabited continent, and bushfires have been here for as long as humans. Unfortunately the warming and drying trend caused by CO2 and greenhouse emissions has made our forests, scrublands and grasslands even more flammable.

Prevention efforts can be effective for human causes (such as throwing away cigarettes, controlling burn offs, etc). However we have seen a significant increase in the number of naturally caused bushfires - specifically lightning-caused fires and "dry" thunderstorms. In 2016, hundreds of thousands of hectares burned in Tasmania due to lightning, and then again in 2018. Former Tasmanian fire chief Mike Brown and other veteran foresters and firefighters told me that this was unknown in previous decades.

So, in a very real sense, we are no longer in control of the bushfire situation, something that is mirrored around the world, such as in California where they lost 18,000 homes and 100 lives in 2018, and 9,000 homes the year before.

This is why I, and my 22 former fire and emergency chief colleagues who are members of Emergency Leaders for Climate Action, are asking the Australian government to take real action on the basic cause: greenhouse emissions. Over time we might then have a chance.

With regard to area burned, about 21% of broadleaf forests were burned this season. That leaves a lot of bush to burn next year or subsequently. In Sydney the suburbs were not touched. Unfortunately our bushfire problem will not go away.

block-time updated-timeUpdated at 12.51am GMT

block-time published-time 12.21am GMT

The new fire zone

The first installment of The Frontline looked at our horror summer - the [*33 people killed*](https://www.theguardian.com/environment/series/the-frontline), the thousands of homes lost. And as Greg just said, they were of an unprecedented intensity and scale that shocked everyone.

In the Gold Coast hinterland, Tony Groom's beloved Binna Burra Lodge stood for more than 80 years. This summer it burned. It's "the kind of lush forest that doesn't usually burn". We spoke to him for our first chapter back in February.

Related: [*Living in the climate emergency: Australia's new fire zone*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 12.24am GMT

block-time published-time 12.16am GMT

What's something we can do that isn't a march?

Our first question for Greg Mullins is from Mark Doyle :

We need to break our of this climate stasis we are in. It requires Australians to take actual action. What's something real and immediate individuals could do to start the citizen-led ball rolling? Not a march.

Mullins:

Thanks for your question, Mark. I think that this summer has woken up a lot of people, including politicians, to the climate change crisis that we face. It is no longer theoretical. The scale of the bushfires, the losses, and the extreme weather conditions that drove them even surprised veteran firefighters and climate scientists.

The big gap that I see is in government policy on emissions reduction: this means our energy sector, transport, manufacturing, ***agriculture*** - none have any signals from government about what needs to be done and how they can do their part. State and territory governments are all adopting net zero policies, but they need Canberra to step up to assist.

We have an opportunity now: independent MP Zali Steggall will introduce a private member's bill to parliament this month based on UK legislation. It will provide a framework for action in Australia. We need our politicians to support this. Many in the Coalition understand the need but they are being bullied by the few climate deniers.

We should all be calling on our federal MPs to support this bill. If necessary, they should cross the floor for climate and for the kids' futures. This is something concrete that all of us can do right now. Politicians rely on votes so they listen to voters.

Come on "quiet Australians": get loud!

block-time updated-timeUpdated at 12.23am GMT

block-time published-time 12.09am GMT

Thanks to Prof Lesley Hughes for her time and incredible expertise. From Antonio Gramsci to mangrove forests, it had it all. Sorry we couldn't get all your reader questions - but we do have more experts lined up for the rest of the day who can. [*A full list is here*](https://www.theguardian.com/environment/series/the-frontline).

Next up is Greg Mullins, former commissioner of Fire and Rescue NSW, volunteer firefighter and climate councillor. He'll be answering questions until 12pm.

Email [*frontline.live@theguardian.com*](mailto:frontline.live@theguardian.com) or tweet #frontlinelive

block-time updated-timeUpdated at 12.22am GMT

block-time published-time 12.08am GMT

Our final question for Lesley Hughes is from Sophie Bickford via email:

Over the past decade with the understandable focus on climate change, other areas of the environment have been given less attention - nature conservation in particular. In some ways the species extinction is a crisis of the same order of magnitude as climate change - and is irreversible. Can we fix both at the same time?

Hughes :

I think the recent bushfire crisis has focused a lot of attention on the threats of climate change to wildlife, and the parlous state of the Australian environment in general. We must be a lot bolder in terms of conservation action - being more prepared, for example, to move species to reduce the risk of extinctions.

We must also resist the knee-jerk reaction of the right wing to blame the fires on the lack of hazard reduction or national parks or "greenies". No amount of hazard reduction would have prevented some of the fires we have just seen. But in terms of conservation more generally, the government must reverse the decline in funding that has been going on since the Abbott government. We can save species, but need to spend money to do so. We can't separate the climate crisis from the extinction crisis - one is exacerbating the other, and both must be addressed simultaneously.

block-time updated-timeUpdated at 12.21am GMT

block-time published-time 12.03am GMT

What can we do?

And now our second-last question for the professor.

From Micaela Ledin:

For those of us who are feeling overwhelmed and helpless right now, what bigger steps can we take as individuals? (Beyond cutting plastic, less water, less driving etc). What actions, specifically, should we be demanding our government to do?

Lesley Hughes:

Use your vote wisely - make sure your parliamentary representatives know that climate change policy will be the number one reason determining your vote at the next election. In the meantime, add your signature to Zali Steggall 's climate bill.

Think about where your money is - in insurance, superannuation and banks. If your bank, insurance company or super fund is investing in fossil fuels, move your money and tell them why. The website [*Market Forces*](https://www.theguardian.com/environment/series/the-frontline) is a great resource to support this action. Put solar panels on your house if you can, or buy green power if you can't.

Depending on your finances, consider installing battery storage and getting an electric car. Reduce your meat and dairy consumption (healthier too!). Finally, a good colleague of mine always says, "Use your time, your talent, and/or your treasure." Join a like-minded community group and give them your time, donate to climate advocacy groups if you can, and volunteer your skills.

In terms of demands to government: we must close down our ageing coal-fired power stations as soon as possible and support investment in renewables and new green technologies. We do actually need a climate and energy policy and we must demand that our governments be guided by facts not opinions.

block-time updated-timeUpdated at 12.08am GMT

block-time published-time 11.58pm GMT

enltrFrom grape to grain: how a warming climate is changing what we eat and drink [*https://t.co/hlFhnoR28*](https://www.theguardian.com/environment/series/the-frontline)This is 'The Lost Harvest', the final episode in   [*@GuardianAus*](https://www.theguardian.com/environment/series/the-frontline) 's multimedia series   [*#TheFrontline*](https://www.theguardian.com/environment/series/the-frontline) : inside Australia's   [*#climateemergency*](https://www.theguardian.com/environment/series/the-frontline)   [*pic.twitter.com/FaT20ib3SR*](https://www.theguardian.com/environment/series/the-frontline)

- Guardian Australia (@GuardianAus) [*March 2, 2020*](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 11.54pm GMT

From Julie Bennett via email:

Could the interruption to global trade with the spread of Covid-19 be the impetus for radical change in lifestyles and institutions required to rapidly reduce greenhouse gas emissions and enable ecosystems time to adapt to changing temperatures?

Lesley Hughes :

These are very big questions, and probably best answered in hindsight! I do think that global emissions will be reduced, at least temporarily, as travel, trade, and goods production (especially in China) slows down. We saw this happen during the GFC. I suspect that once the virus emergency is over (assuming this happens) that most things will return to their previous state, but with some more attention being paid to self-sufficiency (at a country level) and a desire for economies to be less dependent on China (such as diversifying the origin of overseas university students here in Australia). But I think it's probably wishful thinking to expect this crisis to bring about a whole-world change in how we live. But really, your guess is as good as mine!

block-time updated-timeUpdated at 12.01am GMT

block-time published-time 11.49pm GMT

And here are the ***statistics*** behind that question, [*from our initial story*](https://www.theguardian.com/environment/series/the-frontline).

Projected output has dropped by as much as 25% in some parts of Australia's cropping and grazing industries - and that's only at 1C of warming. We are on track for 3C.

Average annual farm profits have already dropped significantly due to global heating: down by 37% in Victoria, and 35.3% in the cropping industry.

[*Farm profit* ***statistics***](https://www.theguardian.com/environment/series/the-frontline)

block-time published-time 11.45pm GMT

Will community gardens save our food crops?

A question on [*The lost harvest*](https://www.theguardian.com/environment/series/the-frontline) from Roan Sajko :

If cropping profits continue to decline in Aus, What kind of food security situation will we be in if many plant farmers decide they can no longer sustain their businesses? Is there a good case for things like urban community gardens? Can indoor hydroponic systems save our crops?

Lesley Hughes :

The impacts of climate change on ***agriculture*** are extremely complex. The most general thing to say is that many types of crops, as well as livestock farming, will need to transition to other locations as the climate in their current location becomes unsuitable - this will mean that considerable disruption in our farming sector is ahead.

Community urban gardens certainly have a place in cities and towns, but are unlikely to provide all the food we need for a growing population (especially considering that by 2050, we might have 10 billion mouths to feed). Shifting out of animal products to a more plant-based diet will help a lot - because producing food from animals is far less efficient than from plants. There are also some exciting fermentation technologies being developed in which animal protein is being produced from genetically modified yeast and other microorganisms. I have just had a piece on this technology in relation to dairy production come out in the Monthly (called " [*The milk of human genius*](https://www.theguardian.com/environment/series/the-frontline) ").

block-time updated-timeUpdated at 11.50pm GMT

block-time published-time 11.41pm GMT

From Cliff Fraser via email:

Trees, plants in general, absorb and sequester carbon. When a tree dies, naturally or otherwise, is the carbon released or still held in the tree remains?

Lesley Hughes:

After plants die they gradually decompose and, as they do so, the carbon is released back to the atmosphere. This will be a much slower process for a large tree than for a small herb.

block-time updated-timeUpdated at 11.47pm GMT

block-time published-time 11.36pm GMT

The lost harvest

Published just yesterday, here's the final chapter of our series. It looks at how the climate emergency is changing the food we eat and crops we grow.

"Consumers are going to have to get used to not being able to get the fruit and vegetables they want at the price they want and the quality they want without sourcing them from overseas," Mark Howden, the director of the Australian National University's climate change institute, told us.

Related: [*From grape to grain: how a warming climate is changing what we eat and drink*](https://www.theguardian.com/environment/series/the-frontline)

'Consumers are going to have to get used to not being able to get the fruit and vegetables they want at the price they want and the quality they want without sourcing them from overseas.' Photograph: David Fanner/The Guardian

block-time updated-timeUpdated at 11.42pm GMT

block-time published-time 11.33pm GMT

More on that answer as well, specifically about mangroves:

Lesley Hughes :

Massive mortality of mangroves in the Gulf of Carpentaria occurred between late 2015 and early 2016, along a 1,000km stretch of coastline. The deaths occurred during an underwater heatwave (responsible for coral bleaching on the Great Barrier Reef at the same time), along with a severe drought and a temporary drop in sea level associated with a strong El Niño event.

Approximately 7,400 hectares of mangroves from the Roper River Estuary, east to Karumba in Queensland, were affected, with some river catchments losing over 25% of their mangroves. These habitats provide important nursery grounds for prawns and fish, which in turn support turtles, dugongs and other marine life, as well as the fishing industry. Mangrove communities also filter ***nutrients*** and sediments from land runoff, act as natural buffers against storm surges, and store vast amounts of carbon. When mangroves die, this carbon is released back into the atmosphere, contributing to further changes in the climate. This type of event could certainly occur again if sea surface temperatures keep rising, as expected.

block-time updated-timeUpdated at 11.41pm GMT

block-time published-time 11.29pm GMT

This graphic shows that change in water temperature Hughes is talking about.

[*Change in water temperatures*](https://www.theguardian.com/environment/series/the-frontline)

block-time updated-timeUpdated at 11.41pm GMT

block-time published-time 11.27pm GMT

One from Phillip Sutton [*via comment*](https://www.theguardian.com/environment/series/the-frontline) :

What percentage of the [*kelp forests have been destroyed*](https://www.theguardian.com/environment/series/the-frontline) in each state? What about the massive mangrove forest loss in the NT? Will this recur? How often and with what consequences?

Lesley Hughes:

I'm not sure the exact percentages of kelp loss in each state, but overall, these important ecosystems are in serious decline. They cover more than 71,000 sq km around the southern mainland coast and Tasmania and are highly productive, supporting rich marine biodiversity. They are facing multiple threats including underwater heatwaves, damage from boats, ***nutrient*** and sediment runoff, and overgrazing by marine herbivores. This latter threat is particularly important in Tasmania.

Since the 1970s, the long-spined sea urchin ( Centrostephanus rodgersii ), originally a resident of the New South Wales coast, has been migrating southwards under the influence of the warming and strengthening East Australian Current. It has now established in large numbers in Tasmania where warming waters mean that the larvae can survive the winter. The urchins graze on the kelp, creating bare patches called "barrens". The habitat of over 150 species is being lost during this process, with flow-on impacts to the abalone and lobster fishing industries, worth over $100m per year in 2016.

block-time updated-timeUpdated at 11.40pm GMT

block-time published-time 11.21pm GMT

Will bushfires affect the water cycle?

From Kerrie Davis :

How will the loss of the forests from bushfires affect the water cycle in the short to medium term? I assume that the millions of hectares of burnt bushland will reduce the amount of water evaporated from the leaves and eventually form less rain.

Lesley Hughes :

A number of things can happen after a bushfire that affects the water cycle. Yes, transpiration of water from the vegetation is greatly reduced, depending on how many leaves are left. This means that uptake of water from the roots is also reduced, affecting soil moisture. If there is heavy rain after the fire (such as we've recently experienced on the east coast), more water will find its way into rivers because it is not being intercepted by the vegetation. Along with this, there may be significant loss of topsoil and ***nutrients***.

The ***nutrients*** in the runoff can affect water quality because they can support excessive growth of algae. Some algae can be quite toxic if ingested so there needs to be careful monitoring of drinking water in catchments under these post-fire circumstances.

block-time updated-timeUpdated at 11.30pm GMT

block-time published-time 11.14pm GMT

The dead sea

Here's one of The Frontline stories that you can ask ecologist Prof Lesley Hughes about.

The sea around the Tasmanian east coast used to be one of the only places in the world where you could dive among underwater forests of giant kelp. In our incredible multimedia episode - The dead sea - you can see footage of these amazing plants.

But rising sea temperatures killed off the last of the forests a few years ago. In their place, a local diver, Mick Baron, says there are only sea urchins - leaving the ocean floor "like an asphalt driveway".

Related: [*The dead sea: Tasmania's underwater forests disappearing in our lifetime*](https://www.theguardian.com/environment/series/the-frontline)

A diver swimming in a kelp forest at Munro Bight, Tasmania, in 2012. Not much of these forests are left in 2020. Photograph: David Fanner/The Guardian

block-time updated-timeUpdated at 11.29pm GMT

block-time published-time 11.08pm GMT

Our first question is in.

ErikFrederiksen asks [*via comment*](https://www.theguardian.com/environment/series/the-frontline) :

A few years ago a NY Times reporter wrote that some climate scientists had told him they held more pessimistic views than they felt comfortable expressing in public. My question to a scientist would be: Do you find this to be typical and do you feel this to be true about yourself?

Prof Lesley Hughes (ecologist, distinguished professor of biology and pro-vice-chancellor (research) at Macquarie University) answers:

The best way I can think of to answer this question is a quote from Antonio Gramsci, an Italian Marxist politician from last century who wrote about the tension between the "pessimism of the intellect and the optimism of the will".

What this means is that most of us (I think) simultaneously hold a lot of very negative thoughts in our heads about the consequences of climate change, as we confront the facts. But at the same time, to be truly pessimistic is to give up - and if we give up, we really are lost. I have come around to thinking that hope is far more than an emotion, it is also a fundamental strategy. We must go forward in hope if we are to have any chance of saving life on Earth. Ultimately this means that at times we might not express as pessimistic a view in public as we feel inside. We need to inspire and motivate, at the same time as being as honest as possible. This is a tightrope to walk!

block-time updated-timeUpdated at 11.28pm GMT

block-time published-time 11.05pm GMT

Your questions answered

Hello and good morning. Over the past three weeks, [*Guardian Australia has been publishing The Frontline*](https://www.theguardian.com/environment/series/the-frontline) - a beautifully filmed and produced six-part multimedia series about how Australians are already living with the effects of the climate crisis.

It's about real-life people [*whose homes have been lost*](https://www.theguardian.com/environment/series/the-frontline). How the extreme heat in Australia   [*is killing us*](https://www.theguardian.com/environment/series/the-frontline). How   [*the taps are running dry*](https://www.theguardian.com/environment/series/the-frontline) for some towns in NSW, and how the climate crisis is changing what   [*we eat and drink*](https://www.theguardian.com/environment/series/the-frontline).

And of course, our black summer of bushfires, [*which killed 33 people*](https://www.theguardian.com/environment/series/the-frontline).

Now, you have a chance to ask our panel of experts about the issues raised in the series. You can ask a general question about the impacts of global heating. (How will it affect you? How it will change society? How can it be stopped?) And you can ask about any of the issues raised in The Frontline - follow-ups, clarifications, anything we left unanswered.

Our panel is:

* 10am-11am : Prof Lesley Hughes - ecologist and distinguished professor of biology, expert on animal and plant species and ecosystems.

1. 11am-12pm : Greg Mullins, former commissioner of Fire and Rescue NSW, expert on bushfires.
2. 12pm-1.30pm : Prof Michael Mann, climatologist and geophysicist and a global expert on climate science.
3. 2pm-3pm : Assoc Prof Donna Green - an expert on the health effects of climate change and air pollution.

Submit your questions via email to [*frontline.live@theguardian.com*](mailto:frontline.live@theguardian.com), or tweet on the hashtag #frontlinelive.

We'll publish your question here on our live blog, alongside the answer from one of our experts.

And the six-part series can be found here: [*The new fire zone*](https://www.theguardian.com/environment/series/the-frontline),   [*The taps run dry*](https://www.theguardian.com/environment/series/the-frontline),   [*The air we breathe*](https://www.theguardian.com/environment/series/the-frontline),   [*The killer heat*](https://www.theguardian.com/environment/series/the-frontline),   [*The dead sea*](https://www.theguardian.com/environment/series/the-frontline),   [*The lost harvest*](https://www.theguardian.com/environment/series/the-frontline).

block-time updated-timeUpdated at 11.27pm GMT

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HINA Digest

January 14, 2021 Thursday

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**Length:** 11580 words

**Body**

Zagreb,Hrvatska14 January 2021 (Hina) - Law on post-quake reconstruction to include all areas affected by 2020 quakes ZAGREB, 14 January (Hina) - The government on Thursday sent to the parliament draft amendments to the law on the post-quake reconstruction of Zagreb, Krapina-Zagorje and Zagreb Counties to include the regulation of the reconstruction of Sisak-Moslavina and Karlovac Counties,hit by the 29 December 6.2 magnitude quake. Construction Minister Darko Horvat sad at a government meeting that the legislative changes were necessary considering extensive damage caused bythe 28 Decemberquake measuring 5.0 on the Richter scale and the 29 December quake measuring 6.2, which took seven lives in the Sisak County. Under the changed law, the Reconstruction Fund, which was set upto deal with the aftermath of the 22 March 5.5-strong earthquake that hit Zagreb and its environs, will be also tasked with reconstruction of the quake-affected areas in the Sisak and Karlovac counties. The state will provide full funding for the reconstruction of the property in which the owner lives in these two counties since they are underdeveloped, according to the explanation given by Horvat. The Culture Ministry, in cooperation with local authorities, will draw up a plan for the reconstruction of cultural and listed buildings.

Government to establish task force for economic revitalisation of quake-hit areas Atask force, which will beco-chaired by Ministers Nataša Tramišak and Tomislav Ćorić, will be set upto prepare a programme for the social and economic revitalisation of the said area. The task force will include local office-holders and parliamentary deputies from constituency VI as well as academics, and representatives of various chambers and business associations. Prime Minister Andrej Pleković said today that the government had not yet been provided with the ***data*** on the exact scope of the damage caused by the29 December 6.2 magnitude quake, and the accuratedata will be known after some time and that will be important for Croatia's application for assistanceunder the European Union's Solidarity Fund. The European Union Solidarity Fund (EUSF),created as a reaction to the severe floods in Central Europe in the summer of 2002,was set up to respond to major natural disasters and express European solidarity to disaster-stricken regions within Europe. Plenkovićsaid that the relevant legislation on the reconstruction of the quake-affected areas in Croatia would regulate temporary accommodation for people left homelessin the 2020 tremors, explaining that quake victims would be provided with prefab containers or could move in state-owned vacant flats. According to Plenković, the amended legislation will take into account the scope of the damage in the Sisak and Karlovac counties as well as the fact that they are mainly rural and underdeveloped areas. He underscored that the quake-affected areas in the Sisak ad Karlovac countieswere demographically, socially and economically below the Croatian average. Deputy PM says food to be distributed to quake victims at yet another location ZAGREB, 14 January(Hina) - Deputy PM Tomo Medved, who heads the task force dealing with the aftermath of the 29 December earthquake, said on Thursday a new location would be set up for the distribution of food for the earthquake victims, in Glina. "Food is distributed at four locations: Sisak, Petrinja, Hrvatska Kostajnica and Kravarsko, and as of today, it will also be distributed in Glina," Medved said at a government session. He recalled a conclusion of the task force of January 9 to mobilise the state-owned Pleter company to prepare and deliver meals for earthquake victims. Speaking of the current situation in the quake-hit areas, Medved said that last week an average 81 staff ofthe Civil Protection Directorate were there on a daily basis, as were 470 staff from the Firefighting Association, 90 members ofthe HGSS mountain rescue service, 354 Red Cross activists, 195 police offices, 340 soldiers and 200 persons mobilised by the Croatian Centre for Earthquake Engineering. Medved said that the Firefighting Association had carried out 3,545 interventions, including the safe removal of the bell tower on the Sisak cathedral and the repair of the roof on the Church of St. Lawrence in Petrinja. The HGSS carried out 692 interventions, mostly works requiring climbing skills and food, water and medicine delivery. They also recorded cracks that appeared in the ground in Donji Kukuruzari and Borojevici and evacuated the town archive, tourism office, land registry and tax authority in Petrinja. The Red Cross Croatia delivered 96,696 hot meals to local residents and 13,254 meals for forces on the ground and it also provided 2,196 services of psychosocial help. The Croatian Centre for Earthquake Engineering has so far received 41,574 damage reports and inspected 18,370 buildings. Of the inspected buildings, 2,368 were assessed as unusable, 3,871 were assessed as temporarily unusable, and 10,318 were assessed as fit for use or fit for use withcertain recommendations. Medved said that the Croatian Army had organised the transfer of 122 residents of retirement homes who had been temporarily accommodated in the Petrinja barracks to Topusko, Gospic, Ogulin and Karlovac, with 155 civilians still staying in the barracks. The army has repaired around 11 kilometres of roads and public areas and started erecting container settlements - three in Sisak andone in Petrinja, Medved said, adding that a settlement was also being planned in Glina. Army makesaerial recordings, inspects Sava and Kupa dikes Medved said that the army had conducted aerial recordings to ***collect*** information on the damage caused by the quake as well as geological probes of the Sava and Kupa river embankments. Police on average did 64 patrols a day. A total of 475 housing containers and mobile homes have been received and most have been installed, he said. Around 500 jobseekers are to be hired to perform public works in Sisak-Moslavina County, for which HRK 16.5 million has been secured and the scheme should be launched on February 1, he said. Medved said that 25,000 housing units were repaired or reconstructed in Sisak-Moslavina County after the 1991-95 war, of which 8,800 had sustained the most extensivedamage in the war. "Most units in that category were rebuilt on existing foundations in line with the original measurements, and a small number of houses were built on other locations," he said. Quake damages 1-3% of rebuilt houses that were most heavily damaged in war Medved noted that the December 29 quake damaged 1-3% of the houses rebuilt after the war that had been most heavily damaged in the war. Inspections of housing units will continue as new tremors cause new damage, he said, noting that the main priority in the coming period would be the installation of container and mobile homes and that Hotel Panonia in Sisak would be used for the temporary accommodation of the quake victims as well. Magnitude 3.2 aftershock rocks Petrinja area An earthquake measuring 3.2 on the Richter scale with the epicentre near Petrinja was registered at 7.46 a.m., Croatia's Seismological Survey said on Thursday morning. The Petrinja area was struck by a magnitude 6.2 tremor on 29 December, killing seven and causing devastating damage in Sisak-Moslavina County. Ćorić: Economic renewal of earthquake-devastated area a priority ZAGREB, 14 January (Hina) - Economy and Sustainable Development Minister Tomislav Ćorić said on Thursday that the government's focus would now be on the economic renewal of the areas devastated by the 29 December earthquake. "Over the next two weeks there will be a tender for small and micro enterprises for initial repairs and equipment. The tender is worth HRK 10 million and with it we will try to meet the needs of several hundred small and micro enterprises," Ćorić told the press before a cabinet meeting. "A major tender is being prepared to increase production capacitiesand to digitalisetechnological processes in the whole country and not just in the earthquake-hit areas, but because of the earthquake Sisak-Moslavina County will be given slightly better treatment than other parts of the country," he added. As for the economic revitalisation of the earthquake-affected area, Ćorić said that a development strategy would need to be prepared for Sisak-Moslavina County to reflect novelties from the national development strategy. He said that the focus would be on incentives to keep people in the area and on strengthening the production capacity of the county. Ministry says its goal is to help farmers in quake-hit areas to keep cattle ZAGREB, 14 January (Hina) - The ***Agriculture*** Ministry said on Thursday its goal was to ensure such conditions that farmers in earthquake-hit areas can keep theircattle throughfeed donations, cattlerelocationand sale mediation, adding that it had mediated the sale of 114 head of cattle to date. The ministry was asked by Hina about reports of cattle buyersin quake-hit areas, if it was doing anything about it and if it was considering intervention buyingto help farmers. Some media have reported about profiteerscoming toSisak-Moslavina County to exploit the situation after the earthquake by buying land and cattle below price. The ministry said it was contacting representatives of the meat and dairy industries to ask them to help by buying cattle and milk from local farmers. The ministry addedthat it didnot participate in price settingbetween the two partiesand that representatives of the meat and dairy industries had said they would offer fair market prices. The ministry said its department for farmland, plant production and the market was also mediating between farmers in quake-hit areas and buyers. Regarding intervention buying, the ministry said it was "the last measure of assistance." Chamber of ***Agriculture*** has no information about profiteers The CroatianChamber of ***Agriculture*** told Hina it had no concrete information about post-earthquake profiteers in Sisak-Moslavina County. There is information that several older people have sold their cattle below price and left Croatia, "but that is their personal decision and they don't intend to come back to live in Sisak-Moslavina County," the Chamber said, adding that "the price was low due to urgency, not because someone wanted to makeadditional gain from already affected people." The Chamber said such sales could not be banned. Some of containers used by medical institutions made available for quake victims ZAGREB, 14 January (Hina) - Some of the containers used by medical institutions have been reallocated for the accommodation of earthquake victims in Sisak-Moslavina County, Interior Minister Davor Božinović told a cabinet meeting on Thursday. "Fifty-five such containers have been made available to the Directorate for Buffer Stocks," Božinović said. He reported that in the past week inspectors and police had carried out 29,411 inspections of businesses and public gatherings, establishing 65 irregularities, issuing 58 verbal warnings and initiating seven misdemeanour proceedings for violations of epidemiological measures. He said that police had found 181 people to be in violation of self-isolation measures and four people had been charged with spreading an infectious disease. Božinović also said that 1.15 million items of protective equipment, weighing 110 tonnes, had been issued from the logistics centre at Jastrebarsko to medical and social welfare institutions and that currently about 650 tonnes of such equipment, or 11.3 million different items, was stored in warehouses. He said that 21 tonnes of protective equipment, including coronavirus testing kits, protective clothing and face masks, procured by the Directorate for Buffer Stocks and the Croatian Embassy to Beijing, had been received. Quake damage to infrastructure estimated at HRK 470m, daily says ZAGREB, 14 January(Hina) - The preliminary amount of the damage caused by the 29 December magnitude 6.2 earthquake to the transport, electrical and water infrastructure in the Banija region stands at HRK 470 million, Jutarnji List daily said on Thursday. Reconstructing the infrastructure and homes is key for the people there to go back to normal living, the paper said, adding that the damage to the infrastructure was already being dealt with. The biggest damage was sustained by the HEP power utility's distribution network. The company estimates that it stands at HRK 200 million, with 238 substations destroyed or badly damaged. Repairing cracked embankmentsis expected to cost between HRK 70 and 100 million. According to preliminary estimates, the damage to state roads and road facilities in Sisak-Moslavina, Zagreb and Karlovac counties amounts to HRK 75 million, while the damage to county and local roads amounts to HRK 20 million. The Sisak railway station, a protected cultural monument,was recently reconstructed and the damage caused by the earthquake is estimated at HRK 20-40 million. The damage done to Croatian Motorways facilities is estimated at HRK 25 million. Petrinja mayor thanks volunteers: We need a functioning system now ZAGREB, 14 January (Hina) -Petrinja Mayor Darinko Dumbović said on Thursday that earthquake-hit areas did not need volunteers any more but a functioning system andexpert teams to inspect damaged buildings. "Structural engineers have conducted part of that task and I thank everyone who volunteered. Now we do not need volunteers in that regard but people who will be given that job, who will be paid and who will have set deadlines," saidDumbovićafter French Foreign Minister Jean-Yves Le Drian visited Petrinja earlier in the morning. According to Dumbović, so farjust over 6,000 of 13,000 buildings have been inspected. He said that professionals are needed and a system that has to function and for professionals to be paid. "When you pay someone they are bound by a deadline, but if we run late now, then everything will be late." Dumbovićbelieves that business premises are important because they are "the key to everything that will keep the city alive." He said that the money the city had received from the state was being spent on elementary needs such as delivering building material to repair chimneys, adding that buildings that could be repaired quickly would have a priority. Germany, France, Austria send Croatia additional assistance after quake ZAGREB, 14 January(Hina) -Germany, France and Austria have sent Croatia additional assistance following a magnitude 6.2 earthquake on 29 December, including sleeping bags, prefab containers, lighting systems and mattresses, the European Commission said on Thursday. They "are on their way to Croatia or will be in the coming days," the Commission noted, adding that "Slovenia delivered supplementary housing containers to Croatia on 11 January." The same day of the devastating tremor in the Petrinja, Glinaand Sisak area, Croatia activated the EU Civil Protection Mechanism, requesting winter tents for six to eight persons, lamps, light towers,electrical heaters, folding beds, sleeping bags and housing containers. Most of the assistance arrived within 24 hours. "Once more, I would like to thank all EU Member States for their prompt response to the earthquake. The overwhelming response of 15 EU Member States and 1 Participating State helping the Croatian people in times of need is a tangible example of EU solidarity,"said Commissioner for Crisis ManagementJanez Lenarčič. He visited Zagreb and the area affected two days after the quake. French foreign minister visits earthquake-hit Petrinja ZAGREB, 14 January (Hina) -French Foreign Minister Jean-Yves Le Drian visited Petrinja on Thursday, saying that his visit, which had been planned earlier, could not have started without first visiting earthquake-hit areas. "It would have been unthinkable to come to Croatia without visiting Petrinja," Le Drian said in the Petrinja barracks at the start of his official visit. "I wanted to start my trip by visiting Petrinja and the region to express my empathy and to show just how much we in France were touched by what happened to the population here," said Le Drian, who expressed solidarity with rescuers for "doing an excellent job." Le Driansaid that the French rememberCroatia's support when the Notre-Dame was in flames. Immediately after the devastating earthquake that struck Sisak-Moslavina County on 29 December, France sent 240 tents with equipment and there are 6 housing containers on their way from France. Croatia's Foreign and European Affairs MinisterGordan Grlić Radmanthanked his French counterpart for his visit,one week afterHungary's Foreign Minister Peter Szijjarto had also visited the earthquake area. "Thank you for your support, financial andmaterial but above all psychological. This expression of solidarity shows that Croatian citizens are not alone," Grlić Radman said in French. Petrinja MayorDarinko Dumbovićtold Le Drianthat Napoleon's forces were stationed in Petrinja at one stage and left their mark on the city.Le Drian then visited a linden tree planted in 1809 during the stay of Napoleaon's troops in that Croatian town. Dumbovićsuggested that each EU member state should take over the reconstruction of one particular building in the city. Croatian culture minister thanks Italian blue helmets of culture ZAGREB, 14 January(Hina) - Croatian Culture Minister Nina Obuljen Koržinek on Wednesday thanked Italian conservators-restorers who helped toevacuate thecultural heritage from earthquake-hit parts in Croatia and agreed the continuation of cooperation with the blue helmets of culture in restoration and reconstruction. The minister met with Italian Ambassador Pierfrancesco Sacco,three Italian cultural heritage protection experts who are members of the blue helmets of culture,and a restorer from the Italian Cultural Heritage and Tourism Ministry. The members of the blue helmets of culture were sent toCroatia by Italian Cultural Heritage and Tourism Minister Dario Franceschini, who already on 29 December, the day of the earthquake in Sisak-Moslavina County, offered the help of experts for the evacuation and protection of the cultural heritage. Obuljen Koržinek thanked the Italian specialists for the evacuation of several valuable ***collections***, the cooperation, and the unselfish exchange of knowledge and experiences with Croatian conservators, her ministry said in a press release. Participants in the meeting agreed the continuation of cooperation in securing and restoringthe damaged cultural heritage. Benedict XVI expresses closeness in prayer with earthquake-hit Croatia ZAGREB, 14 January (Hina) -Pope Emeritus BenedictXVI has sent a letter to the Archbishop of Zagreb, Cardinal JosipBozanić, expressing strong closeness in prayer with the suffering Church and faithful in Croatia, the Zagreb archdiocesan press office reported on Thursday. "Dear excellency, just as I started to write a few words of greeting for the New Year to thank you for your kind wishes in your letter of 10 December, I heard the news of the earthquake that caused considerable destruction in your beloved Archdiocese," Benedict XVI wrote. "I can only express my deep emotion and my share in the pain caused by this incomprehensible event," the Pope Emeritus underlined. In that regard, with all my heart I accept your plea 'to bless the Church in Zagreb and all of Croatia,' Pope Emeritus Benedict XVI wrote. The letter came after Pope Francis, speaking at ageneral audience, called for alleviating "the suffering of the dear Croatian people" who were affected by a 6.2 magnitude earthquake that struck central Croatia on 29 December. Auxiliary Bishop Šaško and Hungarian official discuss aid to quake-affected areas The Auxiliary Bishop of Zagreb, Ivan Šaško, met with Hungary's Secretary of State for Religious and International Relations,Miklós Solt\xC3sz, on Thursday during his visit to Zagreb. Theydiscussed the consequences of the devastating earthquakes in the Banovina region of central Croatia and in Zagreb, as well as Hungarian aid to the affected areas. They also talked about issues concerning Christian culture and evangelical values in the modern European society, the Archdiocesan Press Office said in a statement. Police have not established irregularities in allocation of mobile homes ZAGREB, 14 January(Hina) - The Police Directorate has said that so far no evidence hasbeen found to corroborateclaims about irregularities in the allocation of mobile homes and that a man hasbeen reported for disseminating false news about vaccination against COVID-19 being mandatory inthe earthquake-hit area. After a recording appeared on social networks in which a volunteer from Losinj accusedthe competent authorities of irregularities in the allocation of mobile homes in the region of Banija, hit by a devastating earthquake on 29 December, police started checking the allegations, the Police Directorate said in response to a query from Hina. Police checks conducted so far have not corroborated the allegations about irregularities in the allocation of mobile homes, the Police Directorate said. For some of the mobile homes it has been established that they were delivered to people for whom they were intended and for others checks are being made to establish to whom they were sent since police have established that some of the people for whom mobile homes were intended have in the meantime been given other housing units, which is why they have asked that the mobile homes intended for them be given to other people in need, the police said. The police also reported that a 47-year-old man from Sveti Đurađ was reported for disseminating falsenews on social networks about vaccination against COVID-19 being compulsory in the earthquake-hit areas. Sisak-Moslavina County Police Department spokesman Darko Kačmarčik told Hina that false claims were also disseminated on social networks about members of the Roma minority breaking into houses in the quake-hit area and looting and intercepting trucks with humanitarian aid, addingthat no such illegal activity had taken place. PM: No reason why public shouldn't know who took part in post-war reconstruction ZAGREB, 14 January (Hina) - Prime Minister Andrej Plenković said at a government session on Thursday that there was no reason whatsoever why the public should not be informed of who had taken part in housing reconstruction after the 1991-95 war. Plenković said that he had instructed the state secretary of the Central State Office for Reconstruction and Housing to systematise lists on housing reconstruction after the Homeland War in Sisak-Moslavina County, noting that there was no reason why those lists should not be made available to the public. ***Data*** containedin those lists are to be linked with the houses that underwent different types of reconstruction after the war, he said. "There were many models of reconstruction soit is important to establish all details before making any conclusions," he stressed. He went on to say that since 28 December 846 quakes had been registered, of which 75 measured 3 degrees on the Richter scale, 11 measured 4 and three measured 5 degrees on the Richter scale. On 28 December, the quake measuring 5.0 on the Richter scale hit Petrinja and was felt in central Croatia, and on 29 December, the magnitude 6.2 quake rocked the area and was felt in a largepart of Croatia and neighbouring countries. He thanked everyone helping the residents ofthe quake-hit area, including volunteers who in recent weeks came to Sisak-Moslavina County from other parts of the country or from other towns in the county to help the quake victims "either by working, making donations or preparing meals as caterers." He said that 41,500 reports on quake damage had been submitted so far, and that 18,370 buildings and houses had been inspected. "Compared to Zagreb, where 25,000 units were checked over a period of three months, this is very efficient and quick," he said. He stressed that efforts were being stepped up to vaccinate residents of the quake-hit area against COVID-19 considering specific circumstances and difficulties in complying with anti-epidemic measures. As for one-off allowances to the quake victims of HRK 2,500 for single persons and 3,500 for families, Plenkovićsaid that more than 14,000 requests for such assistance had beensubmitted and that HRK 10.5 million had been paid. By the timeall requests are processed, around HRK 50 million in one-off allowanceswill have been paid out, he said. ***Data*** on post-war reconstruction in Sisak-Moslavina County made public ZAGREB, 14 January (Hina) - The central state office for reconstruction and housing on Thursday released information on thepost-war reconstruction in Sisak-Moslavina County which includeslists of architects, contractors, building control surveyors engaged in that project,as well the costs of reconstruction. The quality of reconstructed houses and other buildings in Sisak-Moslavina County came into focus in the aftermath of the 29 December 6.2 magnitude earthquake whichsignificantly damagednumerous buildings that were rebuilt after the 1991-1995 Homeland War. The extensive damage caused by the disaster raised point of the quality of construction and supervision of works and also of the political and legal responsibility of authorities that organised reconstruction. Considering the justified public interest and series of queries from the media seeking information on hired architects and building control inspectors, contractors and construction auditorsand a statistical presentation of information related to budget funds spent, the central state office for reconstruction and housing has released information that does not hamper the current inspections by the relevant bodies, readsa statement on the office's website There are 83 architects and building control officerslisted and 202 contractors. There are also four branch supervisors and one auditorlisted. Contractors included small and large companies from throughout Croatia. This information is available at the following link:[*https://sduosz.gov.hr/vijesti-8/objava-informacija-o-obnovi-na-podrucju-sisacko-moslavacke-zupanije/1349*](https://sduosz.gov.hr/vijesti-8/objava-informacija-o-obnovi-na-podrucju-sisacko-moslavacke-zupanije/1349) Total of HRK 2.6 billion spent The ***data*** for Sisak-Moslavina County notes that 24,930 buildingswere reconstructed for a total investment of HRK 2.58 billion. The majority of this (HRK 2.17 billion) relates to organised reconstruction of houses designatedas Level IV to VI damage. There were 8,880 of these. A total of HRK 272 million was granted in HBOR loans for the reconstruction of 5,440 properties. Financial support for houses designated asLevel I to III damage amounted to HRK 63.5 million for 4,961 structures. While repairs to apartments, damagedstructuresamounted to HRK 47.7 million. A total of HRK 21 million was paid out as compensation for people who reconstructed or repaired their properties on their own and HRK 3.7 million was paid to obtain building material for the period prior to the Reconstruction Act being adopted. ***Data*** onsupport to local authorities indicates that the highest amount of the HRK 2.58 billion was allocated to Petrinja -HRK 735.1 million,Glina -HRK 412.4 million, Novska -HRK 343.5 million andSisak- HRK 114.5 million. SDP leader says Sisak-Moslavina County needs both reconstruction, revitalisation ZAGREB, 14 January (Hina) - Social Democratic Party (SDP) leader Peđa Grbin has welcomed the government's plan to amend the post-earthquake reconstruction law, noting that his party had called for it ten days ago and noting that Sisak-Moslavina County needed not only reconstruction but also revitalisation. "The SDP welcomes the government's amendments to the Act on the Reconstruction of the Earthquake-affected Areas, but we must study them carefully before taking a stand and deciding whether to submit our amendments. It is good that reconstruction is being expanded and that it will start soon but we already have reservations because the reconstruction effort will be coordinated by both the Fund (for Post-Earthquake Reconstruction) and the Central Office (for Reconstruction and Housing). We fear this will cause additional complications for citizens, excessive red tape and that sometimes it will not be clear who is in charge of what," Grbin said ahead of an online meeting of the SDP Presidency. He added that he was glad the government had accepted yet another of his initiatives, which was that reconstruction was not sufficient. Reconstruction and the relevant law are essential and they will help citizens who have been left without a roof over their heads, but full revitalisation is what is needed as well, he said. It is good the government has decided to launch the process of revitalisation but it is not good that there are no deadlines in that decision, Grbin sad, calling on the government to change that. Le Drian: France understands Croatia's wish to join Schengen area ZAGREB, 14 January (Hina) - The visiting French Minister of Europe and Foreign Affairs,Jean-Yves Le Drian, said in Zagreb on Thursday that Croatia wished to be admitted to the passport-free Schengen areaand that Paris could understand its wish. Addressing a news conference together with his host, Croatian Foreign and European Affairs Minister Gordan Grlić Radman, the French officialsaid that his country stood by Croatia after it was hit by a devastating earthquake. Grlić Radman added that Zagreb was thankful to France for its permanent support to Croatia's efforts to join theOrganisation for Economic Co-operation and Development (OECD). He recalled that admission to the Schengen area, to the euro area and to the OECDwere Croatia's three priorities in foreign affairs. Le Drian recalled that an aspirant's admission to the OECD required the approval of allmembers of that international organisation and that technical requirements should also be met. He commended Croatia for theefforts it had madeto fulfill the technical conditions. Asked by the press whether Paris could step up lobbying for Croatia's cause in return for possible decision by Zagreb to opt for FrenchRafales, one of the four bids for the procurement of multipurpose fighter jets for the Croatian Air Force, Le Drian dismissed this idea as too bold a connection. You imaginethat we may think of Rafale in exchange for Schengen membership, but things do not work that way foreign relations, the French minister said. France insists on two additional elements for the Schengen area - Schengen area management and permanent assessment of whether the member states meet the Schengen area criteria, he added. Croatia has the longest land border of the European Union, 1,150 kilometres, and the country has not finished the job of technical preparation for the Schengen area, Le Drian said. Grlić Radman said that his country was investing huge efforts to prevent unlawful crossings of the border and migrant smuggling. He added that Zagreb supported the proposed pact on asylum and migrants. Commenting on the tender for procurement of fighter jets, Le Drian said that Croatia wished to strengthen its air force and would make this decision autonomously. "It is its sovereign choice which aircraft it will purchase," the French minister said. Apart from the French bid, Israel, the USand Sweden have submitted their bids as well. France's Defence Minister Florence Parly, who visitedZagreb in November, said then that Paris was at the Croatian government's disposal for any additional questions about the planes and France wasconfidently waiting for the results and decision by the technical commission. I hope that in 2021 we will know the Croatian government's final decision, she said then. The French foreign minister reiterated his country's solidarity with the quake-affected Croatia. Immediately after the devastating earthquake struck Sisak-Moslavina County on 29 December, France sent 240 tents with equipment and there are six housing containers on their way from France. Grlić Radman said that the two countries were connected by the Mediterranean and announced Zagreb's bid to join the EUROMED7 initiative whichcurrently brings together Cyprus, France, Greece, Italy, Malta, Portugal and Spain. PM thanks Le Drian for France's quake relief ZAGREB, 14 January (Hina) - Zagreb and Paris have good relations that are based on their strategic partnership and Croatia is grateful for France's aid for itsearthquake-hit area, the Croatian government said after a meeting between PM Andrej Plenković and visiting French Foreign Minister Jean-YvesLe Drian on Thursday. The French ministervisited Zagreb and Petrinja, a town in Sisak-Moslavina County that washit by a 6.2 magnitude earthquake on 29 December. Using the EU Civil Protection Mechanism, France delivered six housing containers for the quake victims after donating several hundred tents to the heavily damaged region of Banija. The meeting between PM Plenković and Minister Le Drian confirms the two countries' good relations,based on their strategic partnership, the PM's office said in the statement. PM Plenković informed his guest that Croatia was committed to achieving two strategic goals - accession to the euro area and accession to the Schengen area of passport-free travel, and that it expected France's support for its efforts, the statementsaid. Addressing a news conference with his host, Foreign Minister Gordan GrlićRadman, Le Drian said that Paris understood Croatia's wish to enter the Schengen area and commended its efforts to meet the necessary technical requirements. PM Plenković and his guest also discussed current European and foreign policy issues, with emphasis on the coronarvirus pandemic, vaccine and economic recovery, it was said. The prime minister thanked France for its helpto the quake-hit areas of Sisak-Moslavina County. Earlier today, Le Drian and Grlić Radman visited Petrinja, where the French official said that he wanted to start his visit there in order to express sympathy and convey the solidarity the French felt with the earthquake victims. President Milanović receives French minister ZAGREB, 14 January (Hina) - President Zoran Milanović received France's Minister of Europe and Foreign Affairs, Jean-Yves Le Drian, during his official visit to Croatia on Thursday, the President's Office said in a press release. Bilateral relations between Croatia and France were described as excellent. The two officials discussed the importance of cooperation within the European Union, notably in the context of the fight against the COVID-19 pandemic and the continuation of the vaccination process. The talks also focused on the implementation of the Dayton agreement which ended the 1992-1995 war in neighbouring Bosnia and Herzegovina. Milanović highlighted the need to ensure full equality for the Croats in Bosnia and Herzegovina as a constituent people. Beroš: Downward trend in number of coronavirus cases continues ZAGREB, 14 January (Hina) - Croatia is seeing a continued downward trend in the numbers of new coronavirus infections and hospitalisations, which is reducing the pressure on the healthcare system, but there is no room for relaxing because of increases in other European countries, Health Minister Vili Beroš told a cabinet meeting on Thursday. "For the first time since 22 November we have recorded a decline in the number of hospitalisations below 2,000," Beroš said. Since many European countries continue to report increased numbers of new cases, despite the improved epidemiological situation in Croatia there is no room for relaxing in adhering to the epidemiological measures in place, the health minister said. 38,281 doses of vaccine have been used since 27 December "Since 27 December, 38,281 doses of vaccine have been used in Croatia. In terms of the number of vaccinations per 100,000 people, according to yesterday's figures Croatia ranks sixth highest in the EU. 3,652 people have been vaccinated in (earthquake-devastated) Sisak-Moslavina County," Beroš said, adding that 18,489 health workers have been vaccinated to date. He said that vaccination of people suffering from chronic diseases and people older than 65 who were not in care homes was starting gradually. He stressed the need for establishing mobile teams to vaccinate bed-ridden patients in care homes and teams to vaccinate people at their place of work. Croatia logs 980 new COVID cases, 45 deaths ZAGREB, 14 January (Hina) - In the past 24 hours there have been 980 new COVID cases registered in Croatia while 45 people have died, the national COVID response team said on Thursday. There are 5,210 active cases in the country, of whom 1,921 are patients in hospital treatment, including176 patients are on ventilators. Since 25 February when the first case was recorded in Croatia, there have been 223,097 registered cases of the novel coronavirurs and4,517 people have died as a consequence. A total of 213,370 have recovered, with 1,025 of them recovering in the past 24 hours. Currently 18,272 people are in self-isolation. A total of 1,102,552 people have been tested for coronavirus, with 6,847 tests conducted in the past 24 hours, the response teamreported. Twice as many men die of COVID than women, says daily ZAGREB, 14 January (Hina) - Twice as many men of all age groups die of COVID-19 thanwomen, the Jutarnji List daily said on Thursday. By 4 January, 4,126 people died of COVID-19 in Croatia - 2,417 men (59%) and 1,709 women (41%). The COVID-19 case fatality rate (CFR), which shows theproportion of deathscompared to the total number of people diagnosed, shows "that this epidemic is much more dangerous for older than younger generations," the newspaper quoted Dario Mustač, a PhD candidateat the Zagreb Faculty of Economics & Business,as saying. "The case fatality rate in every age group is higher for men than for women. For example, one in eight men infectedin the 70-79 age group dies, as do almost 40% of the men infected aged 90 orolder." According to an analysis by Mustač, the CFR in the40-49 age groupis 0.15% for men and0.11% for women, while in the 50-59 age group it is 1.06% for men and 0.26% for women. The higher the age, the higher the CFR, but it is twice as high for men than for women. Inthe 60-69 age group, COVID-19 has been fatal for 3.54% of men and 1.6% of women, in the70-79 age group for 12.83% of men and 6.56% of women, in the 80-89 age group for 24.71% of men and 14.28% of women, and in those 90 and older for 38.71% of men and 17.49% of women. The higher CFR among men in comparison to women is noticeable in mostcountries. The first case studies in China show that it was 2.8% among men and 1.7% among women. Croatia procures close to €1mworth of protective gear from China ZAGREB, 14 January(Hina) - The APL California ship arrived at the Rijeka Port from China on Thursday, carrying close to one million euros worth of protective equipment which the government procured for the Commodity Stockpiles Directorate from the Chinese company Sinopharm. The government said in a statement that this was the third delivery of protective gear from China in January. The latest delivery as well as the previous ones serve to maintain the continuity of protective equipment reserves necessary to fight the coronavirus epidemic, the government said. After it is unloaded, the equipment will be transported to the Civil Protection logistical centre at Jastrebarsko outside Zagreb from where it will be sentto medical and welfare institutionsas well as other institutions involved in the fight against the epidemic. The value of the protective gear delivered today is €905,934 and itconsists of FFP2 face masks, protective overalls and shoe covers. One in three lawmakers registers for vaccination ZAGREB, 14 January (Hina) - One-third of the deputies in parliament (51) wantto be vaccinated against COVID-19, the parliament said on Thursday after the deadline for parliamentarians to register for vaccination expired. Parliamentarians will be vaccinated on Monday ahead of the regular spring sitting. Based on reports parliament has at hand, 36 of the 151 MPs have already contracted and recovered from COVID-19 while 25spent time in self-isolation because they had been in contact with an infected person. If the number of MPs who have recovered from COVID-19 and the number of those who wish to be vaccinated are taken into account, about half of the lawmakers will be protected against the virus. Speaking to reporters after a meeting of the parliamentary leadership, SpeakerGordan Jandroković announced organised, voluntary vaccination of MPs against COVID-19. Asked if it was fair for parliamentarians to be vaccinated before some other people, hesaid that there were two reasons why parliamentarians should be vaccinated. "It is important that as political figures we send the message that people should get vaccinated, that the vaccine is important and that it can help in the fight against COVID-19," he said and underscored that the first lawmakers to be vaccinated would be those who had not contractedthe virus and those who were in risky groups. Jandroković also underlined the role of the Sabor as thebody that passes laws that arethe basis for the activities of the governmentand state institutions, rejecting claims that lawmakers were privileged. He added that he personally would not be vaccinated as he had recovered from COVID-19 and that he would wait six months and getvaccinated in early April. Croatia, Slovenia and Estonia EU members least affected by Brexit ZAGREB, 14 January (Hina) - Croatia is one of the three European Union members that will be least affected by the exit of Great Britain from the bloc, and consequently it will be awarded a lower amountof aid to deal with the aftermath ofBrexit. The European Union's Multiannual Financial Framework has a special€5 billion fund for mitigating the consequences of Brexit.In 2021, 4.2 billion is to be allocated for that purpose. The European Commission has outlined a draft scheme for the disbursement of assistance to the 27 member-states in proportion to the expected impact of the UK departure on them. Estonia, Croatia and Slovenia, the least affected countries, can count on €4.5 million, €4.3 million and €3 million respectively. Ireland, which will be affected the most, is entitled to €1.052 billion. The Netherlands follows and it can expect aid in the amount of €757 million. Germany and France will be entitled to €455 million and €420 million respectively to deal with the consequences of Brexit. The EU member statescan submit applications for aid until 30 September 2023. The grants will be paid in two turns, this year and in 2024. FinMin: Better-than-expected results of 2020 budget likely ZAGREB, 14 January (Hina) - Finance Minister Zdravko Marić said on Thursday that he expected better-than planned results from the 2020 budget, and also added that to date HRK 74.7 million had been raised in donations for the quake-affected areas. Addressing the press ahead of a cabinet meeting, Marić said that the expenditure side of the 2020 budget had almost been executed in its entirety. On the other hand, the revenue side has been a little better than planned by thebudget revision,by about HRK 1 billion. "Hence we can expect a slightly better result," saidMarić. The budget revision conducted in mid-November 2020 projected a total budget revenue of HRK 131.1 billion and expenditure of HRK 155.9 billion. Marić reiterated on Thursday that the 2020 budget was focused onjobkeeping measures and health safety and the circumstances caused by the earthquakes in Sisak-Moslavina, Karlovac and Zagreb countiesat the end of last year. He recalled that reallocation of budget funds had provided funds for health and HRK 120 million from budget reserves were set aside as emergency aid for earthquake-hit areas. Marić explained in detail how taxes would be defined on donations for earthquake relief, adding that to date HRK 74.7 million had been received in donations to the state treasury. The Tax Administration provides information on the matter on its website. Enterprises in lockdown to receive compensation for fixed costs in January too Minister Marićsaid that enterprises that are in lockdown due to extended restrictions imposed by the COVID response team will be eligible for compensation of part or all oftheir fixed costs for January too. He recalled that the criteria for compensation of fixed costs is a fall in revenue of more than 60% in that enterprises with a loss of revenue of between 60% and 90% will be partially compensated while fixed costs will be entirely compensated forthose enterprises with losses of more than 90%. INA pays dividend of HRK 62.27 per share to MOL, Croatian gov't ZAGREB, 14 January (Hina) - The INA oil company has finalised the payment of a dividend of HRK 62.27 per share to its two largest shareholders, the Hungarian MOL oil company and the state, INA reported on Thursday. In 2019 INAgenerated a profit of HRK 655.57 million and at its general assembly, held in August 2020, it decided that the majority of the amount or HRK 622.7 million should be paid out in dividends, amounting to HRK 62.27 per share. On25 September 2020 INA paid the dividend of HRK 62.27 per share to shareholders with the exception of its two largestshareholders who agreed that their dividend be paid by 15 January 2021 in an effort to uphold the company's money flow. A few days before the September payment, the government decided that it would extend the deadline for state-owned companies to pay their profit after tax into the state budget until 15 January 2021. A dividend of HRK 62.27 per share indicates that MOL, which holds slightly more than 4.9 million shares or 49.1% of the company, received HRK 305.6 million while the Croatian government, which holds 4.48 million shares or a stake of 44.8%, received HRK 279.2 million. Private andinstitutional investors, who hold a total of just over 608,000 shares or 6.1%, were paid a total of HRK 37.9 million in dividends. In the first nine months of 2020, INA Group generated a loss of HRK 1.05 billion whereas in the comparable period in 2019 it generated a profit of HRK 681 million. A financial statementissued previously for the Jan-Sept period of 2020 indicatedthat INA's sales revenue had contracted by 32% to HRK 11.2 billion. Bill on investment incentives sent to parliament ZAGREB, 14 January (Hina) - The government sent a bill on investment incentives to parliament on Thursday whereby the legislation is aligned with the latest EU directives and introduces new measures to relieve the consequences of the COVID-19 pandemic. The bill introduces three additional incentives to bail out the economy which has been affected with disruptions in 2020 caused by the COVID-10 epidemic. Economy Minister Tomislav Ćorić explainsthe bill will enable support for investments exclusively for those companies who did not have any difficulties on31 December 2019 but in the period from 1 January to 30 June 2020 fell into hardship. The bill will also enable the beneficiaries of incentives to extend the three-year implementation of relevant projectsfor another year. As far as liabilities prior to 31 December 2019, beneficiaries of investment incentives have to confirm that for two years prior to applying for the investment project and two years after its completion, thatproject has not been transferred elsewhere withinthe European economic area.The loss of jobs in the same or similar activities in the period from 1 January 2020 to 30 June 2021 in a particular project shall not be considered as a transfer in light of this law, due to theCOVID-19 pandemic. To date 1,300 applications for investment incentives pursuant to previous legislation havebeen received for investment projects conductedsmall, medium-sized and large enterprises. Of that number, 251 related to large enterprises and 1,049 were for SMEs. By October 2020, 90 entrepreneurs withdrew their applications and 43 were rejected, the government noted in a report. The planned amount of investments for a total of 1,167 investment projects (approved or being processed) amounts to more than HRK 52.3 billion and the plan is to open 28,629 new jobs. Of that amount HRK 25.5 billion and 10,961 new jobs are related to investments by large enterprises and more than HRK 26.8 billion are related to investments bySMEs and 17,668 new jobs. National development strategy sent to parliament for discussion ZAGREB, 14 January (Hina) - At its meeting on Thursday, the Croatian government adopted a proposal for a national development strategy until 2030 and sent it to parliament for discussion. The Minister of Regional Development and EU Funds, Nataša Tramišak, said that the national development strategy was the hierarchically highest act of strategic planning in the country and that its purpose was to ensure long-term targeting of public policies for social and economic development. "The implementation of the national development strategy will ensure sustainable and stable development of Croatia and increase the quality of life for all our citizens," Tramišak said. The strategy has been developed with the participation of experts, socially relevant partners and all government departments. It was unveiled by Prime Minister Andrej Plenković and his ministers on 12 November 2020, after which it was put to public consultation for 30 days. It was adopted by the steering committee on Wednesday, the minister said. Prime Minister Plenković thanked everyone who had participated in the development of the strategy in the last three years, saying that it was a very good document that would serve asa basis for the development of the country in the decade ahead. During the presentation of the strategy in November, Plenković said that ten years from now he saw Croatiaas a competitive, innovative and stable country of recognisable identity and culture, with preserved resources, good living standards and equal opportunities for all. The document lists 13 goals: a competitive and innovative economy;educated and employed people;an efficient judiciary, public administration and state property management;global recognisability anda stronger international position and role of Croatia;healthy, active and high-quality life of citizens;demographic revitalisation and a better status of family;security for stable development;ecological and energy transition to climate neutrality;self-sufficiency of food production and development of a bioeconomy;sustainable mobility, digital transition of society and the economy;development of assisted areas and areas with development particularities;and greater regional competitiveness. One of the targets is for GDP per capita to reach 75% of the EU average by 2030, up from the 65% in 2019. The employment rate should reach 75% (66.7% in 2019), and Croatia should rank 45th or higher on the Global Competitiveness Index (63rd in 2019). Croatia still above EU average in terms of house price growth ZAGREB, 14 January (Hina) - In Q3 2020 Croatia continued to record an increase in house prices that was above the EU average but it was also among the four countries where those prices fell compared to the previous quarter, shows a ***Eurostat*** report. Real estate prices in the EU in Q3 2020 rose by 5.2% from the same period of 2019 and the same increase was also registered in Q2. In the euro area house prices grew by 4.9%, just as in Q2. Among the EU countries for which ***data*** were available, house prices grew the most in Q3 again in Luxembourg, by 13.6%, and in Poland, by 10.9%. Austria followed with an increase of 8.8%. In Croatia, prices of real estate in Q3 2020 grew by 6.9% from the same period of 2019. They grew by 8.3% in Q2 and by 9.1% in Q1. A year-on-year decline in house prices was reported in Q3 only by Cyprus and Ireland, of 1.4% and 0.8% respectively. House prices in the EU in Q3 grew by 1.4% from Q2, when they rose at the same rate. Among EU countries, real estate prices in Q3 grew the most on the quarter in Hungary, by 5.2%, according to preliminary ***statistics***. Hungary is followed by Denmark and Latvia, with quarterly increases of 4.2% and 3.7% respectively. In Croatia house prices in Q3 were down from Q2 for the first time in slightly more than two years, by 0.6%. They grew by 1.8% in Q2 and by 2.7% in Q1. The other countries that saw a quarterly drop in house prices were Cyprus (-4.8%), Romania (-2.6%) and Italy (-2.5%). Tourist guides, like other interested parties, can participate in public consultation ZAGREB, 14 January (Hina) - Tourism and Sport Minister Nikolina Brnjac said on Thursday that the proposed amendments to the law on tourism services had been put to public consultation and that all interested parties could participate, including tourist guides who hadcriticised her over the amendments. Tourist guides have criticised the ministry over the amendments, saying that while they had paid for expensive courses and taken exams the ministry was now allowing foreign tourist guides to work in Croatia without such training and without any criteria. They also complained about being excluded from the consultation on the bill. "The bill has now been put to e-consultation for 30 days and all interested parties can participate in it. There are two infringements of EU law that we need to address. One concerns travel vouchers and the other tourist guides," Brnjac told reporters before a cabinet meeting, adding that any comments made during the consultation would be considered and later included in the elaboration of rules. She said that under the amended law anyone not wishingto use vouchers for paid travel that could not beeffected because of the coronavirus pandemic would be refunded. As for the infringement concerning tourist guides, she said that the European Commission called for streamlining of training because now there were 21 professional exams in force plus a general exam that tourist guides needed to take. Brnjac said that foreign tourist guides needed approval from the the Ministry of Tourism and Sport to be able to work in Croatia and that they wererequired to present proof that they had passed a professional exam. ECHR: Croatian authorities' response to homophobic attack was ineffective ZAGREB, 14 January (Hina) - The European Court of Human Rights (ECHR) has ruled that the Croatian prosecutorial authorities did not effectively respond to a report of a violent homophobic attack that occurred in 2010. The ECHR found that articles of the European Convention on Human Rights prohibiting inhuman or degrading treatment and discrimination had been violated in this case, the office of the Croatian representative to the Strasbourg-based court said on Thursday. The case was brought by a woman after she was attacked by a man in a Zagreb nightclub in 2010. She refused his advances, saying that she was a lesbian, after which he severely beat and kicked her. She reported the attack to the authorities, but in her opinion they did not respond adequately and effectively to protect her human rights. The attacker was convicted in minor-offence proceedings of breach of public peace and order and given a fine of HRK 300 (€40). The applicant lodged a criminal complaint before the State Attorney's Office, alleging she had been the victim of a violent hate crime and discrimination. The State Attorney's Office rejected the criminal complaint because the attacker had already been prosecutedin the minor-offence proceedings for the same crime, saying that his prosecution would amount to double jeopardy. The ECHR found in particular that the minor-offence proceedings against the attacker had not addressed the hate-crime element of the offence and had resulted in a derisory fine. It said that the authorities should have examined this element instead of rejecting the criminal complaint on the grounds of double jeopardy. The ECHR found that the Croatian authorities, by unnecessarily instituting the ineffective minor-offence proceedings, had themselves undermined the possibility of putting properly into practice the relevant provisions and requirements of domestic criminal law. The ruling is not final yet and it will become so if neither party applies to the ECHR Grand Chamber within the next three months. PM says HDZ MP Puljašić resigns from parliament ZAGREB, 14 January (Hina) - Prime Minister Andrej Plenković confirmed on Thursday that Požega Mayor and HDZ MP Darko Puljašić had resigned as a member of parliament following media reports revealing his involvement in the rigging of a tender for the energy renovation of buildings in that town. "We support the competent institutions in shedding light on the matter, and if responsibility is established, he should answer," Plenković told a news conference after a recording was made public in the media of a conversation in which Puljašić spoke about fixing a tender for the energy renovation of apartment buildings. The county HDZ branch will decide whether Puljašić will remain in the party, said Plenković. Asked why Puljašićwas put on the party's slate for the parliament considering that he had been indicted in other cases, Plenković said that he was put on the slate after the head of the county HDZ branch, Željko Glavić, decided not to run for parliament. "We can'tscore every time. We can even admit mistakes if necessary, that's a major step forward," Plenković added. As for the freedom of media, Plenković said that he supported it in every regard and that it would never occur to him to sue a media outlet but that he also had the right to say what a media outlet reported about and how. He declined to comment on senior HDZ official and EC Vice-President Dubravka Šuica's statements about Banovina and Banija and claims that the media were trying to topple the HDZ, saying that he did not want to comment on "closedmeetings". He said reporters should ask for a clarification those who shared such information fromclosed party meetings and to first identify "the deep throat". As for plans for the relaxation of anti-epidemic measures as of 1 February if the number of new infections drops more significantly, Plenković said that in the period until 31 January thesituation would be analysed and that if it provedgood, the current restrictions could be relaxed. Slovenian gov't agrees to pay smaller amount of funding to STA news agency ZAGREB, 14 January(Hina) - The Slovenian government on Thursday approved a certain amount of funding which it is legally obliged to pay to the national news agency STA following numerous interventions and expressions of support from the country and abroad to the agency's staff so that they can dobusiness as usual. The government's communication office (UKOM) said that the government's decision came after theEuropean Commission clarified, at thegovernment's request, that there are no obstacles to funding member states' news agencies for their public service performance if the state subsidy does not exceed €15 million annually and if it is given as help to agencies in their role of socially useful information services. The STA is financed annually, based on a contract,with around €2 million from the state budget, and the agency earns the rest of the funds necessary for its operation on the market. Hina has learned that the government has for now approved the payment of its obligations towards the agency only for the last two months of 2020, which itwas refusing to do until now, claiming that the agency's management isrefusing to disclose to it some business information. STA staff considers this to be a pretext to exert influence on journalists' work and their view has been supported by journalists' associations and unions. STA has been trying for months, without success,to launch talks with the government on the conclusion of a regular annual financing contract for 2021 so its business stability and sustainability of its financing arestill at risk. Krško nuclear power plant exceeds business plan for 2020 ZAGREB, 14 January (Hina) - The GEN energy company, which operates the Slovenian half of the Krško nuclear power plant on behalf of the government, earned a gross profit of €56 million last year, exceeding its business plan, CEO Martin Novšak told a press conference on Thursday. GENis a member of the GEN Energija consortium which also operates hydroelectric power plants on the River Sava, supplying 40% of electricity in Slovenia. The company's revenue surpassed €2.3 billion, and the consortium reported €100 million in investments last year. In 2020, the Krško nuclear power plant exceeded its planned output by 1.4%, generating more than 6 terawatt-hours of electricity, despite a brief automatic shutdown following a strong earthquake in the Petrinja area of central Croatia at the end of December. Speaking of plans for the Krško plant, Danijel Levičar, Chief Operating Officer of the GEN Energija consortium, said that important steps had been taken in developing a second block of the plant. He said that a macroeconomic study was being prepared with an assessment of the economic and societal impact of the second block. "In Slovenia, nuclear technology is indispensable for a modern, strategically-oriented energy self-sufficiency of the country and for strengthening its economic and social development," Levičar said. This year the plant will be shut down for 35 days for regular overhaul, Levičar announced. The Krško nuclear power plant, located in the east of the country near the border with Croatia,is co-owned by GEN Energija and the Croatian state-owned power company HEP. Slovenia logs 1,767 coronavirus cases, extends state of epidemic for 2 months ZAGREB, 14 January(Hina) - In the past 24 hours 1,767 coronavirus cases have been confirmed in Slovenia and restrictions will remain in place by 22 January at the earliest, the government said on Thursday, extending the state of epidemic for another two months. The government said the conditions did not allow for relaxing restrictions because the number of daily infections are still high, although the number of hospitalisations is stabilising. In the past 24 hours 1,415 of the 5,637 PCR tests done came back positive, while 5,857 rapid antigen tests confirmed 352 infections, the Health Ministry said. The number of active cases is 23,230 and the daily average of newinfections in the past seven days is 1,549, with both indicators declining. Currently 1,244 COVID-19 patients are hospitalised, including 205 in intensive care. In the past 24 hours 17 COVID-19 patients have died, bringing the death toll to 3,070. By Tuesday24,462 people in Slovenia have been vaccinated against the virus. Bosnia sees fall in coronavirus numbers, Pfizer vaccine to arrive by end of January ZAGREB, 14 January(Hina) - In the last 24 hours, 343 new cases of the coronavirus infection have been registeredin Bosnia and Herzegovina, and there have been 12 deaths linked to COVID-19, the local authorities stated on Thursday. Civilian Affairs Minister Ankica Gudeljević was quoted by the local media as saying that the first batch of between 4,000-5,000 doses of the COVID-19 vaccinedeveloped by Pfizer, could be expected in the country bythe end of this month. The shipment of the vaccinewill be organised through the COVAX system. One miner killed, four injured in central Bosnia ZAGREB, 14 January (Hina) - A worker was killed and four more were injured in a mining accident in Breza, central Bosnia and Herzegovina, local media outlets reproted on Thursday. Mine workers trade union leader Sinan Husic was quoted by media as saying that the miner lost his life and four more sustained injuries when a large amount of coal had fallen on them in an underground coal mine in the town of Breza. Mining accidents are rather frequent in local mines due to poor working conditions. Eight young people who died in Bosnia killed by carbon monoxide ZAGREB, 14 January(Hina) - Carbon monoxide poisoning was the cause of death of eight young people on 1 January near Posušje, Bosnia and Herzegovina,the Western Herzegovina Canton prosecutor's office said on Thursday. "It was established after blood analysis that all eight were poisoned by carbon monoxide and that the blood level was fatal," cantonal prosecutor Josip Aničić told the press. The findings confirmed investigators' initial assumptions as to the cause of death ofMirelaRezo, StjepanJukić, IvanMiličević, Stipe Romić, ŽanaPavković, MiaSoldo, Stipe Pavković andMarija Pavković. A generator that was the cause of the gas exhausted that killed the four young men and women was also analysed. Three Serb ex-soldiers given 14 years each for war crimes in central Bosnia ZAGREB, 14 January (Hina) - The Appeals Chamber of the State Court of Bosnia and Herzegovina on Thursday upheld a trial-court ruling sentencing three wartime Bosnian Serb soldiers to 14 years in prison each for killing 28 Bosniak and Croat prisoners of war in central Bosnia in 1995, the court reported on Thursday. The defendants Branko Čigoja, Željko Todić, and Saša Boškić were convicted of war crimes they had committed in Mrkonjić Grad and Donji Vakuf. On 13 September 1995, they killed 24 local Bosniaks and four Croats in the village of Oborci near Donji Vakuf after the victims had been captured in Mrkonjić Grad and forced to dig ditches for the Serb army in the area. In other news: 6.4% more building permits issued in November 2020 y-o-y ZAGREB, 14 January (Hina) -In November 2020, there were 851 building permits issued in Croatia, which is 6.4% more than in November 2019, the Croatian Bureau of ***Statistics*** (DZS) reported on Thursday. Based on the type of construction, 83% of permits (703) were issued forbuildings and 17% (148) for civil engineering works. Year on year, the number of permits issued in November 2020 for buildings increased by 8.6% while civil engineering works decreased by 3.3%. The value of construction based on the permits issued in November 2020 amounted to HRK 2.55 billion or 43% less than in November 2019 when they were valued at HRK 4.45 billion. The value of construction works on buildings is estimated at HRK 1.73 billion or 2.2% less than in November 2019 while the value of other construction works contracted by almost 70% to HRK 814.3 million. According to the type of construction, 644 building permits or 76% were issued for new structures while 24% or 207 were for reconstruction. Based on the permits issued in November 1,146 new apartments are expected to be built. In the first eleven months of 2020 a total of 8,519 building permits were issued, down 6.2% on the year, and the works were estimated at a value of HRK 25.3 billion, down 23% from the corresponding period in 2019. Industrial producer prices in Dec drop 2.5% ZAGREB, 14 January (Hina) -In December 2020, producer prices of industrial products increased by 1% compared to November 2020, whilecompared to December 2019, they decreased by 2.5%, the Croatian Bureau of ***Statistics*** said on Thursday. Industrial producer prices have been decreasing year on year since March 2020, when they fell by 2.7% from March 2019. The highest annual drop was recorded in May, by 6.6%. In December 2020, producer prices of industrial products on the non-domestic marketincreased by 0.8% compared to November 2020, while compared to December 2019, they decreased by 4.0%. Producer prices of industrial products on the domestic marketincreased by 1.0% compared to November 2020, while they decreased by 1.2% compared to December 2019. As compared to November 2020, producer prices of industrial products increased in Energy by 4.8%, in Intermediate goods by 0.2%, in Capital goods and Durable consumer goods by 0.1%, while they decreased in Non-durable consumer goods by 0.2%. As compared to December 2019, producer prices of industrial products increased in Capital goods by 0.6% and in Intermediate goods by 0.1%, while they decreased in Energy by 10.8%, in Durable consumer goods by 1.4% and in Non-durable consumer goods by 0.3%. ZSE: Crobex breaks 7-day upward trend ZAGREB, 14 January (Hina) - The Zagreb Stock Exchange (ZSE) Crobex index fell by 0.07% to 1,821 points on Thursday, breaking its seven-day upward trend, while the Crobex10 continued going up for eight straight days, gaining 0.05% to close at 1,142 points. Turnover at the close of the trading session was HRK 4.5 million, about 3.4 million lower than on Wednesday. An additional HRK 3.6 million was generated by a block transaction with shares of the HT telecommunications company, at HRK 184 per share. The highest turnover, of HRK 2 million, was generated by shares of the Podravka food company. Their price increased by 1.2% to HRK 500 per share. No other stock passed the turnover mark of one million kuna. Twenty-six stocks traded today, with nine of them registering share price increases, 10 recording price decreases and seven remaining stable in price. (€1 = HRK 7.574979) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2100 HRS THURSDAY. (Hina) ms Masthead Brief News Bulletin is published by the Croatian News Agency HINA Marulićev trg 1610 000 ZagrebCroatia web:[*www.hina.hr*](http://www.hina.hr) mail: [*hina@hina.hr*](mailto:hina@hina.hr) phone: (+385 1) 48 08 660; fax (+385 1) 48 08 822 Publisher: Branka Gabriela Valentić, DirectorEditor in Chief: Serđo Obratov Bulletin Editor: Marija Šestan

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antiperspirant soap; antiperspirants; artificial tanning preparations; bath lotions; bath salts not for medical purposes; beard softeners; beauty care products; beauty masks; bleaching preparations and other substances for laundry use, cleaning, polishing, scouring and abrasive preparations; body care products; body powder; boot cream; boot polish; cleaning agents for the hands; cleaning preparations; cleansers; cleansing milk for toilet purposes; colouring matters; cosmetic kits; cosmetic preparations for tanning the skin; cosmetics; creams; dentifrices; deodorant soaps; deodorants; depilatory preparations; detergents; disinfectant soaps; dye stuffs (cosmetic); dyes for the beard; eau-de-cologne; emery cloth; emery cloth for nail grooming; emery paper; essential oils; eye makeup; eyebrow cosmetics; eyebrow pencils; gels for use on the hair; hair bleaching preparations; hair care products; hair colorants; hair dyes; hair lotions; hair setting preparations; hair spray; hair waving preparations; hand care preparations; lip balms [non-medicated-]; lotions for cosmetic purposes; makeup; makeup powder; makeup preparations; makeup removing preparations; medicated soaps; moisturisers; mouthwashes; nail care preparations; nail polish; nail vanish removing preparations.; nail varnish; non-medicated preparations for use after shaving; non-medicated toilet preparations; oil for the body; oils for cosmetic purposes; oils for perfumes and scents; perfumery; perfumes; preparation for the care of the body; preparations for freshening the breath [not medicated]; pre-shaving and after shaving lotions; shampoos; shaving preparations; shaving soaps; shoe cream; shoe polish; shoe wax; shower preparations; skin care products; skincare preparations; soaps; stain removers; sun tanning preparations; talcum powder; tints and lotions all for the hair and beard; tissues impregnated with cosmetic lotion; toilet articles; toilet water; toiletries; towels containing non-medicated toilet preparations; washing and bathroom preparations; parts, fittings and components for all the aforesaid goods.Class 4Industrial oils and greases; wax; lubricants; dust absorbing, wetting and binding compositions; fuels and illuminants; candles and wicks for lighting; non-chemical fuel additives; wool for use as fuel; christmas tree candles; electrical energy; grease for boots, shoes and leather; illuminating wax; oils for paints; perfumed and scented candles.; sweeping (dust binding compositions for –); tapers; textile oil; parts, fittings and components for all the aforesaid goods.Class 5Pharmaceuticals, medical and veterinary preparations; sanitary preparations for medical purposes; dietetic food and substances adapted for medical or veterinary use, food for babies; dietary supplements for human beings and animals; plasters, materials for dressings; material for stopping teeth, dental wax; disinfectants; preparations for destroying vermin; fungicides, herbicides; adhesive plaster; adhesives for dentures; air freshening preparations; analgesics; antiseptic preparations; bacteriological cultures (media for–); bandages and dressings; belts for sanitary napkins [towels]; car air fresheners; chemical conductors for electrocardiograph electrodes; cold creams for the treatment of sporting injuries; contact lens cleaning preparations; dietary supplements for humans and animals; dietetic beverages adapted for medical purposes; dietetic food and substances adapted for medical or veterinary use, food for babies; dietetic food preparations having a low fat content [adapted for medical purposes].; dietetic foods adapted for persons having complex metabolic disorders for medical purposes; dietetic substances adapted for medical use; dietetic substances for medical use in weight control; disinfectants for hygiene purposes; dog washes; drinks predominantly of minerals or vitamins; drugs for medical purposes; filled first aid boxes and kits; food supplements; foods for persons having complex metabolic disorders; gauze bandages [dressings]; hand-sanitising preparations; kits containing medical preparations; materials for dressings; meal replacement and dietary supplement drink mixes; meal replacement powders; medicated food for sportsmen; medicated foods for sports persons [vitamins or minerals]; medicinal preparations and substances; mineral and protein preparations and substances; mineral drinks [medicated]; muscle relaxants; naturopathic and homeopathic preparations and substances; ***nutrients*** and nutriments; nutritional and dietary supplements; oxygen for medical purposes; pesticides; pharmaceutical preparations and substances; plant compounds and extracts for use as dietary supplements; plasters; powdered dietary food concentrates and dietetic substances for use in a weight reduction programme for medical purposes; preparations for dietary use; protein foods for human consumption [adapted for medical purposes]; protein supplements; radium for medical purposes; sterilising preparations; stimulants made of vitamins; tapes for bandaging; vitamin, dietary and mineral supplements; vitamin drinks; vitamin preparations; vitamins; waters [beverages] for medical purposes; parts, fittings and components for all the aforesaid goods.Class 6Common metals and their alloys, ores; metal materials for building and construction; transportable buildings of metal; non-electric cables and wires of common metal; small items of metal hardware; metal containers for storage or transport; safes; small items of metal hardware; unwrought and partly wrought common metals including simple products made of them; badges of metal for vehicles; metal badges; keyrings and key chains; locks; keys; ornaments; metallic bins; keys, key blanks; signs; statues, statuettes and figurines; bronzes; trophies made of metal; money boxes; boxes; trophies; models of precious metal; all made wholly or principally of common metals; parts, fittings and components for all the aforesaid goods.Class 8Hand tools and implements, hand-operated; cutlery; side arms; razors; hand-operated hygienic and beauty implements for humans and animals; lifting tools; emergency and rescue hand tools; garden tools, hand operated; scissors; crimping irons, curling tongs; eyelash curlers; manicure sets; nail clippers, nail files; pedicure sets; pruning shears; tweezers; tongs; pizza cutters; emery boards; electric irons; hair styling apparatus; hair waving apparatus; parts, fittings and components for all the aforesaid goods.Class 9Scientific, research, navigation, surveying, photographic, cinematographic, audio-visual, optical, weighing, measuring, signalling, detecting, testing, inspecting, life-saving and teaching apparatus and instruments; apparatus and instruments for conducting, switching, transforming, accumulating, regulating or controlling the distribution or use of electricity; apparatus and instruments for recording, transmitting, reproducing or processing sound, images or ***data***; recorded and downloadable media, computer software, blank digital or analogue recording and storage media; mechanisms for coin-operated apparatus; cash registers, calculating devices; computers and computer peripheral devices; diving suits, divers' masks, ear plugs for divers, nose clips for divers and swimmers, gloves for divers, breathing apparatus for underwater swimming; fire-extinguishing apparatus; abdominal guards (for protection against accidents and injury); alarms; amplifiers; antennas; apparatus and instruments for recording, transmitting and reproducing sound, ***data*** and/or images; apparatus for recording, transmission or reproduction of sound or images; apparatus for use with computers; audio and video tapes and discs, all in pre-recorded form; audio apparatus; audio recordings; audio speakers; audio systems; automatic playback machines; bags and cases specially adapted for holding or carrying portable, mobile, handheld and tablet devices and equipment and accessories for such devices; batteries; batteries, electric; battery boxes; battery chargers; binoculars; blank and pre-recorded cods, discs, records, tapes and cassettes; blank tapes for recording audio and video; body protectors; books recorded on disc; breast protectors; cabinets and stands all adapted for audio, video and television apparatus and instruments; cables, electric; calculating machines; calculators; camcorders; camera film; camera lenses; cameras; cards containing an integrated circuit chip; cards encoded with security features for authentication purposes; cards using magnetic memories and integrated circuit memories; carriers for mobile phones; carrying cases adapted for sunglasses; cases adapted for binoculars; cases for mobile phones; cases for spectacles and sunglasses; cassette decks; cd players; cd radio cassettes; cd roms; cellular phones; chains and cords for spectacles and sunglasses; cinematographic film, exposed; cleaning apparatus for sound recording discs; clocks (time recording devices) and timers; clothing for protection against accidents, radiation and fire; coin-operated apparatus (mechanisms for –); combined televisions and vcrs; compact discs; company magazines downloaded via the internet; computer application software; computer application software for portable, mobile, handheld and tablet devices; computer application software relating to or featuring games, casino games, card games, gambling or betting; computer game and video game programs; computer game software; computer games; computer games hardware; computer hardware; computer peripherals; computer programs; computer software; computer software and computer hardware apparatus with multimedia and interactive functions; computer software and computer programs downloadable from or provided via the internet; computer software and computer programs relating to or featuring games, games based on skill, casino games, card games, gambling or betting; computer software for telecommunications and communication via local or global communication networks, including wifi, the internet, intranets, extranets, television, mobile communication, cellular and satellite networks; computer terminals; computers; computers, laptop and notebook computers, game computers; conductors, electric; containers for microscope slides; controllers and keypads all for heating, ventilation, air conditioning, lighting and security; counters; ***data*** carriers with integrated electronic chips; ***data*** carriers with integrated microprocessor chips; digital audio tapes; digital versatile discs; disc and tapes all for video games; disc drives; discs and tapes all for video games; discs bearing video recordings; divers apparatus; downloadable computer and video game software and programs; downloadable electronic computer game and video game software and programs; downloadable electronic publications; downloadable interactive computer game and video game software and programs; downloadable publications, namely, company magazines downloadable via the internet; downloadable virtual reality computer game and video game software and programs; ear plugs; elbow pads, shields and protectors; electric cleaning apparatus; electric hair curling apparatus; electric installations for the remote control of industrial operations; electric power cables; electrical apparatus and instruments, all for office use; electrical domestic appliances; electrolysers; electronic bulletin boards; electronic computer game and video game programs; electronic computer game and video game software; electronic message boards and electronic information display boards; electronic publications distributed via email; encoded cards and magnetic encoders; encoded chip cards containing programming used for financial applications, loyalty programs, rewards programs and card holder preferences; extension cables; extension leads; eyeglass cases; eyeglasses; eyewear, spectacles, sun glasses, sports goggles and eyewear, swimming goggles; face shields; facsimile processing apparatus and instruments; fences (electrified –); filters for respiratory masks; flexible (shaped-) covers for the controls of electrical apparatus; floats for bathing and swimming; fluorescent screens; frames and lenses for spectacles and sunglasses; frames for glasses; games software; goggles for skiing; goggles for use in sports; graphic equalisers; head cleaning tapes; headphones; headsets; helmets (excluding cycling helmets); holders adapted for mobile phones; hologram impregnated cards; holograms; interactive computer game and video game programs; interactive computer game and video game software; interactive electronic computer game and video game software; interactive multimedia computer game and video game programs and software; joysticks for use with computers; juke boxes; karaoke machines; knee pads, shield and protectors; laptop carrying cases; laptop covers; lenses for eyewear, spectacles and sunglasses; life belts, jackets and buoys; light conducting filaments [optical fibers]; luggage scales; magnetic ***data*** carriers, recording discs; magnets; magnifying glasses; measures; measuring instruments; measuring tapes; memory sticks; mobile applications featuring virtual reality software and games; mobile phone covers; mobile phone straps; mobile telephones, cordless telephones; money counting and sorting machines; monitoring apparatus, electric; mouse mats; mouse pads; mouth protectors (gum shields); mp3 players and portable and handheld digital electronic devices for recording, organising, transmitting, manipulating, and reviewing text, ***data***, audio and video files; navigation apparatus for vehicles [on-board computers]; odontoguards; optical apparatus and instruments; paging apparatus; pedometers; periscopes; personal cd players; personal stereos; phone appliances; phone covers [specifically adapted] and covers for portable and handheld digital electronic devices; phonograph records, cassettes and discs; photocopying apparatus and instruments; photographic apparatus and instruments; plastic covered cards bearing printed matter [encoded]; plugs, sockets and other contacts [electric connections].; pocket calculators; portable audio apparatus and instruments; pre-paid magnetic cards; programmable timers; protection devices for personal use against accidents; protective clothing and accessories; protective clothing for diving; protective clothing for participants in motor sports [for the prevention of accidents]; protective clothing, headgear and footwear for use in sport; protective glasses, sunglasses and goggles; protective helmets; punched card machines for offices; radio cassettes; radio receivers; radios, clock radios; record players; remote control apparatus; safety survival suits; satellite navigational apparatus; satellites and decoders; scales; security encoded cards; semi-conductors; shaped covers for the controls of electrical apparatus; signalling whistles; skateboard helmets; smart cards, magnetic coded cards, electronic ***data*** carrier cards, charge cards, bank cards, credit cards, debit cards, chip cards, stored value cards, payment cards, pre-paid cards; sound recording; speakers, loud speakers, earphone speakers, speaker cables; spectacle holders; sport glasses [eye glasses]; sports eyewear; sports goggles; sports helmets and visors; stamping mail (apparatus to check –); straps and cases for eyewear and sunglasses; straps for sunglasses; sunglasses; surge protectors; swimming goggles; tape players; tape recorders; tapes, discs and floppy discs, all recorded with computer programs; telecom apparatus (including international prepaid phonecards and electronic vouchers); telecommunication installations, apparatus and instruments; telecommunications apparatus (including international prepaid phonecards and electronic vouchers); telephone answering apparatus and instruments; telephone apparatus; telephones, mobile telephones, cordless telephones; television aerials; television apparatus and instruments; televisions; televisions for receiving satellite broadcasting; tokens for activating electrical, electronic and telecommunications apparatus and instruments; transformers; tuners; turntables; typewriting apparatus and instruments; digital storage devices; video apparatus and instruments; video cameras; video disc players; video game software; video games; video recording machines; virtual reality computer game and video game programs; virtual reality computer game and video game software; virtual reality headsets and helmets; visual display units; voting machines; wearable video display monitors; word processing apparatus and instruments; compasses; cases for mobile telephones; computer games; parts, fittings and components for all the aforesaid goods; all of the aforesaid excluding body protection for cyclists and cycle helmets.Class 10Surgical, medical, dental and veterinary apparatus and instruments, artificial limbs, eyes and teeth; orthopaedic articles; suture materials; therapeutic and assistive devices adapted for persons with disabilities; massage apparatus; apparatus, device and articles for nursing infants; bandages; cold and hot packs for medical purposes; dental face mask and dental gloves; elasticized wraps for limbs and joints for medical use; face masks for medical use; hearing protectors; neoprene braces for limbs and joints for medical use; orthodontic machines and instruments for dental purpose; prosthetic instruments for dental purposes; sports supports; suspensory bandages for use in sports; parts, fittings and components for all the aforesaid goods.Class 11Apparatus and installations for lighting, heating, steam generating, cooking, refrigerating, drying, ventilating, water supply, sanitary purposes; apparatus and installations for refrigerating; barbecue grills (lava rocks for use in –); conditioning air (installations for –); curling lamps; disposable sterilization pouches; filters for drinking water; gas lighter; glow sticks; hair drying apparatus and appliances; heating apparatus; hot water bottles; hydrants; lamps; nuclear fuel and nuclear moderating material (installations for processing); radiators, electric; refrigerators; stage smog maker; toilet seats; torches for lighting; ultraviolet ray lamps, not for medical purposes; watering installations, automatic; all the aforesaid excluding cycle lighting and associated apparatus for cycle lighting; socks, electrically heated; burners; parts, fittings and components for all the aforesaid goods; all of the aforesaid excluding cycle lighting and associated apparatus in this class.Class 12Vehicles; apparatus for locomotion by land, air or water; car screen shields and sun blinds; car tidies; coverings for car seats; electric vehicles; hand cars; inner tubes (repair outfits for–); shopping carts; sleighs; vehicle accessories, components and parts included in this class; vehicle wheel tires [tyres]; vehicle wheel tyre accessories, components and parts; windshields; all the aforesaid excluding bicycle parts, components and attachments; parts, fittings and components for all the aforesaid goods; all of the aforesaid excluding cycle parts, components and accessories in this class.Class 13Firearms; ammunition and projectiles; explosives; fireworks; parts and fittings for all the aforesaid goods.Class 14Precious metals and their alloys; jewellery, precious and semi-precious stones; horological and chronometric instruments; alarm clocks; badges of precious metal; boxes; boxes of precious metal; bracelets; cases for clock and watches; cases for watch-making; chains of precious metal; clock cases; clock hands; clocks; cufflinks, tie clips, tie pins; imitation gold; jewel cases of precious metal; jewellery and imitation jewellery; jewellery cases; key rings; kitchen containers of precious metal; medals, badges of precious metals, candle rings of precious metal; movements for clocks and watches; ornaments of precious metals; rings being jewellery; sports watches; time keeping instruments; trinkets; trophies, belt buckles, all being of precious metal or coated therewith; watch bands; watch straps; watches; wrist watches; chaplets; key fobs made of leather incorporating key rings; parts, fittings and components for all the aforesaid goods.Class 15Musical instruments; music stands and stands for musical instruments; conductors’ batons; parts and fittings for all the aforesaid goods.Class 16Paper and cardboard; printed matter; bookbinding material; photographs; stationery and office requisites, except furniture; adhesives for stationery or household purposes; drawing materials and materials for artists; paintbrushes; instructional and teaching materials; plastic sheets, films and bags for wrapping and packaging; printers' type, printing blocks; adhesive for stationery purposes; adhesive tape dispensers [office requisites]; adhesives for stationery or household purposes; agendas; albums; architects' models; artists’ materials; bags [envelopes, pouches] of paper or plastics, for packaging; block notepads; bookbinding material; books, magazines [periodicals], brochures, leaflets and other printed publications; brochures; calendars; cards made of plastic [other than encoded or magnetic]; cases for pens; cases for stationery; catalogues; decalcomanias; desk note pads; diaries; document files [stationery]; drawing boards; drawing instruments; erasers; event programmes; felt tip pens; gift cards; gift vouchers; glue sticks; greeting cards; handkerchiefs of paper; highlighters; indexed books for the recordal of information relating to fitness training; ink pens; inks for pens; instructional and teaching material (except apparatus); magazines; marking pens (stationery); newsletters; note books; note pads; official programmes [printed matter]; paint brushes; paper, cardboard and goods made from these materials, not included in other classes; pastels [crayons]; pencil cases; pencil sharpeners; pencils; pens; periodicals [printed matter]; photographs; plastic film for wrapping; plastic materials for packaging (not included in other classes); posters; printed agendas; printed matter; printed publications; printed tickets; printers' type; printing blocks; removable self-stick notes; removable tattoos; rulers; shopping [carrier] bags of plastic; souvenir programmes; stamps [seals]; staplers; staples; stationery; stencils; tissues; typewriters and office requisites (except furniture); wall charts for use as diaries; wall charts for use as diaries; white boards; office machines; cheque book holders; parts, fittings and components for all the aforesaid goods.Class 18Leather and imitations of leather; animal skins and hides; luggage and carrying bags; umbrellas and parasols; walking sticks; whips, harness and saddlery; collars, leashes and clothing for animals; art portfolios [cases]; articles of luggage; athletic bags; attaché cases; baby and child carriers; backpacks; baggage; bags; bags for travel accessories; beach bags; belt bags; billfolds; boot bags; briefcases; business card cases; camping bags; canes; card cases; card holders; carry-on luggage; cases; cases; clutch bags; cosmetic bags; credit card cases; credit card holders; diaper bags; document cases; duffel bags; evening bags; fastenings and straps of leather; framed carrying apparatus in the nature of rucksacks for carrying babies; frames for handbags; frames for umbrellas; garment bags; golf umbrella seats; golf umbrellas; gym bags; handbags; harnesses; haversacks; hides; hip pouches; holdalls; horse blankets.; horse tack; horse tack and equestrian articles; key cases; key holders; key pouches; knapsacks; laces (leather–); leashes (leather–); leather portfolios [covers]; luggage; luggage tags; luggage straps; overnight bags; overnight luggage; parasols; pocket books; pocket wallets; portfolios; pouches; purses; purses; record bags; riding saddles; riding saddles; rucksacks; saddlery; school bags; school satchels; schoolchildren's backpacks; shoe bags; shopping bags; shopping carts [wheeled shopping bags]; shoulder bags; skins and hides; sporting bags; sports bags; straps for skates; suitcases; toiletry bags; tote bags; travelling bags; travelling cases; travelling trunks; trunks; umbrella seats; umbrellas; waist bags; waist packs; pouches for waist bags; pouches for waist packs; walking sticks; wallets; wallets for attachment to belts; whips; charts for use as diaries; white boards; luggage label made of leather; parts, fittings and components for all the aforesaid goods; all the aforesaid excluding cycle bags.Class 20Furniture, mirrors, picture frames; containers, not of metal, for storage or transport; unworked or semi-worked bone, horn, whalebone or mother-of-pearl; shells; meerschaum; yellow amber; bedding [except linen]; beds for household pets; bracelets (identification), not of metal, for hospital purposes; cable or pipe clips of plastics; camping furniture.; clothes hangers; curtain rings; ; decorations of plastic for foodstuffs; display boards; foam camping mattresses; furniture fittings, not of metal; hampers [baskets]; inflatable pillows [other than for medical use] for fitting around the neck; mannequins; pillows; parts, fittings and components for all the aforesaid goods.Class 21Household or kitchen utensils and containers; cookware and tableware, except forks, knives and spoons; combs and sponges; brushes, except paintbrushes; brush-making materials; articles for cleaning purposes; unworked or semi-worked glass, except building glass; glassware, porcelain and earthenware; baskets for domestic use; beer mugs; bowls and dishes; brush goods; candle holders; candle rings of precious metal; candlesticks of precious metal; china ornaments; cleaning instruments [hand-operated]; cocktail shakers; coffee pots non electric, household containers, household containers all of precious metal; containers for food; containers for household use for storage purposes; cooking utensils; cool bags; cool bags for fishing bait; cosmetic utensils; cups; decorative articles made of glass, decorated china, chinaware, earthenware or porcelain; drink bottles; drinking straws; drinking vessels; figurines; flat-iron stands; flower pots; foldable water bottles; fruit juice extractors (hand-operated); giftware articles and works of art, all made of bone china, china crystal, earthenware, glass, porcelain or terracotta; glass, unworked or semi-worked [except building glass]; household or kitchen utensils and containers; ice buckets; insect traps; jugs and drinking vessels; kettles; kitchen and household utensils and containers; lunch boxes; miniature figures; mixers [non-electric-] for mixing drinks; mixers, manual [cocktail shakers]; mugs; non-electric instruments and materials, all for cleaning; ornaments; picnic baskets (fitted –), including dishes; plates; porcelain ware; re-usable drinking straws; re-usable straws; saucers of precious metal; shaker bottles; sports bottles; steel wool; storage containers for food; storage receptacles for household use; straws; tankards; thermally insulated bags for household or kitchen use or use in transporting and storing food and beverages; thermally insulated containers for food; thermally insulated flasks for household use; toothbrushes; toothpicks; trays for domestic purpose; trinket boxes; vases and urns; water bottles; watering cans; gardening articles; works of art; parts, fittings and components for all the aforesaid goods.Class 22Ropes and string; nets; tents and tarpaulins; awnings of textile or synthetic materials; sails; sacks for the transport and storage of materials in bulk; padding, cushioning and stuffing materials, except of paper, cardboard, rubber or plastics; unfitted coverings; raw fibrous textile materials and substitutes therefor; wax cloth; covers for camouflage; parts, fittings and components for all the aforesaid goods.Class 23Yarns and threads, for textile use; cotton thread and yarn; sewing thread and yarn; silk thread and yarn; woollen thread and yarn; spun cotton, silk and wool; parts, fittings and components for all the aforesaid goods.Class 24Textiles and substitutes for textiles; household linen; curtains of textile or plastic; banners; bath linen; bed and table covers; bed clothes; bed covers; bed linen; bed spreads; blinds; coasters; covers (fitted toilet lid –) of fabric; covers for pillows; curtain tie backs; curtains; cushion covers; duvet covers; duvets; eiderdowns; face towels; flannels; furniture coverings; handkerchiefs; kitchen towels; linen and upholstery fabrics; marabouts [cloth]; napkins; non-woven textile fabrics; pillow cases; pillow covers; printers' blankets of textile; quilt covers; quilts; rugs; sheets; shower curtains; shrouds; sleeping bags; table clothes; table cloths; table covers; table linen; table mats; table napkins; tea towels; textile curtain pelmets; textile goods; textile materials; textiles for making articles of clothing; towels; towels of textile; travellers rugs; travelling rugs (lap robes); upholstery fabrics; wall hangings of textile; washing mitts; white cloth strip; sleeping bag; parts, fittings and components for all the aforesaid goods.Class 25Clothing; footwear; headgear; anoraks; armbands [clothing]; balaclavas; belts [clothing]; belts made of imitation leather; belts made of leather; boots; cagoules; caps (shower –); caps [headwear]; chasubles; coats; dresses; exercise wear; fashion-wear; fishing jackets, boots and vests; fishing smocks; football boots; football jerseys; gaiters; gloves; hats; hosiery; jackets; jeans; leisure clothing; leisure wear; lightweight clothing; maniples; neckties; protective clothing for surfing; pullovers; replica football kits; safety clothing, gloves, headgear and footwear (other than for protection against accidents or injuries); salopettes; sashes for wear; scarves; shirts; shoes; ski wear; sleep masks; sleeping attire; smocks; socks; sporting articles (clothing) for equestrian use; sporting articles [clothing] for equestrian use; sports clothing; sports garments; sports headgear (other than helmets); sports shoes, walking boots; sports uniforms; sportswear; studs for football boots [shoes]; surf shorts; swimwear; thermal clothing; trainers; trousers; t-shirts; underwear; vests; walking boots; waterproof and weatherproof clothing; waterproof clothing; weatherproof clothing; wet suits; wimples; wristbands [clothing]; all the aforesaid excluding clothing for cyclists; parts, fittings and components for all the aforesaid goods; all the aforesaid excluding clothing for cyclists.Class 26Lace, braid and embroidery, and haberdashery ribbons and bows; buttons, hooks and eyes, pins and needles; artificial flowers; hair decorations; false hair; boxes for needles; brooches (clothing accessories); buckles (clothing accessories); fastenings for clothing; fastenings for hair; hair ornaments; hair bands; knitting needles; needle and pin cushions; ornamental novelty badges; shoe laces; competitors’ numbers; zippers; accessories for apparel, sewing articles and decorative textile articles; parts, fittings and components for all the aforesaid goods.Class 27Carpets, rugs, mats and matting, linoleum and other materials for covering existing floors; wall hangings, not of textile; imitation turf; wallpaper; car mats; mats; artificial ground coverings; wall and ceiling coverings; yoga mats; parts, fittings and components for all the aforesaid goods.Class 28Games, toys and playthings; video game apparatus; gymnastic and sporting articles; decorations for Christmas trees; apparatus for boxing; apparatus for playing skill games; apparatus for playing sports; apparatus for skiing; apparatus for use in the game of football; archery implements; artificial Christmas trees and Christmas tree stands; backgammon games; bags adapted for carrying sporting articles; bags especially designed for ski and surfboards; bags specially adapted for sports equipment; balloons; balls; balls being sporting articles; balls for games; balls for use in sports; balls including tennis balls, tennis rackets, squash rackets and related goods and accessories in this class; baseball masks; batons for cheering squad; bats; bats for sport; bats for sports; board games; body protectors; body-building apparatus; body-building apparatus sporting articles for use in racquet games; body-building apparatus/body-training apparatus/rehabilitation apparatus (body-); breast protectors; camouflage screens [sports articles]; card games; cases adapted for carrying sporting apparatus; checkers; chess; Christmas decorations; christmas tree stands; Christmas trees of synthetic material; coin-operated gaming equipment; confetti; cricket bags; dart mats; darts; elbow guards (sport articles); electronic games; exercise equipment; fairground ride apparatus; fish hooks; fishing apparatus and articles; fishing tackle; fist guards [sporting articles]; fitness equipment; fitness exercise machines; football gloves; football or soccer goals; game chips; games; games adapted for use with television receivers; games apparatus; games relating to skill gaming; games relating to sport; gloves for sporting purposes [specifically adapted for]; goal nets; goal posts; golf bags, with or without wheels; golf mats; gymnastic and sporting articles and apparatus; hand exercisers; hand exercisers [other than for therapeutic use]; hand held electronic games; hand protectors adapted for sporting use; handheld and portable devices for gaming; hip-guards specially made for playing sports [parts of sports suits]; inflatables in the nature of soccer balls, footballs, basketballs, volleyballs, inflatable balls for sports; in-line skates; jigsaw puzzles; kaleidoscopes; knee guards [sports articles]; knee protectors adapted for use whilst playing sports; knee protectors for use when participating in sports; leg guards adapted for playing sport; leg guards adapted for playing sport; shin pads [sports articles]; military figurines [toys]; novelties; novelties for parties, dances [party favours]; paddling pools; paper party hats.; parts and fittings for apparatus for skiing; parts and fittings for games and playthings; parts and fittings for the aforesaid goods.; physical exercises (Machines for –); plastic tracks; play tents; playground equipment; playing cards; playthings; roller skates; sailboards; scratch cards for playing lottery; shin guards for athletic use; shin pads [sports articles]; skateboards ; surfboards; snowboards; skis; skates; skill games; skill gaming chips; skill gaming equipment; snooker balls and cues; snooker tables; soccer ball goal nets; soft toys; souvenirs; sporting articles; sporting articles for use in boxing, gymnastics, indoor and field athletics, and for use in playing the games of badminton, squash, hockey, ice hockey, football, lacrosse, fives, table tennis, netball, bowls, lawn tennis, cricket, croquet, clock golf, golf, quoits, discs and putting golf, water polo, bowling, volleyball, sports similar to hockey, sports including the use of a ball; clubs for golf and polo; sporting articles for use in playing football [other than clothing or articles for protective purposes] football or soccer goals; sporting articles for use in racquet games; sporting articles for wear adapted for use in specific sports; sporting articles including articles and accessories for the games of tennis, squash, table tennis, softball, golf, badminton, volleyball, basketball, baseball, ice hockey and hockey; sports equipment and accessories; sports gloves; stationary exercise bicycles; stomach protectors [adapted for use in a specific sport]; string materials for sporting racquets; sweat-absorbent bands for rackets; swimming pools [play articles]; tennis nets and posts; tennis thermal bags; toy bicycles; toy glow sticks; toy miniature figurines, artificial Christmas trees and Christmas tree stands; toy trucks; toys and games; training apparatus for use in relation to football; whistles; wrist guards for athletic use; electronic games; games adapted for use with television receivers; parts, fittings and components for all the aforesaid goods; all the aforesaid excluding body protection for cyclists.Class 29Meat, fish, poultry and game; meat extracts; preserved, frozen, dried and cooked fruits and vegetables; jellies, jams, compotes; eggs; milk, cheese, butter, yoghurt and other milk products; oils and fats for food; potato crisps; prepared meals; proteinaceous preparations in the form of bars for human consumption; snack bars [foodstuffs].Class 30Coffee, tea, cocoa and artificial coffee; rice, pasta and noodles; tapioca and sago; flour and preparations made from cereals; bread, pastries and confectionery; chocolate; ice cream; sorbets and other edible ices; sugar, honey, treacle; yeast, baking-powder; salt, seasonings, spices, preserved herbs; vinegar, sauces and other condiments; ice (frozen water); beverages made from cereals; biscuits; bread, pastry and confectionery; cakes; cereal preparations; chocolate based beverages; chocolate beverages with milk; coffee based beverages; coffee beverages with milk; coffee flavourings; confectionery for decorating christmas trees; cookies; corn starch derivatives in powder form for making into drinks; edible decorations for cakes; edible ices; energy bars.; flavourings [other than essential oils] for beverages; fondants; ice sherbets; ice sorbets; ices; instant powder for making flavoured drinks; ketchup; meat pies; mustard; non-medicated additives for beverages: aerated beverages with a coffee, cocoa or chocolate base; pate [pastries]; pies; pizzas; popcorn; powder for making beverages; preparations for use as dietetic additives for consumption by sports persons; preparations made from cereals for food; protein cereal bars; protein snack bars.; puddings; sandwiches; sauces; snack bars (foodstuffs); snack foods; tarts; tea based beverages; tea beverages; waffles; whiteners [non-dairy] for beverages.Class 32Beers; non-alcoholic beverages; mineral and aerated waters; fruit beverages and fruit juices; syrups and other non-alcoholic preparations for making beverages; beers; beverages for use as aids to slimming [not for medical purposes].; cordials; energy drinks; energy drinks containing caffeine; energy drinks for sports people and athletes; flavoured carbonated beverages; fruit drinks and fruit juices; isotonic drinks [not for medical purposes]; mineral and aerated waters and other non-alcoholic drinks; preparations for making non-alcoholic drinks; seltzers [beverages]; shandy; sorbets [beverages]; sports drinks; syrups and other preparations for making beverages; tisanes [non-medicated beverages and other than tea based]; water.Class 35Advertising; business management; business administration; office functions; accountancy, book keeping and auditing; accounting; accounts [drawing up of statements of-]; administration [commercial-] of the licensing of the goods and services of others, of a discount program for enabling participants to obtain discounts on goods and services through use of a discount membership card, competitions for advertising purposes, consumer loyalty programs, customer loyalty and incentive schemes, loyalty programs involving discounts or incentives, loyalty rewards programmes, membership schemes, newspaper subscription [for others], sales and promotional incentive schemes, sales promotion incentive programs, the business affairs of franchises, the business affairs of retail stores; administration relating to marketing and sales methods; administrative loyalty card services; administrative processing of orders; administrative support and ***data*** processing services; advertising, marketing and promotional services; advertisement for others on the internet; advertising and marketing services provided by means of social media; advertising by mail order; advertising of the goods of other vendors, enabling customers to conveniently view and compare the goods of those vendors; advertising particularly services for the promotion of goods; advertising services for the promotion of e-commerce; advertising through all public communication means; advice relating to the business management of fitness clubs; advice relating to the business management of health clubs; advice relating to the business operation of fitness clubs; advice relating to the business operation of health clubs; arranging and conducting of advertising events, fairs and exhibitions for business and advertising purposes; arranging commercial transactions, for others, via online shops; arranging newspaper subscriptions for others; arranging of displays for commercial purposes, displays for trade purposes, exhibitions for advertising purposes, exhibitions for commercial purposes, presentations for advertising purposes, presentations for commercial purposes; arranging subscriptions of the online publications of others, to electronic journals, to information media, to media packages, to telecommunication services for others; auctioneering services; auditing; bill-posting; brand creation, evaluation, positioning, strategy and testing services; business administration services for the processing of sales made on the internet; business advice and consultancy relating to franchising; business advisory services; business analysis and information services, and market research; business appraisals; business assistance, management and administrative services; business consultancy and advisory services; business consultancy services relating to management, marketing and promotion of fund raising campaigns; business ***data*** analysis; business information services; business inquiries; business intelligence services; business investigations; business management and organization consultancy; business management for shops, entertainment venues, hotels, performing artists, sports personalities, retail outlets, sporting club, sporting facilities, sporting venues, sports people, swimming pool complexes, wholesale and retail outlets; business management services; business monitoring and consulting services, namely, tracking users and advertising of others to provide strategy, insight, marketing guidance, and for analysing, understanding and predicting consumer behaviour and motivations, and market trends; business networking; business operation of shopping centres and shopping malls; business organisation and management consulting services; business planning services; business promotion services; business research; business strategic planning services; clerical services for the taking of sales orders; ***collecting*** business ***statistics***; commercial administration of the licensing of the goods and services of others; commercial consultancy services; commercial information; commercial information and advice for consumers [consumer advice shop]; commercial or industrial management assistance; company management [for others]; comparison shopping services; compilation of advertisements for use on internet web pages; compilation of business information; compilation of information into computer databases; compilation of ***statistics***; compilation, production and dissemination of advertising matter; compiling and maintaining online directories; computer ***data*** recording services; computerized file management; consulting in sales techniques and sales programmes; consulting services relating to marketing; consulting services relating to publicity; corporate planning; cost price analysis; customer club services and customer loyalty services, for commercial, promotional and/or advertising purposes; ***data*** processing, systematisation and management; demonstration of goods; digital advertising services; digital marketing; direct mail advertising; dissemination of advertising matter; distribution of advertising, marketing and promotional material; distribution of samples; document reproduction; economic forecasting; efficiency experts; employment agencies; event marketing; export-import agency services; fashion show exhibitions for commercial purposes; fashion shows for promotional purposes [organization of-]; file management [computerized-]; franchising [business advice relating to-]; human resources management and recruitment services; import-export agencies; information about sales methods; information services relating to advertising; invoicing; layout services for advertising purposes; loyalty, incentive and bonus program services; magazine advertising; mail order retail services for clothing; mail-order advertising; management [advisory services for business-]; management assistance; market analysis and research services; marketing; marketing research; marketing services; marketing the goods and services of others by distributing coupons; modelling for advertising or sales promotion; news clipping services; office machines and equipment rental; on-line advertising; on-line advertising on a computer network; online and email advertisements, including development and production of social media campaigns and viral marketing measures; online marketing; online ordering services; opinion polling; organisation of customer loyalty programs for commercial, promotional or advertising purposes; organisation of exhibitions and events for commercial or advertising purposes; organisation of prize draws for advertising purposes; organisation of promotions using audio-visual media; organisation of trade fairs for commercial or advertising purposes; organisation, operation and supervision of loyalty schemes, incentive schemes, sales and promotional incentive schemes; organization of exhibitions, events, expositions, trade fairs and trade shows for commercial or advertising purposes; outsourcing services [business assistance]; payroll preparation; personnel management consultancy; personnel recruitment; photocopying services; placing advertisements and promotional displays in electronic sites accessed via computer networks; planning of advertising and marketing strategies; presentation of goods and services; presentation of goods on communication media, for retail purposes; price comparison services; procurement services for others [purchasing goods and services for other businesses]; product demonstrations and product display services; product sales information; production of advertising matter and commercials; promoting the goods and services of others; promoting the goods and services of others by distributing coupons, by means of a loyalty rewards card scheme, through discount card programs, through the administration of sales and promotional incentive schemes involving trading stamps, by awarding purchase points for credit card use, through promotional events, through the distribution of printed material and promotional contests; promoting the sale of the services [on behalf of others] by arranging advertisements; promotion of competitions and events, goods and services for others, goods and services through sponsorship, special events, sports competitions and events; promotion services relating to esports events; promotional management for sports personalities; promotional services; providing a searchable online advertising guide featuring the goods and services of online vendors; providing advertising space on a website; providing business information over the internet; ; providing commercial information to consumers; providing consumer product information via the internet; providing information regarding organising and conducting volunteer programmes and community service projects; providing market information in relation to consumer products; providing shopping information; provision and dissemination of business information, advertising and publicity materials relating to exhibitions, trade shows and expositions for business purposes; provision and dissemination of business information, assistance and advice for exhibition attendants, visitors and exhibitors; provision and rental of advertising space, time and media; provision of an online marketplace for buyers and sellers of goods and services; provision of information and advice to consumers regarding the selection of products and items to be purchased; provision of information and advisory services relating to e-commerce; provision of online price comparison services; public relations; publication of publicity texts; publicity; relocation services for businesses; rental of advertising space, of advertising time on communication media, of office machines and equipment, of photocopying machines, of vending machines; research for business purposes; research services relating to advertising and marketing; retail clothing shop services; retail of third-party pre-paid cards for the purchase of clothing; retail of third-party pre-paid cards for the purchase of entertainment services; retail shop window display arrangement services; sales promotion; sales promotion for others by means of privileged user cards; sales promotion through customer loyalty programs; sales promotions at point of purchase or sale, for others; secretarial services; shop window display arrangement services; sponsorship search; subscription to an information media package; systemization of information into computer databases; talent agency services; tax preparation; telecommunication services [arranging subscriptions to-] for others; telemarketing services; telephone answering for unavailable subscribers; television advertising; trade show and commercial exhibition services; transcription; typing; updating of advertising material; word processing; writing of publicity texts; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of chemicals for use in industry, science and photography, as well as in ***agriculture***, horticulture and forestry, unprocessed artificial resins, unprocessed plastics, fire extinguishing and fire prevention compositions, tempering and soldering preparations, substances for tanning animal skins and hides, adhesives for use in industry, putties and other paste fillers, compost, manures, fertilizers, biological preparations for use in industry and science; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of paints, varnishes, lacquers, preservatives against rust and against deterioration of wood, colorants, dyes, inks for printing, marking and engraving, raw natural resins, metals in foil and powder form for use in painting, decorating, printing and art, mordants, dyes, colorants, pigments and inks, dyestuffs, food dyes, food colourants, toner ink cartridges, filled, for printers and photocopiers; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of non-medicated cosmetics and toiletry preparations, non-medicated dentifrices, perfumery, essential oils, bleaching preparations and other substances for laundry use, cleaning, polishing, scouring and abrasive preparations, body cleaning and beauty care preparations, cosmetics, toiletries, oral hygiene preparations, perfumery and fragrances, animal grooming preparations, aromatic extracts; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of household fragrances, laundry preparations, leather and shoe-cleaning and polishing preparations, vehicle cleaning preparations, antiperspirant soap, antiperspirants, artificial tanning preparations, bath lotions, bath salts not for medical purposes, beard softeners, beauty care products, beauty masks; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of bleaching preparations and other substances for laundry use, cleaning, polishing, scouring and abrasive preparations, body care products, body powder, boot cream, boot polish, cleaning agents for the hands, cleaning preparations, cleansers, cleansing milk for toilet purposes, colouring matters, cosmetic kits, cosmetic preparations for tanning the skin, cosmetics, creams; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of dentifrices, deodorant soaps, deodorants, depilatory preparations, detergents, disinfectant soaps, dye stuffs [cosmetic], dyes for the beard, eau-de-cologne, emery boards, emery cloth, emery cloth for nail grooming, emery paper, essential oils, eye makeup, eyebrow cosmetics, eyebrow pencils, gels for use on the hair, hair bleaching preparations, hair care products, hair colorants; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of hair dyes, hair lotions, hair setting preparations, hair spray, hair waving preparations, hand care preparations, lip balms [non-medicated-], lotions for cosmetic purposes, makeup, makeup powder, makeup preparations, makeup removing preparations, medicated soaps, moisturisers, mouthwashes, nail care preparations, nail polish, nail vanish removing preparations, nail varnish; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of non-medicated preparations for use after shaving, non-medicated toilet preparations, oil for the body, oils for cosmetic purposes, oils for perfumes and scents, perfumery, perfumes, preparation for the care of the body, preparations for freshening the breath [not medicated], pre-shaving and after shaving lotions, shampoos, shaving preparations, shaving soaps, shoe cream, shoe polish, shoe wax; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of shower preparations, skin care products, skincare preparations, soaps, stain removers, sun tanning preparations, talcum powder, tints and lotions all for the hair and beard, tissues impregnated with cosmetic lotion, toilet articles, toilet water, toiletries, towels containing non-medicated toilet preparations, washing and bathroom preparations; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of industrial oils and greases, wax, lubricants, dust absorbing, wetting and binding compositions, fuels and illuminants, candles and wicks for lighting, non-chemical fuel additives, wool for use as fuel, christmas tree candles, electrical energy, grease for boots, shoes and leather, illuminating wax, oils for paints; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of perfumed and scented candles, sweeping [dust binding compositions for–], tapers, textile oil, pharmaceuticals, medical and veterinary preparations, sanitary preparations for medical purposes, dietetic food and substances adapted for medical or veterinary use, food for babies, dietary supplements for human beings and animals, plasters, materials for dressings, material for stopping teeth, dental wax; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of disinfectants, preparations for destroying vermin, fungicides, herbicides, adhesive plaster, adhesives for dentures, air freshening preparations, analgesics, antiseptic preparations, bacteriological cultures [media for–], bandages and dressings, belts for sanitary napkins [towels], car air fresheners; , carbohydrates in liquid form; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of chemical conductors for electrocardiograph electrodes, cold creams for the treatment of sporting injuries, contact lens cleaning preparations, dietary supplements for humans and animals, dietetic beverages adapted for medical purposes, dietetic food and substances adapted for medical or veterinary use, food for babies, dietetic food preparations having a low fat content [adapted for medical purposes]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of dietetic foods adapted for persons having complex metabolic disorders for medical purposes, dietetic substances adapted for medical use, dietetic substances for medical use in weight control, disinfectants for hygiene purposes, dog washes, drinks predominantly of minerals or vitamins, drugs for medical purposes, filled first aid boxes and kits, food supplements; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of foods for persons having complex metabolic disorders, gauze bandages [dressings], hand-sanitising preparations, kits containing medical preparations, materials for dressings, meal replacement and dietary supplement drink mixes, meal replacement powders, medicated food for sportsmen, medicated foods for sports persons [vitamins or minerals], medicinal preparations and substances; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of mineral and protein preparations and substances, mineral drinks [medicated], muscle relaxants, naturopathic and homeopathic preparations and substances, ***nutrients*** and nutriments, nutritional and dietary supplements, oxygen for medical purposes, pesticides, pharmaceutical preparations and substances, plant compounds and extracts for use as dietary supplements, plasters; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of powdered dietary food concentrates and dietetic substances for use in a weight reduction programme for medical purposes, preparations for dietary use, protein foods for human consumption [adapted for medical purposes], protein supplements, radium for medical purposes, sterilising preparations, stimulants made of vitamins; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of tapes for bandaging, vitamin, dietary and mineral supplements, vitamin drinks, vitamin preparations, vitamins, waters [beverages] for medical purposes, common metals and their alloys, ores, metal materials for building and construction, transportable buildings of metal, non-electric cables and wires of common metal, small items of metal hardware, metal containers for storage or transport; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of safes, small items of metal hardware, unwrought and partly wrought common metals including simple products made of them, badges of metal for vehicles, metal badges, keyrings and key chains, locks, keys, ornaments, metallic bins, keys, key blanks, signs, statues, statuettes and figurines, bronzes, trophies made of metal, money boxes; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of boxes, trophies, models of precious metal, all made wholly or principally of common metals, machines, machine tools, power-operated tools, motors and engines, except for land vehicles, machine coupling and transmission components, except for land vehicles, ***agricultural*** implements, other than hand-operated hand tools, incubators for eggs, automatic vending machines; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of hand tools and implements, hand-operated, cutlery, side arms, razors, hand-operated hygienic and beauty implements for humans and animals, lifting tools, emergency and rescue hand tools, garden tools, hand operated, scissors, crimping irons, curling tongs, eyelash curlers, manicure sets, nail clippers, nail files, pedicure sets, pruning shears, tweezers, tongs, pizza cutters; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of scientific, research, navigation, surveying, photographic, cinematographic, audio-visual, optical, weighing, measuring, signalling, detecting, testing, inspecting, life-saving and teaching apparatus and instruments, apparatus and instruments for conducting, switching, transforming, accumulating, regulating or controlling the distribution or use of electricity; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of apparatus and instruments for recording, transmitting, reproducing or processing sound, images or ***data***, recorded and downloadable media, computer software, blank digital or analogue recording and storage media, mechanisms for coin-operated apparatus, cash registers, calculating devices, computers and computer peripheral devices, diving suits, divers' masks, ear plugs for divers; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of nose clips for divers and swimmers, gloves for divers, breathing apparatus for underwater swimming, fire-extinguishing apparatus, abdominal guards [for protection against accidents and injury], alarms, amplifiers, antennas, apparatus and instruments for recording, transmitting and reproducing sound, ***data*** and/or images, apparatus for recording, transmission or reproduction of sound or images; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of apparatus for use with computers, audio and video tapes and discs, all in pre-recorded form, audio apparatus, audio recordings, audio speakers, audio systems, automatic playback machines, bags and cases specially adapted for holding or carrying portable, mobile, handheld and tablet devices and equipment and accessories for such devices, batteries, batteries, electric, battery boxes; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of battery chargers, binoculars, blank and pre-recorded CDs, discs, records, tapes and cassettes, blank tapes for recording audio and video, body protectors, books recorded on disc, breast protectors, cabinets and stands all adapted for audio, video and television apparatus and instruments, cables, electric, calculating machines, calculators, camcorders, camera film, camera lenses; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of cameras, cards containing an integrated circuit chip, cards encoded with security features for authentication purposes, cards using magnetic memories and integrated circuit memories, carriers for mobile phones, carrying cases adapted for sunglasses, cases adapted for binoculars, cases for mobile phones, cases for spectacles and sunglasses, cassette decks, cd players, cd radio cassettes; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of cd roms, cellular phones, chains and cords for spectacles and sunglasses, cinematographic film, exposed, cleaning apparatus for sound recording discs, clocks [time recording devices] and timers, clothing for protection against accidents, radiation and fire, coin-operated apparatus [mechanisms for–], combined televisions and VCRs, compact discs, company magazines downloaded via the internet; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of computer application software, computer application software for portable, mobile, handheld and tablet devices, computer application software relating to or featuring games, casino games, card games, gambling or betting, computer game and video game programs, computer game software, computer games, computer games hardware, computer hardware, computer peripherals, computer programs; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of computer software, computer software and computer hardware apparatus with multimedia and interactive functions, computer software and computer programs downloadable from or provided via the internet, computer software and computer programs relating to or featuring games, games based on skill, casino games, card games, gambling or betting; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of computer software for telecommunications and communication via local or global communication networks, including Wi-Fi, the internet, intranets, extranets, television, mobile communication, cellular and satellite networks, computer terminals, computers, computers, laptop and notebook computers, game computers, conductors, electric, containers for microscope slides; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of controllers and keypads all for heating, ventilation, air conditioning, lighting and security, counters, ***data*** carriers with integrated electronic chips, ***data*** carriers with integrated microprocessor chips, digital audio tapes, digital versatile discs, disc and tapes all for video games, disc drives, discs and tapes all for video games, discs bearing video recordings, divers apparatus; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of downloadable computer and video game software and programs, downloadable electronic computer game and video game software and programs, downloadable electronic publications, downloadable interactive computer game and video game software and programs, downloadable publications, namely, company magazines downloadable via the internet; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of downloadable virtual reality computer game and video game software and programs, ear plugs, elbow pads, shields and protectors, electric cleaning apparatus, electric hair curling apparatus, electric installations for the remote control of industrial operations, electric irons, electric power cables, electric shoe polishers, electric steam curling sets; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of electric vacuum hose, electrical apparatus and instruments, all for office use, electrical domestic appliances, electrolysers, electrolysis apparatus for personal use for electroplating purpose, electronic bulletin boards, electronic computer game and video game programs, electronic computer game and video game software, electronic games; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of electronic message boards and electronic information display boards, electronic publications distributed via email, encoded cards and magnetic encoders, encoded chip cards containing programming used for financial applications, loyalty programs, rewards programs and card holder preferences, extension cables, extension leads, eyeglass cases, eyeglasses; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of eyewear, spectacles, sun glasses, sports goggles and eyewear, swimming goggles, face shields, facsimile processing apparatus and instruments, fences [electrified–], filters for respiratory masks, flexible [shaped-] covers for the controls of electrical apparatus, floats for bathing and swimming, fluorescent screens, frames and lenses for spectacles and sunglasses, frames for glasses; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of games adapted for use with television receivers, games software, goggles for skiing, goggles for use in sports, graphic equalisers, hair styling apparatus, hair waving apparatus, head cleaning tapes, headphones, headsets, helmets [excluding cycling helmets], holders adapted for mobile phones, hologram impregnated cards, holograms; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of interactive computer game and video game programs, interactive computer game and video game software, interactive electronic computer game and video game software, interactive multimedia computer game and video game programs and software, joysticks for use with computers, juke boxes, karaoke machines, knee pads, shield and protectors, laptop carrying cases; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of laptop covers, lenses for eyewear, spectacles and sunglasses, life belts, jackets and buoys, light conducting filaments [optical fibers], luggage scales, magnetic ***data*** carriers, recording discs, magnets, magnifying glasses, measures, measuring instruments, measuring tapes, memory sticks, mobile applications featuring virtual reality software and games; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of mobile phone covers, mobile phone straps, mobile telephones, cordless telephones, money counting and sorting machines, monitoring apparatus, electric, mouse mats, mouse pads, mouth protectors [gum shields], mp3 players and portable and handheld digital electronic devices for recording, organising, transmitting, manipulating, and reviewing text, ***data***, audio and video files; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of navigation apparatus for vehicles [on-board computers], odontoguards, office machines, optical apparatus and instruments, paging apparatus, pedometers, periscopes, personal cd players, personal stereos, phone appliances, phone covers [specifically adapted] and covers for portable and handheld digital electronic devices, phonograph records, cassettes and discs; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of photocopying apparatus and instruments, photographic apparatus and instruments, plastic covered cards bearing printed matter [encoded], plugs, sockets and other contacts [electric connections]., pocket calculators, portable audio apparatus and instruments, pre-paid magnetic cards, programmable timers, protection devices for personal use against accidents, protective clothing and accessories; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of protective clothing for diving, protective clothing for participants in motor sports [for the prevention of accidents], protective clothing, headgear and footwear for use in sport, protective glasses, sunglasses and goggles, protective helmets, punched card machines for offices, radio cassettes, radio receivers, radios, clock radios, record players, remote control apparatus; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of safety survival suits, satellite navigational apparatus, satellites and decoders, scales, security encoded cards, semi-conductors, shaped covers for the controls of electrical apparatus, signalling whistles, skateboard helmets, smart cards, magnetic coded cards, electronic ***data*** carrier cards, charge cards, bank cards, credit cards, debit cards, chip cards, stored value cards, payment card; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of pre-paid cards, socks, electrically heated, sound recording, speakers, loud speakers, earphone speakers, speaker cables, spectacle holders, sport glasses [eye glasses], sports eyewear, sports goggles, sports helmets and visors, stamping mail [apparatus to check–], straps and cases for eyewear and sunglasses, straps for sunglasses, sunglasses, surge protectors, swimming goggles, tape players; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of tape recorders, tapes, discs and floppy discs, all recorded with computer programs, telecom apparatus [including international prepaid phonecards and electronic vouchers], telecommunication installations, apparatus and instruments, telecommunications apparatus [including international prepaid phonecards and electronic vouchers], telephone answering apparatus and instruments, telephone apparatus; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of telephones, mobile telephones, cordless telephones, television aerials, television apparatus and instruments, televisions, televisions for receiving satellite broadcasting, tokens for activating electrical, electronic and telecommunications apparatus and instruments, transformers, tuners, turntables, typewriting apparatus and instruments, digital storage devices; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of video apparatus and instruments, video cameras, video disc players, video game software, video games, video recording machines, virtual reality computer game and video game programs, virtual reality computer game and video game software, virtual reality headsets and helmets, visual display units, voting machines, wearable video display monitors, word processing apparatus and instruments; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of surgical, medical, dental and veterinary apparatus and instruments, artificial limbs, eyes and teeth, orthopaedic articles, suture materials, therapeutic and assistive devices adapted for persons with disabilities, massage apparatus, apparatus, device and articles for nursing infants, bandages, cold and hot packs for medical purposes, dental face mask and dental gloves; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of elasticized wraps for limbs and joints for medical use, face masks for medical use, hearing protectors, neoprene braces for limbs and joints for medical use, orthodontic machines and instruments for dental purpose, prosthetic instruments for dental purposes, sports supports, suspensory bandages for use in sports; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of apparatus and installations for lighting, heating, steam generating, cooking, refrigerating, drying, ventilating, water supply, sanitary purposes, apparatus and installations for refrigerating, barbecue grills [lava rocks for use in–], conditioning air [installations for–], curling lamps, disposable sterilization pouches; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of filters for drinking water, gas lighter, glow sticks, hair drying apparatus and appliances, heating apparatus, hot water bottles, hydrants, lamps, nuclear fuel and nuclear moderating material [installations for processing], radiators, electric, refrigerators, stage smog maker, toilet seats, torches for lighting, ultraviolet ray lamps, not for medical purposes, watering installations, automatic; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of vehicles, apparatus for locomotion by land, air or water, car screen shields and sun blinds, car tidies, coverings for car seats, electric vehicles, hand cars, inner tubes [repair outfits for–], shopping carts, sleighs, vehicle accessories, components and parts included in this class, vehicle wheel tires [tyres], vehicle wheel tyre accessories, components and parts; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of windshields, firearms, ammunition and projectiles, explosives, fireworks, precious metals and their alloys, jewellery, precious and semi-precious stones, horological and chronometric instruments, alarm clocks, badges of precious metal, boxes, boxes of precious metal, bracelets, cases for clock and watches, cases for watch-making, chains of precious metal, clock cases, clock hands, clocks; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of cufflinks, tie clips, tie pins, imitation gold, jewel cases of precious metal, jewellery and imitation jewellery, jewellery cases, key rings, kitchen containers of precious metal, medals, badges of precious metals, candle rings of precious metal, movements for clocks and watches, ornaments of precious metals, rings being jewellery, sports watches, time keeping instruments; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of trinkets, trophies, belt buckles, all being of precious metal or coated therewith, watch bands, watch straps, watches, wrist watches, musical instruments, music stands and stands for musical instruments, conductors’ batons, paper and cardboard, printed matter, bookbinding material, photographs, stationery and office requisites, except furniture; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of adhesives for stationery or household purposes, drawing materials and materials for artists, paintbrushes, instructional and teaching materials, plastic sheets, films and bags for wrapping and packaging, printers' type, printing blocks, adhesive for stationery purposes, adhesive tape dispensers [office requisites], adhesives for stationery or household purposes, agendas, albums; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of architects' models, artists’ materials, bags [envelopes, pouches] of paper or plastics, for packaging, block notepads, bookbinding material, books, magazines [periodicals], brochures, leaflets and other printed publications, brochures, calendars, cards made of plastic [other than encoded or magnetic], cases for pens, cases for stationery, catalogues, chaplets, compasses; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of decalcomanias, desk note pads, diaries, document files [stationery], drawing boards, drawing instruments, erasers, event programmes, felt tip pens, gift cards, gift vouchers, glue sticks, greeting cards, handkerchiefs of paper, highlighters, indexed books for the recordal of information relating to fitness training, ink pens, inks for pens; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of instructional and teaching material [except apparatus], luggage label made of leather, magazines, marking pens [stationery], newsletters, note books, note pads, official programmes [printed matter], paint brushes, paper, cardboard and goods made from these materials, not included in other classes, pastels [crayons], pencil cases, pencil sharpeners, pencils, pens; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of periodicals [printed matter], photographs, plastic film for wrapping, plastic materials for packaging [not included in other classes], posters, printed agendas, printed matter, printed publications, printed tickets, printers' type, printing blocks, removable self-stick notes, removable tattoos, rulers, shopping [carrier] bags of plastic, souvenir programmes, stamps [seals], staplers; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of staples, stationery, stencils, tissues, typewriters and office requisites [except furniture], wall charts for use as diaries, wall charts for use as diaries, white boards, unprocessed and semi-processed rubber, gutta-percha, gum, asbestos, mica and substitutes for all these materials, plastics and resins in extruded form for use in manufacture; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of packing, stopping and insulating materials, flexible pipes, tubes and hoses, not of metal, leather and imitations of leather, animal skins and hides, luggage and carrying bags, umbrellas and parasols, walking sticks, whips, harness and saddlery, collars, leashes and clothing for animals, art portfolios [cases], articles of luggage, athletic bags, attaché cases; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of baby and child carriers, backpacks, baggage, bags, bags for travel accessories, beach bags, belt bags, belts, belts made of imitation leather, belts made of leather, billfolds, boot bags, briefcases, business card cases, camping bags, canes, card cases, card holders, cheque book holders, carry-on luggage, cases, cases for mobile telephones; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of cases, clutch bags, cosmetic bags, credit card cases, credit card holders, diaper bags, document cases, duffel bags, evening bags, fastenings and straps of leather, framed carrying apparatus in the nature of rucksacks for carrying babies, frames for handbags, frames for umbrellas, garment bags, golf umbrella seats, golf umbrellas, gym bags, handbags, harnesses, haversacks; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of hides, hip pouches, holdalls, horse blankets., horse tack, horse tack and equestrian articles, key cases, key fobs made of leather incorporating key rings, key fobs made of leather incorporating key rings, key holders, key pouches, knapsacks, laces [leather–], leashes [leather–], leather goods including horse tack and equestrian articles, leather portfolios [covers], luggage, luggage tags; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of luggage straps, overnight bags, overnight luggage, pannier bags, parasols, pocket books, pocket wallets, portfolios, pouches, purses, purses, record bags, riding saddles, riding saddles, rucksacks, saddlery, school bags, school satchels, schoolchildren's backpacks, shoe bags, shopping bags, shopping carts [wheeled shopping bags], shoulder bags, skins and hides, sporting bags, sports bags; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of straps for skates, suitcases, toiletry bags, tote bags, travelling bags, travelling cases, travelling trunks, trunks, umbrella seats, umbrellas, waist bags, waist packs, pouches for waist bags, pouches for waist packs, walking sticks, wallets, wallets for attachment to belts, whips, charts for use as diaries, white boards ; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of materials, not of metal, for building and construction, rigid pipes, not of metal, for building, asphalt, pitch, tar and bitumen, transportable buildings, not of metal, monuments, not of metal, furniture, mirrors, picture frames, containers, not of metal, for storage or transport, unworked or semi-worked bone, horn, whalebone or mother-of-pearl; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of shells, meerschaum, yellow amber, bedding [except linen], beds for household pets, bracelets [identification], not of metal, for hospital purposes, cable or pipe clips of plastics, camping furniture., clothes hangers, curtain rings; , decorations of plastic for foodstuffs, display boards, foam camping mattresses, furniture fittings, not of metal; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of hampers [baskets], inflatable pillows [other than for medical use] for fitting around the neck, mannequins, pillows, sleeping bag, household or kitchen utensils and containers, cookware and tableware, except forks, knives and spoons, combs and sponges, brushes, except paintbrushes, brush-making materials, articles for cleaning purposes; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of unworked or semi-worked glass, except building glass, glassware, porcelain and earthenware, baskets for domestic use, beer mugs, bowls and dishes, brush goods, burners, candle holders, candle rings of precious metal, candlesticks of precious metal, china ornaments, cleaning instruments [hand-operated], cocktail shakers, coffee pots non electric, household containers; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of household containers all of precious metal, containers for food, containers for household use for storage purposes, cooking utensils, cool bags, cool bags for fishing bait, cosmetic utensils, cups, decorative articles made of glass, decorated china, chinaware, earthenware or porcelain, drink bottles, drinking straws, drinking vessels, figurines, flat-iron stands, flower pots, foldable water bottles; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of fruit juice extractors [hand-operated], giftware articles and works of art, all made of bone china, china crystal, earthenware, glass, porcelain or terracotta, glass, unworked or semi-worked [except building glass], household or kitchen utensils and containers, ice buckets, insect traps, jugs and drinking vessels, kettles, kitchen and household utensils and containers, lunch boxes; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of miniature figures, mixers [non-electric-] for mixing drinks, mixers, manual [cocktail shakers], mugs, non-electric instruments and materials, all for cleaning, ornaments, picnic baskets [fitted–], including dishes, plates, porcelain ware, re-usable drinking straws, re-usable straws, saucers of precious metal, shaker bottles, sports bottles, steel wool, storage containers for food; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of storage receptacles for household use, straws, tankards, thermally insulated bags for household or kitchen use or use in transporting and storing food and beverages, thermally insulated containers for food, thermally insulated flasks for household use, toothbrushes, toothpicks, trays for domestic purpose, trinket boxes, vases and urns, water bottles, watering cans, gardening articles, works of art; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of ropes and string, nets, tents and tarpaulins, awnings of textile or synthetic materials, sails, sacks for the transport and storage of materials in bulk, padding, cushioning and stuffing materials, except of paper, cardboard, rubber or plastics, unfitted coverings, raw fibrous textile materials and substitutes therefor, wax cloth, covers for camouflage; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of yarns and threads, for textile use, cotton thread and yarn, sewing thread and yarn, silk thread and yarn, woollen thread and yarn, spun cotton, silk and wool, textiles and substitutes for textiles, household linen, curtains of textile or plastic, banners, bath linen, bed and table covers, bed clothes, bed covers, bed linen, bed spreads, blinds, coasters, covers [fitted toilet lid–] of fabric; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of covers for pillows, curtain tie backs, curtains, cushion covers, duvet covers, duvets, eiderdowns, face towels, flannels, furniture coverings, handkerchiefs, kitchen towels, linen and upholstery fabrics, marabouts [cloth], napkins, non-woven textile fabrics, pillow cases, pillow covers, printers' blankets of textile, quilt covers, quilts, rugs, sheets; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of shower curtains, shrouds, sleeping bags, table clothes, table cloths, table covers, table linen, table mats, table napkins, tea towels, textile curtain pelmets, textile goods, textile materials, textiles for making articles of clothing, towels, towels of textile, travellers rugs, travelling rugs [lap robes], upholstery fabrics, wall hangings of textile, washing mitts, white cloth strip; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of clothing, footwear, headgear, anoraks, armbands [clothing], balaclavas, belts [clothing], belts made of imitation leather., belts made of leather, boots, cagoules, caps [shower–], caps [headwear], chasubles, coats, dresses, exercise wear, fashion-wear, fishing jackets, boots and vests, fishing smocks, football boots, football jerseys, gaiters, gloves, hats, hosiery; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of jackets, jeans, leisure clothing, leisure wear, lightweight clothing, maniples, neckties, protective clothing for surfing, pullovers, replica football kits, safety clothing, gloves, headgear and footwear [other than for protection against accidents or injuries], salopettes, sashes for wear, scarves, shirts, shoes, ski wear, sleep masks, sleeping attire, smocks, socks; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of sporting articles [clothing] for equestrian use, sporting articles [clothing] for equestrian use, sports clothing, sports garments, sports headgear [other than helmets], sports shoes, walking boots, sports uniforms, sportswear, studs for football boots [shoes], surf shorts, swimwear, thermal clothing, trainers, trousers, t-shirts, underwear; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of vests, walking boots, waterproof and weatherproof clothing, waterproof clothing, weatherproof clothing, wet suits, wimples, wristbands [clothing], lace, braid and embroidery, and haberdashery ribbons and bows, buttons, hooks and eyes, pins and needles, artificial flowers, hair decorations, false hair, boxes for needles, brooches [clothing accessories], buckles [clothing accessories]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of fastenings for clothing, fastenings for hair, hair ornaments, hair bands, knitting needles, needle and pin cushions, ornamental novelty badges, shoe laces, competitors’ numbers, zippers, accessories for apparel, sewing articles and decorative textile articles, carpets, rugs, mats and matting, linoleum and other materials for covering existing floors; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of wall hangings, not of textile, imitation turf, wallpaper, car mats, mats, artificial ground coverings, wall and ceiling coverings, yoga mats, games, toys and playthings, video game apparatus, gymnastic and sporting articles, decorations for christmas trees, apparatus for boxing, apparatus for playing skill games, apparatus for playing sports, apparatus for skiing; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of apparatus for use in the game of football, archery implements, artificial christmas trees and christmas tree stands, backgammon games, bags adapted for carrying sporting articles, bags especially designed for ski and surfboards, bags specially adapted for sports equipment, balloons, balls, balls being sporting articles, balls for games; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of balls for use in sports, balls including tennis balls, tennis rackets, squash rackets and related goods and accessories in this class, baseball masks, batons for cheering squad, bats, bats for sport, bats for sports, board games, body protectors, body-building apparatus, body-building apparatus sporting articles for use in racquet games; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of body-building apparatus/body-training apparatus/rehabilitation apparatus [body-], breast protectors, camouflage screens [sports articles], card games, cases adapted for carrying sporting apparatus, checkers, chess, christmas decorations, christmas tree stands, christmas trees of synthetic material, coin-operated gaming equipment, computer games, confetti; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of cricket bags, dart mats, darts, elbow guards [sport articles], electronic games, exercise equipment, fairground ride apparatus, fish hooks, fishing apparatus and articles, fishing tackle, fist guards [sporting articles], fitness equipment, fitness exercise machines, football gloves, football or soccer goals, game chips, games; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of games adapted for use with television receivers, games apparatus, games relating to skill gaming, games relating to sport, gloves for sporting purposes [specifically adapted for], goal nets, goal posts, golf bags, with or without wheels, golf mats, gymnastic and sporting articles and apparatus, hand exercisers, hand exercisers [other than for therapeutic use]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of hand held electronic games, hand protectors adapted for sporting use, handheld and portable devices for gaming, hip-guards specially made for playing sports [parts of sports suits], inflatables in the nature of soccer balls, footballs, basketballs, volleyballs, inflatable balls for sports, in-line skates, jigsaw puzzles, kaleidoscopes, knee guards [sports articles]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of knee protectors adapted for use whilst playing sports, knee protectors for use when participating in sports, leg guards adapted for playing sport, leg guards adapted for playing sport, shin pads [sports articles], military figurines [toys], novelties, novelties for parties, dances [party favours], paddling pools, paper party hats., parts and fittings for apparatus for skiing; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of parts and fittings for games and playthings, parts and fittings for the aforesaid goods., physical exercises [machines for–], plastic tracks, play tents, playground equipment, playing cards, playthings, roller skates, sailboards, scratch cards for playing lottery, shin guards for athletic use, shin pads [sports articles], skateboards , surfboards, snowboards, skis, skates; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of skill games, skill gaming chips, skill gaming equipment, snooker balls and cues, snooker tables, soccer ball goal nets, soft toys, souvenirs, sporting articles; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of sporting articles for use in boxing, gymnastics, indoor and field athletics, and for use in playing the games of badminton, squash, hockey, ice hockey, football, lacrosse, fives, table tennis, netball, bowls, lawn tennis, cricket, croquet, clock golf, golf, quoits, discs and putting golf, water polo, bowling, volleyball, sports similar to hockey, sports including the use of a ball; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of clubs for golf and polo, sporting articles for use in playing football [other than clothing or articles for protective purposes] football or soccer goals, sporting articles for use in racquet games, sporting articles for wear adapted for use in specific sports; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of sporting articles including articles and accessories for the games of tennis, squash, table tennis, softball, golf, badminton, volleyball, basketball, baseball, ice hockey and hockey, sports bags, sports equipment and accessories, sports gloves, stationary exercise bicycles, stomach protectors [adapted for use in a specific sport], string materials for sporting racquets; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of sweat-absorbent bands for rackets, swimming pools [play articles], tennis nets and posts, tennis thermal bags, toy bicycles, toy glow sticks, toy miniature figurines, artificial christmas trees and christmas tree stands, toy trucks, toys and games, training apparatus for use in relation to football, whistles, wrist guards for athletic use; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of meat, fish, poultry and game, meat extracts, preserved, frozen, dried and cooked fruits and vegetables, jellies, jams, compotes, eggs, milk, cheese, butter, yoghurt and other milk products, oils and fats for food, potato crisps, prepared meals, proteinaceous preparations in the form of bars for human consumption, snack bars [foodstuffs]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of coffee, tea, cocoa and artificial coffee, rice, pasta and noodles, tapioca and sago, flour and preparations made from cereals, bread, pastries and confectionery, chocolate, ice cream, sorbets and other edible ices, sugar, honey, treacle, yeast, baking-powder, salt, seasonings, spices, preserved herbs, vinegar, sauces and other condiments, ice [frozen water]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of beverages made from cereals, biscuits, bread, pastry and confectionery, cakes, cereal preparations, chocolate based beverages, chocolate beverages with milk, coffee based beverages, coffee beverages with milk, coffee flavourings, confectionery for decorating christmas trees, cookies, corn starch derivatives in powder form for making into drinks, edible decorations for cakes; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of edible ices, energy bars., flavourings [other than essential oils] for beverages, fondants, ice sherbets, ice sorbets, ices, instant powder for making flavoured drinks, ketchup, meat pies, mustard, non-medicated additives for beverages: aerated beverages with a coffee, cocoa or chocolate base, pate [pastries], pies, pizzas, popcorn, powder for making beverages; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of preparations for use as dietetic additives for consumption by sports persons, preparations made from cereals for food, protein cereal bars, protein snack bars., puddings, sandwiches, sauces, snack bars [foodstuffs], snack foods, tarts, tea based beverages, tea beverages, waffles, whiteners [non-dairy] for beverages; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of raw and unprocessed ***agricultural***, aquacultural, horticultural and forestry products, raw and unprocessed grains and seeds, fresh fruits and vegetables, fresh herbs, natural plants and flowers, bulbs, seedlings and seeds for planting, live animals, foodstuffs and beverages for animals, malt, beers, non-alcoholic beverages, mineral and aerated waters, fruit beverages and fruit juices; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of syrups and other non-alcoholic preparations for making beverages, beers, beverages for use as aids to slimming [not for medical purposes]., cordials, energy drinks, energy drinks containing caffeine, energy drinks for sports people and athletes, flavoured carbonated beverages, fruit drinks and fruit juices, isotonic drinks [not for medical purposes]; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of mineral and aerated waters and other non-alcoholic drinks, preparations for making non-alcoholic drinks, seltzers [beverages], shandy, sorbets [beverages], sports drinks, syrups and other preparations for making beverages, tisanes [non-medicated beverages and other than tea based], water, alcoholic beverages, except beers, alcoholic preparations for making beverages; retail services, online retail services, wholesale and direct-mail retail services relating to the sale of tobacco and tobacco substitutes, cigarettes and cigars, electronic cigarettes and oral vaporizers for smokers, smokers' articles, matches; information, advisory and consultancy services relating to the foregoing.Class 36 Insurance; Financial affairs; Monetary affairs; Real estate affairs; automated and electronic payment services; bill payment services; budget account services; credit and debit card services; discount and incentive schemes, provision of credit and finance services; electronic fund transfer services; financial affairs; financial analysis and financial consulting services; financial investigation services; financial planning and management; financial research; financial services; financial services provided over the Internet; financial services relating to the provision of vouchers for the purchase of goods; financial valuations; incentive services (included in this class), and programs and services related to the granting of discounts, the provision of loans and financial resources, a budget account, the issuance of coupons and value cards, and other stimulants, related to consumer loyalty; Insurance; insurance services; issuance of certificates or other incentives in relation to loyalty systems.; issuing electronic payment cards in relation to bonus and reward schemes.; issuing of payment gift vouchers; issuing of tokens of value or other incentives in relation to loyalty schemes; issuing of vouchers; Issuing tokens of value as a reward for customer loyalty; issuing tokens of value in the form of gift vouchers; provision of prepaid cards and tokens; lending on mortgages; loans and finance services; monetary affairs; provision of credit and finance services; real estate affairs; services relating to the issue and redemption of tokens, points and vouchers; store card services; information, advisory and consultancy services relating to the foregoing.Class 38 Telecommunications services; air to ground telecommunications services; audio visual communication services; broadcasting; broadcasting and transmission of interactive television, interactive games, interactive news, interactive entertainment and interactive competitions; broadcasting via the Internet, mobile phone networks and other telecommunications networks; communication and broadcasting of information and advertising by computer, computer terminals, the Internet, television, mobile communications device, telegraphy, telephone, wireless communications device or other electronic means; communication services; communication services for the transmission of advertising, images, text and ***data***, information, voices, sound and ***data***; communications and telecommunications; computer communication and internet access; digital network telecommunications services; electronic mail services; electronic transmission of ***data*** and information via a global computer network; facilitating access to a worldwide computer and/or telecommunications networks for downloading computer software and information; fibre optic telecommunications services; information about telecommunications; information services relating to telecommunications; interactive telecommunications services; internet communication services; mobile and fixed telecommunications and telephone services; news information and news agency services; operation of a telecommunications network; operation of a television subscription service (pay-tv) including video-on-demand.; operation of telecommunications satellites; operation of telecommunications systems; optical fibre telecommunications services; professional consultancy relating to telecommunications; providing access to advertising, news, information and audio, video, text and other multimedia content, via local and/or global computer and/or telecommunications networks; providing access to and leasing of access time to a computer database; providing access to gaming websites; providing information about telecommunications; providing online access to computer networks, computer databases, the Internet, on-line bulletin boards, chat rooms, virtual worlds, virtual worlds including user generated characters, and libraries of text, graphics and audio-visual and multimedia information and entertainment; providing on-line chat room for transmission of messages among computer users concerning topics; providing on-line electronic bulletin board services, leader boards and chat rooms; provision and rental of telecommunications facilities and equipment; provision of access to content, websites and portals; provision of electronic communication links; provision of telecommunications connections and access to the Internet and/or computer databases; radio telecommunications; receipt and/or delivery of messages, documents and other ***data*** by electronic transmission; rental of radio and television broadcasting facilities; return pack management for the provision of news, sporting events and other information services and Internet application and broadcasts.; satellite capacity provision [telecommunications]; satellite telecommunications; satellite telecommunications services; streaming of audio and video material of events and competitions on the internet; telecommunication and broadcasting services; telecommunication services; telecommunication services for the ***collection*** and supply of information; telecommunications access services; telecommunications consultancy services; telecommunications routing and junction services; telecommunications services between computer networks; telecommunications services by satellite; telecommunications services for aircraft passengers; telecommunications services for typesetting; telegraph telecommunications services; teletext and interactive broadcasting services; transfer of ***data*** by telecommunications; transmission of computer games, video games, electronic games and interactive games via the internet, computer networks and electronic communication networks; transmission of information via local and/or global computer and/or telecommunication networks; transmission, broadcast, reception and other dissemination of audio, video, still and moving images, text and ***data*** whether in real or delayed time; information, advisory and consultancy services relating to the foregoing.Class 39Transport; packaging and storage of goods; travel arrangement; arrangement of transportation of retail goods; arranging the delivery of goods by air and rail; arranging transportation of goods; courier service; courier services for the delivery of goods, parcels, packages and cargo by land, sea and air; delivery of goods by road; freight forwarding; rental of warehouses; shipping; transport; transport information, advice and reservation services; transport, packaging, warehousing, ***collection*** and storage of goods; transportation, distribution, delivery, storage and warehousing, packaging products, courier services; information, advisory and consultancy services relating to the foregoing.Class 40Treatment of materials; recycling of waste and trash; air purification and treatment of water; printing services; food and drink preservation; custom manufacture and assembly services; energy production; treatment and transformation of materials; printing, photographic and cinematographic development; duplication of audio and video recordings; rental of equipment for the treatment and transformation of materials; for energy production and for custom manufacturing; information, advisory and consultancy services relating to the foregoing.Class 41Education; providing of training; entertainment, sporting and cultural activities; advisory and consultancy services relating to sports, fitness and physical wellbeing ; amusement game services; amusement machine entertainment services; amusement parks; amusement services; amusements; animal training; animated musical entertainment services; arranging and conducting award ceremonies; arranging and conducting of conferences and congresses, presentation of live performances, arranging and conducting of seminars and symposiums; arranging for seminars for educational purposes; arranging for ticket reservations for shows and other entertainment events; arranging of competitions for education or entertainment; arranging of conferences relating to entertainment; arranging of conventions for entertainment purposes; arranging of demonstrations for entertainment purposes; arranging of displays for entertainment purposes; arranging of exhibitions for entertainment purposes; arranging of festivals for entertainment purposes; arranging of musical entertainment; arranging of presentations for entertainment purposes; arranging of seminars relating to entertainment; arranging of visual and musical entertainment; arranging or seminars for educational purposes; audio entertainment services; audio programming; audio-visual display presentation services for entertainment purposes; betting services; booking of entertainment; booking of entertainment halls; bookmobile services; camp services; card game services; casino services; cinematographic entertainment services; closed circuit television entertainment services; club and resort entertainment, education or recreation services; coaching services for sporting activities; competitions (organisation of-) [education or entertainment]; competitions (organization of sports–) ; rental of sports equipment, except vehicles; concert and nightclub entertainment services; conducting entertainment exhibitions in magic shows; conducting fitness classes; conducting of exhibitions for entertainment purposes; corporate hospitality (entertainment); cruise ship entertainment services; diet and nutrition services; discotheque services; dissemination of entertainment material; distribution of video cassettes; dub and resort entertainment and recreation services; educational services; electronic games services provided by means of the internet; electronic newsletters distributed via the internet, electronic mail or portable, mobile, handheld or tablet devices; electronic newsletters regarding entertainment, television entertainment, sporting activities, cultural activities, skill gaming, gaming, gambling, betting, casinos, poker tournaments, card games and poker distributed via the internet, electronic mail or portable, mobile, handheld or tablet devices; enabling the use of sports facilities; entertainer services; entertainment agency services; entertainment and educational services, namely, provision of an immersive 3d virtual reality experience in the nature of non-downloadable feature films and videos; entertainment booking services; entertainment by film; entertainment by means of concerts, roadshows, television and theatre productions; entertainment club services; entertainment in the form of live musical performances (services providing-), recorded music (services providing-), television programmes (services providing-), a water park and amusement centre, air shows, an amusement park ride, automobile races, ballet performances, baseball games, basketball games, beauty pageants, boxing contests, circuses, competitions in the field of spelling, dance performances, ethnic festival, fashion shows, football games, golf tournaments, gymnastic performances, hockey games, ice hockey games, laser shows, light shows, magic shows, on-going game shows, on-going television programs in the field of variety, orchestra performances, virtual reality games, virtual reality mobile applications and virtual reality experiences, roller derby, soccer games, symphony orchestra performances, television news shows, tennis tournaments, theatre productions, track and field competitions, weight lifting competitions, wrestling contests, yacht races; entertainment information; entertainment information services; entertainment information services; organisation of sports competitions; entertainment or educational club services; entertainment party planning; entertainment provided by cable television, telephone, videotext systems, during intervals of sporting events, via the Internet; entertainment relating to wine tasting; entertainment services; entertainment services by stage production and cabaret; entertainment services for children; entertainment services for producing live shows; entertainment services in the form of cinema performances, concert performances, motion pictures, television programmes, a wrestling club, an amusement park show, arranging social entertainment events, live performances of roller skating exhibitions and competitions; entertainment services in the nature of on-line computer games, video games, electronic computer and video games, interactive computer and video games, virtual reality computer and video games, multiple player computer and video games; entertainment services in the nature of skating events; entertainment services in the nature of video game leagues, contests, games, tournaments, exhibitions, competitions and events; entertainment services performed by a musical group, musicians or singers; entertainment services provided at a motor racing circuit, race track, country club, discotheques, nightclubs, by a music group, a musical group, vocalists, by hotels, by radio, telephone, television; entertainment services provided during intervals at sports events; entertainment services provided for children; entertainment services provided on-line from a computer database or the internet; entertainment services relating to competitions, quizzes, sports, ten pin bowling, the playing of golf; entertainment ticket agency services; entertainment, education and instruction services; exhibition services for entertainment purposes; fan club services; fashion shows for entertainment purposes (organization of-); festivals (organisation of-) for entertainment purposes; fetes (organisation of-) for entertainment purposes; film distribution and production; fitness advisory services; gambling services; games [not downloadable] played via a global computer network; gaming machine entertainment services; gaming services; gaming services for entertainment purposes; gymnastic instruction; provision of education regarding the health and beauty of individuals; health club services; health clubs; hire and rental of equipment for sports; holiday camp services (entertainment); holiday centre entertainment services; hospitality services (entertainment); hosting [organising] awards; hosting video gaming leagues; hypnotist shows [entertainment]; information on playing sports; information relating to entertainment, provided on-line from a computer database or the internet; instruction courses relating to sporting activities; instruction in diet and nutrition (not medical); instruction in health and beauty; instruction in sporting activities; instruction services; instructional services relating to gymnastics, weight training, body building, aerobics, physical exercises, physical rehabilitation; interactive entertainment; interactive entertainment services; interviewing of contemporary figures for entertainment purposes; jazz music entertainment services; kindergarten services [education or entertainment]; language teaching; laser show services [entertainment]; leisure centre, health club, fitness centre and gymnasium services; library services; lighting productions for entertainment purposes; live demonstrations for entertainment; live entertainment; live entertainment production services; live entertainment services; live entertainment services relating to video game leagues contests, games, tournaments, exhibitions, competitions and events at indoor and outdoor venues and through the media of radio, television, and the internet; modelling for artists; motion picture production, live performances, theatrical productions, stage, screen and television entertainment services; movie translation; music entertainment services; musical entertainment; musical entertainment services; nightclub services; on-line entertainment; operating lotteries; operation of leisure/fitness centres, recreational facilities and health clubs; organisation and conducting of sports events; organisation of competitions for education or entertainment, conferences related to entertainment; organisation of entertainment and cultural events, entertainment events, entertainment services, events for cultural, entertainment and sporting purposes, fashion shows, musical entertainment, outings for entertainment, parties and events in a computer and video game arena, parties and events in respect of computer and video gaming, sports competitions, sporting activities, sporting events, sporting competitions, ; rental of sports equipment; organisation, production and presentation of tournaments, shows, competitions, games, gameshows, concerts, exhibitions and events; organisation, production and presentation of tournaments, shows, competitions, contests, games, gameshows, exhibitions and events all relating to amusement games, skill games and gaming, gaming, gambling, betting, card games, games of skill, poker games and casino games; organising and conducting stage shows, theatre productions, contests, dances and parties; organising competitions (education holiday entertainment); organising events for entertainment purposes; organising of competitions [entertainment] by telephone, competitions for entertainment, entertainment, entertainment competitions, exhibitions for entertainment purposes, meetings in the field of entertainment, shows for entertainment purposes, sporting activities and competitions; organising tournaments and exhibitions for computer video gaming contests; organising video gaming leagues; organization of competitions [education or entertainment], fashion shows for entertainment purposes, sports competitions, sports events and competitions; organization, arranging and conducting of exhibitions, conferences, conventions, seminars, workshops, expositions and events, all for cultural, entertainment or educational purposes; organizing and arranging exhibitions for entertainment purposes; organizing and presenting displays of entertainment relating to style and fashion; personal fitness instructor services; play schemes [entertainment/education]; poker game services; popular entertainment services; preparation of entertainment programmes for broadcasting; preparation of entertainment programmes for the cinema; preparation of special effects for entertainment purposes; presentation of live performances; presentation of live program; production of audio entertainment, audio tapes for entertainment purposes, entertainment in the form of a television series, entertainment in the form of sound recordings, entertainment in the form of television programmes, entertainment in the form of video tapes, entertainment shows featuring dancers, entertainment shows featuring dancers and singers, entertainment shows featuring instrumentalists, entertainment shows featuring singers, films for entertainment purposes, live entertainment, live entertainment features, live television programmes for entertainment, radio and television programmes, television entertainment features, television entertainment programmes, TV shows; production, presentation and distribution of audio, video, still and moving images and ***data***; provide on-line digital music, not downloadable; providing entertainment information; providing entertainment information via a website; providing facilities for entertainment, sporting and entertainment events, competitions and award programmes, sporting events, sports and athletic competitions and recreation activities, including providing stadium facilities for football games; providing information in the field of entertainment by means of a global computer network; providing information on entertainment through computer networks; providing of an on-line service enabling physically remote players of electronic games to communicate, play against and compete with selected players; providing of sport facilities, entertainment services provided during intervals at sport events, training; providing on-line electronic publications, not downloadable; providing on-line information in the field of computer gaming entertainment; providing on-line publications and digital music (which cannot be downloaded by) from the internet; providing sports facilities, providing recreation facilities, health club services; provision of cinema facilities, club entertainment services, computer and video game arenas, digital music (not downloadable) from the internet, educational or training material, entertainment, live entertainment, musical entertainment, on-line electronic publications, digital music (not downloadable) from the Internet, on-line entertainment, radio and television entertainment services, recreational and sporting facilities, rooms adapted for entertainment, rooms for entertainment, sports facilities, teaching facilities for sports and recreational activities; provision of entertainment by telephone, entertainment facilities, entertainment facilities in hotels, entertainment services for children, entertainment services through the media of audio tapes, cine-films, publications, television, video-films; provision of entertainment, education, recreation, instruction, tuition and training; provision of facilities relating to gymnastics, weight training, body building, aerobics and physical exercise; provision of information relating to entertainment online from a computer database of the internet; publication of books relating to entertainment; publication of cultural, entertainment or educational materials all relating to exhibitions, conferences, conventions, seminars, workshops, expositions and events; publication of texts [other than publicity texts]; publishing; publishing services including electronic publishing services; radio and television entertainment; radio and television entertainment services; radio entertainment; radio entertainment production; radio entertainment services; recording studio services for sound, films, videos and television; recreation; recreation facilities (providing-); rendering of musical entertainment by instrumental groups and/or vocal groups; rental of apparatus for games, recorded entertainment, sporting apparatus, sports competitions, sports equipment, sports competitions, sports facilities, sports grounds, stadium facilities, toys; road shows being entertainment services; services for the production of entertainment in the form of film, television, video, animated motion picture entertainment, live musical performances; showing of educational films; showing of pre-recorded entertainment; single-player and multi-player skill games, skill game rooms and games of skill provided live or by means of the internet or via television or via portable, mobile, handheld or tablet devices; skill gaming services; social club services for entertainment purposes; sound recording and video entertainment services; sport camp services; sporting and cultural activities; sporting and recreational activities; sporting equipment rental; sporting results services; sports camp services; sports club services; sports coaching; sports entertainment services; sports equipment rentals; sports equipment（rental of-）[except vehicles]; sports refereeing; sports training and teaching academies; staged light entertainment services; staging of light entertainment productions; summer camps [entertainment and education]; symposiums relating to entertainment; telephone conversation services for entertainment purposes; telephone information services relating to entertainment; television and radio entertainment; television and radio entertainment services; television entertainment; television entertainment services; the provision of any of the aforesaid services live or through the medium of television or on-line from a computer database or via the internet or via portable, mobile, handheld or tablet devices; the provision of discussion forums, games of skill; the provision of information relating to entertainment services, television entertainment services, television programmes, sporting activities, cultural activities, amusement services, amusement games, skill gaming services, gaming services, gambling services, betting services, casino services, card game services, poker game services, tournaments, competitions, contests, games, gameshows and events; the provision of on line electronic publications and digital music (not downloadable) from the global telecommunication network and/or the Internet; theatre entertainment; ticket agency services [entertainment]; ticket information services for entertainment events; ticket procurement services for entertainment events; ticket reservation and booking services for entertainment, sporting and cultural events; ticket reservation, booking and information services for entertainment, sporting and cultural events; training; training of non-medical staff in the care of children; TV entertainment services; video entertainment services; video game entertainment services; video game tournaments and exhibitions rendered live at venues and through various media including radio, television and the internet; vocational guidance services; wedding celebrations (organisation of entertainment for-); wine tastings [entertainment services]; information, advisory and consultancy services relating to the aforesaid.Class 42Scientific and technological services and research and design relating thereto; industrial analysis, industrial research and industrial design services; quality control and authentication services; design and development of computer hardware and software; rental of computer software; software as a service [SaaS]; hosting an online web-based system and on-line portal for gamers to participate in on-line gaming, operation and coordination of leagues, game tournaments, and tours for computer game playing purposes; providing non-downloadable software that allows users to create, modify, upload, download, share, preview, and publish user created interactive video game content, music, and other media files via a global computer network; design services relating to the production of computer and video games, interactive entertainment products and computer and video game competitions; comparative analysis studies of the performance of software applications, computer and video games, computer and video games competitions, websites, virtual worlds and computer based audio visual content; services for gathering, processing, analysing, managing and reporting information concerning online, internet and web site activity; design and development of computer hardware and software; organisation, installation and maintenance of computer software; designing, drawing, creating and maintaining web pages; design and development of computer application software; design and development of computer application software for portable, mobile, handheld and tablet devices; development of multimedia websites; provision of an Internet platform for social networking services; image scanning services; providing technical support; information, advisory and consultancy services relating to the foregoing.Class 43Services for providing food and drink; temporary accommodation; cafe, restaurant, bar, club, public house, cafeteria and catering services; cafeterias, self-service restaurants; snack bars; coffee shops; restaurants; provision of restaurant and drinking house facilities; catering; accommodation services; hotel and hotel reservation services; day nurseries; camp services; crèche services; catering services for the provision of food and drink; club, hotels; hotel reservation, restaurant, public house, café and cafeteria services; organising and providing facilities for conferences and exhibitions; children care; child care centres; providing child care centres; rental of furniture, linens, table settings and equipment for the provision of food and drink; information, advisory and consultancy services relating to all of the aforesaid services.Class 44Medical services; veterinary services; hygienic and beauty care for human beings or animals; ***agriculture***, aquaculture, horticulture and forestry services; beauty treatment services; ***agriculture***, horticulture and forestry services; provision of medical services at sporting events; aromatherapy; aromatherapy services; baths; beauty salons; chiropody; consultancy in the field of beauty, body and skincare, make up and dress; convalescent services; cosmetic body care services; cosmetic dentistry services; dentistry services; dietary guidance; dietetic and nutritional advice; dietician services; fitness testing; hair implantation; hairdressing; hairdressing salons; hairdressing services; health care relating to homeopathy; hospital services; hygiene and special alimentary, dietetic or nutritional care; manicure and pedicure services; massage; medical, hygienic and beauty care services; medical testing services, namely, fitness evaluation; midwifery services; non-business consultancy in the field of body care; nutritional guidance; opticians services; pharmacy advice; physical therapy; physiotherapy; physiotherapy services; plastic surgery; provision of exercise and steam facilities; provision of exercise and steam rooms; provision of sauna facilities; provision of Turkish baths facilities; reflexology; sun tanning salons; sun tanning salons services; Turkish baths; information, advisory and consultancy services relating to the foregoing.Class 45Legal services; security services for the physical protection of tangible property and individuals; personal shopper services, personal fashion consulting services; personal gift selection for others; tagging and security services; information, advisory and consultancy services relating to the foregoing.

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[***Synthesis and in vitro characterization of the genotoxic, mutagenic and cell-transforming potential of nitrosylated heme***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:693X-JCV1-F129-P0M4-00000-00&context=1516831)

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**Body**

Introduction

Several epidemiological studies suggest that a direct correlation between the incidence of colorectal cancer (CRC) and the consumption of red and processed red meat, but not white meat, exists in industrialized nations (English et al. ; Larsson et al. ; Norat et al. ; WCRF/AICR ; Vargas and Thompson ; Bray et al. ). For instance, Orlich et al.

() compared CRC incidence in individuals consuming a non-vegetarian or a pescovegetarian diet and concluded that the consumption of a pescovegetarian diet significantly reduces cancer risk and that meat may be one of the most important factors in nutrition-associated CRC. Depending on the method of preparation, all types of meat—i.e. red as well as white meat and fish—may contain potentially carcinogenic compounds such as polycyclic aromatic hydrocarbons (PAHs; Vanmaanen et al. ; Kazerouni et al. ; Sinha et al. ; Demeyer et al. ) or heterocyclic aromatic amines (HCAs; Hasegawa et al. ; Shirai et al. ; Ni et al. ; Puangsombat et al. ). However, such heat-induced contaminants are rather unlikely to play a prominent role in increasing CRC risk specifically associated with red/processed red meat, as (1) they have been found to occur in all types of heated meat, i.e. also in white meat, which is not associated with CRC formation, and (2) their chemical structure often precludes that significant amounts are taken up by colonic cells. For instance, in the case of HCAs, bioavailability has been shown to be typically around 1–2% (Watkins et al. ; Nicken et al. ). In addition, extremely high doses are needed to induce carcinogenic effects in vivo (reviewed by Stavric ) and no malignant cell transformation has been shown to occur in vitro (Nicken et al. ). In the case of the PAH lead compound benzo[a]pyrene (BaP), a case–control study performed by Helmus et al. () showed that the control group was exposed to higher BaP concentrations derived from white meat than the group comprising the actual CRC cases. Moreover, results from another epidemiological study have failed to demonstrate a consistent link between PAH ingestion and CRC (Tabatabaei et al. ). On the contrary, it has been suggested that mutagenic factors directly arising from red meat itself may in fact play a role in CRC development (Helmus et al. ).

In line with this hypothesis, the International Agency for Research on Cancer (IARC) has recently classified the consumption of red meat as probably carcinogenic to humans (Group 2A) and the consumption of processed meat as carcinogenic to humans (Group 1; Bouvard et al. ). Up to now, the consumption of white meat has not been evaluated by IARC regarding its carcinogenicity and meta-analyses suggest that its consumption does not increase CRC risk (Huxley et al. ; Carr et al. ; Etemadi et al. ). In fact, the above-mentioned evidence indicates that red meat may contain endogenous genotoxic constituents and several hypotheses have been brought forward to explain the discrepancy between red and white meat regarding their antithetical association with CRC, with one being the significantly lower heme content in white meat when compared to red meat (Lombardi-Boccia et al. ; Vanden Bussche et al. ; Pretorius et al. ).

Heme is a rather large (616 Da) porphyrin-iron complex (Wright and Nair ), whose main function consists in transporting oxygen through the body as a component of hemoglobin in red blood cells (Carpenter and Mahoney ; Alayash et al. ). In spite of its important physiological function, heme may promote the formation of CRC by different mechanisms, including the induction of hyperproliferation and/or the increased formation of genotoxic compounds (reviewed by Seiwert et al. ). A diet rich in heme (i.e. abundant in red meat) has been shown to increase the occurrence of reactive lipoperoxides (Bastide et al. ) and to promote the growth of azoxymethane-induced preneoplastic aberrant crypt foci in the colon of rats (Pierre et al. , ). Further evidence for a carcinogenic potential emanating from heme was contributed by Gilsing et al. (), who reported a heme-associated increase in the incidence of APC and KRAS mutations in a cohort study performed in The Netherlands. The higher heme content in red meat might also be responsible for the presumed carcinogenicity of processed red meat. The term “processed” or “cured” commonly refers to the addition of nitrite or nitrate salts to (red) meat, which directly or endogenously react with various meat components (e.g. heme) to form N-nitroso compounds (NOCs) such as nitrosylated heme (NO-heme), which is also known as the “cooked cured meat pigment” (Stevanovic et al. ; Kuhnle et al. ; Honikel ; Sun et al. ). The bonding of nitric oxide to the central iron atom of the heme molecule is a pH-dependent process (Hornsey ). For this reason, it is assumed that the slightly acidic conditions of prevailing in the proximal colon (pH 5.4–5.9; Payne et al. ; Moon et al. ) may trigger the release of nitric oxide, which, in addition to the above-mentioned genotoxic properties intrinsic to the heme moiety, could induce further pro-carcinogenic effects (Cupid et al. ; Gottschalg et al. ). This hypothesis is supported by results coming from a human nutrition study that showed higher fecal NOC concentrations and an increase in the number of DNA adducts in exfoliated colonic cells after red meat consumption, whereby both effects were positively correlated (Lewin et al. ). This suggests that NO-heme may be a very important factor in the context of processed red meat-related CRC development.

Although NO-heme has been detected in the gut of human volunteers that consumed a meat-rich diet (Kuhnle et al. ), its potential mutagenic effects as well as its involvement in (colorectal) carcinogenesis are still unclear, as demonstrated by the lack of scientific studies exploring the potential association of (pure) NO-heme with CRC. This might be explained by the fact that studies on specific biological/toxic effects of NO-heme are difficult to perform due to its insolubility in aqueous media as well as in typical cell culture-compatible solvents (e.g. ethanol or dimethyl sulfoxide [DMSO]) and its reduced stability when exposed to light and atmospheric oxygen levels (Andersen and Skibsted ; Jankiewicz et al. ; Moller et al. ). Moreover, NO-heme is not commercially available and most NO-heme-containing solutions synthesized according to various elder protocols (Killday et al. ; Jankiewicz et al. ; Pegg and Shahidi ; Soltanizadeh and Kadivar ) do not only contain the pure compound, but also a mixture of potentially toxic and/or mutagenic substances as well as reaction by-products (e.g. nitrite; Stevanovic et al. ).

Therefore, the aim of the present study was to generate purified NO-heme and to evaluate its potential DNA-damaging and cell-transforming effects using various in vitro approaches, in order to shed more light on its hypothetical role in red meat-associated carcinogenesis.

Materials and methods

Cell culture

BALB/c 3T3 clone A31-1-1 cells from the laboratory of M. Umeda (Hatano Research Institute, Japan) were kindly provided by Dr. A. Poth (Knoell Germany GmbH, Mannheim, Germany). The cells were cultured in minimum essential medium (MEM) supplemented with 10% (v/v) fetal calf serum (FCS), 2 mM (v/v) -glutamine, 100 µg ml−1 streptomycin and 100 IU ml−1 penicillin (all components were obtained from Biochrom [Merck], Berlin, Germany). Chinese hamster ovary cells (subclone K1, CHO-K1-BH4) were kindly provided by B. J. Phillips in the context of the International Food Irradiation Project (IFIP; Ministry of ***Agriculture***, Fishery and Food, UK 1984) and cultured in McCoy’s 5A medium supplemented with 10% (v/v) FCS, 100 IU ml−1 penicillin and 100 µg ml−1 streptomycin (all components were obtained from Life Technologies, Darmstadt, Germany). The human colon adenocarcinoma cell line Caco-2 was purchased from the German ***Collection*** of Microorganisms and Cell Cultures (DSMZ; Braunschweig, Germany). These cells were cultured in MEM Eagle’s (EMEM) medium supplemented with 1% (v/v) non-essential amino acids, 2 mM (v/v) -glutamine, 50 IU ml−1 penicillin G, 50 µg ml−1 streptomycin (all components were obtained from Lonza, Verviers, Belgium) and 10% (v/v) FCS obtained from Biowest (Nuaille, France). All cell lines were kept at 37 °C in a humidified atmosphere containing 5% CO2.

Chemicals and control solutions

Sodium nitrite (Carl Roth, Karlsruhe, Germany) and dehydroascorbic acid (DHAA; Sigma-Aldrich, Schnelldorf, Germany) were dissolved and diluted in ultrapure water. The nitrite concentration used in the various in vitro assays is based on the limit of quantification (LOQ) of the method used to quantify the residual nitrite content in the purified NO-heme solution prepared in the present study (see below). The concentration of DHAA applied in the various test systems was estimated by dividing the starting concentration of ascorbic acid in the NO-heme solution as published by Soltanizadeh and Kadivar () (123.08 mM; see below) by the purification-based dilution factor calculated for nitrite under the assumption that DHAA is fully oxidized during the nitrosylation reaction. In order to obtain adequate solvent controls for NO-heme and hematin, acetone (99.7%; Carl Roth) was diluted in ultrapure water (acetone/H2O) or in 20 mM NaOH (acetone/NaOH) (Carl Roth) to a final concentration of 80% (v/v) in the case of the NO-heme solution and the hematin solution, respectively. Further chemicals used are mentioned in the respective assay sections below.

Preparation and purification of heme solutions

The chemical structure of the different heme species mentioned in this study is shown in Supplementary Fig. a. Impure NO-heme was prepared as previously described by Soltanizadeh and Kadivar (). Briefly, 6.52 mg porcine hemin (Sigma-Aldrich) were dissolved in 1.88 ml 0.1 M NaOH and diluted in 8 ml acetone. Then, in order to obtain a 1 mM hemin solution, 120 µl of a 12.02 M HCl solution (Carl Roth) were added. Finally, heme nitrosylation was achieved by the stepwise addition of 217 mg ascorbic acid (Carl Roth; final concentration: 123.08 mM) and 138 mg sodium nitrite (final concentration: 200 mM) to the prepared hemin solution.

Chemical characterization of NO-heme. a UV–Vis and b IR spectra of different heme species. c IR spectrum of NO-heme compared to spectra of educts, by-products and solvents used in the nitrosylation reaction. d Detection of nitrite in purified NO-heme solutions (black and grey symbols; 100–200 µM NO-heme) by means of the standard addition method by using spiked nitrite standards (white symbols; 0–200 µM nitrite). Shown is the mean and standard deviation (SD) of three independent UV–Vis measurements

In order to subsequently remove nitrite and DHAA residues and thus produce purified NO-heme, 10 ml of the above-mentioned solution were dialyzed at 4 °C protected from light for 24 h against distilled and ultra-pure water using Slide-A-Lyzer® dialysis cassettes (MWCO: 3500; Thermo Scientific, Dreieich, Germany). Purified NO-heme was then obtained as follows: in a first step, the solution in the dialysis cassette was removed and centrifuged at 2500 rcf for 10 min, leaving only precipitated NO-heme inside the cassette. In a second step, 8 ml pure acetone were injected into the empty dialysis cassette and subsequently removed once the NO-heme precipitate was (almost) completely dissolved. Thereafter, both solutions were combined, divided into 1.5 ml aliquots and dried for 90 min at 60 °C using a centrifugal vacuum concentrator (Concentrator 5301; Eppendorf, Hamburg, Germany). Lastly, all resulting pellets were dissolved and pooled in a total volume of 600 µl 80% acetone/H2O, flushed with nitrogen and stored at − 80 °C protected from light until further use. Immediately before the respective in vitro assays mentioned below were performed, NO-heme was quantified a second time and diluted to the desired concentration using 80% acetone/H2O. The cellular treatment with NO-heme was always performed in a darkened room with the lamp of the laminar flow cabinet as the only source of light.

To obtain a 4 mM hematin solution, 13.04 mg porcine hemin were dissolved in 1 ml 20 mM NaOH and diluted in 4 ml acetone. Thus, hematin contained the same acetone concentration as the NO-heme solutions, i.e. 80%.

Photometric detection and quantification of heme species

All initial non-nitrosylated hemin as well as the NO-heme solutions were diluted in 80% acetone and their content was analyzed by UV–Vis spectroscopy in the range of 350–750 nm using a microplate reader (Infinite M200; Tecan, Crailsheim, Germany). The concentration of NO-heme was determined by applying the Beer–Lambert law and the published extinction coefficient of NO-heme, which is 11.3 mM−1 × cm−1 at 540 nm (Hornsey ).

Fourier-transform infrared (FTIR) spectroscopy of heme species, reagents and reaction by-products

In order to further identify the hemin and NO-heme molecules present in the above-mentioned solutions, nitrogen-dried samples were analyzed in the range of 4000–400 cm−1 using an FTIR spectrometer (IRAffinity-1S; Shimadzu, Duisburg, Germany). Reference spectra of reagents and reaction by-products present in the NO-heme solution (e.g. DHAA, sodium nitrite and hemozoin [obtained from InvivoGen, Toulouse, France]) were recorded using the undissolved (i.e. dry) compounds.

Stability analysis of NO-heme under different storage conditions

For the analysis of stability, NO-heme was stored in 15 ml centrifuge tubes (Greiner Bio-One, Frickenhausen, Germany) under different light and atmospheric conditions. Briefly, 80 ml of the NO-heme solution were first synthesized, purified and concentrated as described above. The final solution was further diluted in 80% acetone/H2O to a final volume of 12.5 ml and allocated to four centrifuge tubes containing 3 ml each. Two of the NO-heme samples were stored in the dark at room temperature, flushed with nitrogen and additionally sealed with thermoplastic film (Parafilm® M, Sigma-Aldrich). The other samples were incubated at room temperature and exposed to sunlight and air. The NO-heme content of each tube was analyzed by UV–Vis and FTIR spectroscopy after 0, 2, 4 and 24 h of incubation.

Nitrite content in NO-heme solutions

The residual nitrite concentration of the NO-heme solution was measured photometrically and calculated using the standard addition method, i.e. by adding increasing amounts of sodium nitrite to identical volumes and concentrations of the same NO-heme sample. This method enables the generation of a nitrite standard curve while avoiding matrix effects caused by compounds absorbing light at the same wavelength as the reaction reagents used to quantify nitrite (e.g. NO-heme itself). The colorimetric quantification of nitrite was performed as reported beforehand, albeit with slight modifications (Mohamed et al. ). NO-heme was diluted in ultra-pure water and mixed with 11.61 mM sulfanilamide (Sigma-Aldrich) and 2.51 mM N-(1-naphtyl)-ethylenediamine dihydrochloride (NED, Sigma-Aldrich) in 96-well plates (TPP, Trasadingen, Switzerland). Both reagents were dissolved in 0.5 M HCl, with solutions always being freshly prepared when needed. After the addition of NED, samples in the 96-well plates were incubated for 15 min at room temperature, followed by the measurement of the absorption at 540 nm. The absorption of the blank sample was determined by adding 0.5 M HCl instead of sulfanilamide and NED.

To estimate the nitrite content in NO-heme solutions after dialysis and vacuum concentration, nitrite standards (0, 100 and 200 µM concentrated in ultrapure water) as well as solutions of 100 and 200 µM NO-heme were spiked with nitrite and analyzed as described above. Thereafter, the nitrite standards were plotted in a diagram and used as indicators for nitrite detection in the NO-heme samples.

SDS-PAGE and Western blotting

The cellular uptake of NO-heme and hematin was qualitatively investigated by using the expression of the intracellular heme-degrading protein heme oxygenase 1 (HO-1) as surrogate marker. Its expression was analyzed via SDS-PAGE and Western blotting in NO-heme-treated Caco-2 cells. Beforehand, the cytotoxicity of the heme species as well as solvents was evaluated using a commercial kit measuring cell viability based on the WST-1 reagent obtained from Roche Diagnostics (Mannheim, Germany) and performed according to the manufacturer's instructions. Briefly, 5 × 104 cells/well were seeded in 96-well plates (TPP) and incubated for 24 h. Then, the cells were treated with the test substances in triplicate for a further 24 h before they were washed with phosphate buffered saline (PBS) and incubated for 1.5 h with 100 µl/well medium supplemented with 10% (v/v) WST-1 reagent. Finally, absorption was measured at 450 nm (with a reference wavelength at 650 nm). For HO-1 expression analysis, Caco-2 cells (3 × 105/3.5 cm plate) were treated for 24 h as mentioned above, with 2% acetone/H2O and 2% acetone/NaOH serving as solvent controls. Subsequently, the supernatant and the PBS-washed cellular fraction were ***collected***, pelleted with trypsinized cells and resuspended in 1× Lämmli loading buffer pre-heated to 95 °C. Proteins were then separated by SDS-PAGE and transferred onto a nitrocellulose membrane (Perkin Elmer, Rodgau, Germany) using a wet-blot chamber (BioRad, Munich, Germany) as previously described (Seiwert et al. ). After blocking the membrane in 5% non-fat dry milk (Carl Roth) in Tris-buffered saline/0.1% Tween-20 (TBS-T), incubation with primary antibodies occurred overnight at 4 °C. The membrane was then washed thrice in TBS-T followed by an incubation with secondary antibodies for 1 h at room temperature. After final washings steps, proteins were detected with enhanced chemoluminescence using an Azure 300 CL imaging system (Azure biosystems, Dublin, USA). Anti-heat shock protein 90 (Hsp90) α/β (mouse monoclonal; no. sc-13119; Santa Cruz Biotechnology, Heidelberg, Germany) and anti-heme oxygenase-1 (rabbit polyclonal; no. GTX101147, GeneTex, Irvine, California, USA) were used as primary antibodies. Horseradish peroxidase-conjugated secondary antibodies were purchased from Santa Cruz (anti-mouse) and Cell Signaling Technologies (anti-rabbit; Frankfurt am Main, Germany).

Single cell electrophoresis assay (comet assay)

DNA-damaging effects of NO-heme were determined in Caco-2 and BALB/c 3T3 cells using the single cell electrophoresis assay (comet assay). The detection of genotoxicity in BALB/c 3T3 cells was thereby performed to enable a direct comparison of these results with effects documented in the BALB/c 3T3 cell transformation assay (see below). The comet assay was performed as previously reported (Briviba et al. ), with the following modifications: 2.15 × 104 cells/well were seeded in 6-well plates (Corning, Kennebunk, USA) and cultivated for five days. At day six after seeding, the cells were treated for 1 h with the different test substances diluted in Hank’s Balanced Salt Solution (HBSS; Lonza). Hydrogen peroxide and iron sulfate (both from Sigma-Aldrich) served as positive controls. After treatment, the cells were prepared as previously published (Briviba et al. ) and incubated in a specific lysis buffer (100 mM Na2EDTA, 1% Triton X-100, 2.5 mM NaCl, 1% lauroyl sarcosine sodium salt, 10 mM tris(hydroxymethyl)aminomethane [TRIS] and 10% dimethyl sulfoxide; all purchased from Merck, Darmstadt, Germany) for 1 h at 4 °C. Then, microscope slides were incubated in electrophoresis buffer (1 mM Na2EDTA, 300 mM NaOH; Merck) for 20 min at room temperature, followed by an electrophoresis run at 25 V and 300 mA for 40 min. Thereafter, the slides were washed three times with TRIS buffer (0.4 M; pH 7.5) and stained using 85 µl of a 4,6-diamidino-2-phenylindole solution (5 µg ml−1; Merck). For quantification of the results, 100 cells per slide were analyzed using a DM 400 B fluorescence microscope (Leica, Wetzlar, Germany) connected to the Comet Assay II Image Analysis System (Perceptive Instruments, Halstedt, UK).

Bacterial reverse mutation assay (Ames test)

The Ames test was performed according to the pre-incubation method described by Mortelmans and Zeiger (), albeit with slight modifications. Briefly, the lyophilized Salmonella typhimurium strains TA100 (lot number 5220D, Trinova, Gießen, Germany) and TA1535 (lot number 5209D, Trinova) were cultured overnight in 50 ml ***nutrient*** broth no. 2 (Thermo Scientific) at 37 °C. Subsequently, the bacterial cultures were shaken for two hours at 125 rpm and 37 °C until the suspension reached an optical density of 1–1.3 at 600 nm. Then, 100 µl of the suspension were mixed with 500 µl of sodium phosphate buffer (final concentrations: 12 mM NaH2PO4, 88 mM Na2HPO4 [pH 7.4]; all components purchased from Carl Roth) and 50 µl of the test compound. Sodium azide (Sigma-Aldrich) was used as positive control and dissolved in ultrapure water. The bacteria were mixed and incubated with the test compounds for 30 min at 37 °C prior to being plated and further incubated for 48 h at 37 °C. Finally, the number of grown revertant colonies was counted.

In vitro mammalian cell gene mutation test (HPRT assay)

The investigation of potential cytotoxic effects induced by NO-heme in CHO-K1 cells was performed using a commercial cell proliferation kit based on the MTT reagent obtained from Roche Diagnostics and performed according to the manufacturer's instructions. Briefly, 3.5 × 104 cells/well were seeded in 96-well plates (Greiner Diagnostic, Balingen, Germany). Approximately 24 h later, the cells were treated with different NO-heme and acetone concentrations for another 24 h. Subsequently, cells were incubated with the MTT solution for 4 h, before 100 µl DMSO (Carl Roth) were added and absorbance was measured at a wavelength of 570 nm using a microplate reader (EL600; BioTek Instruments, Winooski, USA). The mitochondrial metabolic activity of NO-heme-treated cells was thereby compared to the vehicle control. The HPRT assay was performed according to OECD test guideline no. 476 (OECD ) without exogenous metabolic activation. Briefly, 5 × 105 cells per sample were seeded in a 75 cm2 cell culture flask (Greiner Bio-One) containing 15 ml of McCoy’s 5A medium. After 24 h, the cells were treated with the different test substances for 4 h, whereby ethyl methanesulfonate (EMS; Sigma-Aldrich) served as the mutation-inducing positive control. Then, the cells were washed with buffered saline, replenished in fresh medium and incubated for another 48 h. In order to evaluate the expression of the mutant phenotype, cells were sub-cultured every 48 h for 9 days. On day nine post treatment, 2 × 105 cells were transferred in triplicate to new flasks, each containing 6-thioguanine (10 µg ml−1; Sigma-Aldrich). After another period of 9 days, colonies resistant to 6-thioguanine were fixed with methanol (Carl Roth), stained with methylene blue (Carl Roth) and counted. For the final evaluation of the test, the absolute number of mutations per one million CHO-K1 cells was calculated.

BALB/c 3T3 cell transformation assay (CTA)

The appropriate concentrations of NO-heme to be used in the cell transformation assay were determined using a slightly modified colony forming efficiency (CFE) method according to Sasaki et al. (). Briefly, 200 BALB/c 3T3 cells were seeded in 60 mm dishes (TPP) filled with 4 ml MEM medium. After 24 h, the cells were treated with NO-heme or the control substances for three days. 3-Methylcholanthrene (MCA, Sigma-Aldrich) dissolved in DMSO was used as positive control. On day 4, the medium was removed and 4 ml fresh culture medium were added. On day 9, the cells were washed with saline, fixed with 4 ml ice-cold methanol (Carl Roth) for 10 min and then stained with Giemsa solution (Carl Roth) for 30 min. Finally, the stained dishes were washed with water and air-dried before cell colonies with a diameter of ≥ 2 mm were counted.

The CTA was performed as previously described (Sasaki et al. ) and began with the seeding of 2 × 104 BALB/c 3T3 cells in 100 mm dishes (TPP) filled with 10 ml MEM medium. On day 1, the cells were incubated with the test substances for three days, followed by a medium change on day 4. From now on, the cells were incubated in DMEM/HAM’s F-12 medium supplemented with 2% (v/v) FCS, 100 µg ml−1 streptomycin, 100 IU ml−1 penicillin (all components were obtained from Biochrom) and 2 µg ml−1 bovine pancreas insulin solution (Sigma-Aldrich). On days 7, 10, 14, 17, 21 and 24, the medium was changed and the cells were finally fixed on day 31 using ice-cold methanol. Lastly, the plates were stained with Giemsa solution and the number of type III foci formed was counted using a stereo microscope (SZX2-ILLT; Olympus, Hamburg, Germany). Focus characterization and assessment were performed in accordance with the photo catalogue published by Sasaki et al. ().

Statistical analysis

All results were statistically analyzed using Prism (version 8.4.1; GraphPad, La Jolla, USA). Prior to the significance analysis (α = 0.05), the ***data*** were examined with respect to normality distribution by using the Shapiro–Wilk test. Detailed information on the number of replicates and the used ***statistic*** tests are mentioned in the legends of the corresponding Tables and Figures.

Results

Analytical characterization of heme species

NO-heme showed absorbance maxima at 480, 540 and 566 nm, whereas the non-nitrosylated hemin solution showed maxima at 510, 542 and 640 nm in the UV–Vis spectra (Fig. a). As depicted in Fig. b, the IR spectra of NO-heme exhibited bands at 2918.30, 2850.79, 1701.22, 1662.64, 1629.85, 1411.89, 1274.95, 1219.01, 950.91, 840.96, 704.02 and 476.42 cm−1. Although the spectrum of hemin was similar, with signals at 2916.37, 1697.36, 1662.64, 1408.04, 1278.81, 1209.37, 937.40, 844.82, 704.02 and 478.35 cm−1, NO-heme showed a maximum IR absorbance at 1662.64 cm−1, whereas hemin solutions featured an intensity maximum at 1697.36 cm−1. The IR spectra of hemin, acetone, sodium nitrite, ascorbic acid and DHAA were recorded in parallel and served as references to exclude interfering signals in the NO-heme spectra. As depicted in Fig. c, nitrite showed no bands in the range of 1500–1900 cm−1, while DHAA showed a maximum IR intensity at 1774.51 cm−1. In the case of ascorbic acid, bands at 1753.29 and 1654.92 cm−1 were documented. Similar to the IR spectra of hemin, acetone showed a maximum intensity at 1703.14 cm−1.

The efficiency of the NO-heme purification process was verified by quantifying the residual content of nitrite in the synthesized solutions. Non-purified 1 mM NO-heme solutions contained 102.7 ± 10.7 mM nitrite (mean ± SD; n = 6) or 10.27 mM nitrite when diluted in a 100 µM NO-heme solution. In comparison, a 100 µM NO-heme solution subjected to dialysis and vacuum concentration contained amounts of nitrite below the LOQ (100 µM) of the nitrite quantification assay (Fig. d). This degree of purification corresponds to a higher than 100-fold dilution of nitrite in NO-heme solutions produced by the above-mentioned modified protocol.

Stability of NO-heme solutions

The stability of NO-heme solutions, which were protected from light and flushed with nitrogen, was not affected over an incubation period of up to 24 h according to the UV–Vis and IR spectra depicted in Fig. a and b. Storage at -80 °C additionally helped to maintain stability for at least eight weeks, as depicted in Supplementary Fig. . Exposure of NO-heme solutions to UV light and oxygen reduced the respective absorbance signals in the UV–Vis spectrum within two hours of exposure (Fig. c), while additional IR bands emerged at 1207.44 and 1554.63 cm−1 (Fig. d). In addition to these newly appeared bands, the color of the exposed NO-heme solution changed from red to brown and a precipitate was formed, which consisted of brown crystalline structures. IR spectra of these crystals were identical to the IR spectrum of the heme dimer hemozoin (Fig. ).

Stability of NO-heme under different lighting and atmospheric conditions after 0, 2, 4 and 24 h of incubation. a UV–Vis and b IR spectra of NO-heme stored in the dark under a nitrogen atmosphere. c UV–Vis and d IR spectra of NO-heme exposed to sunlight under normal atmospheric conditions (i.e. air)

Analysis of photolyzed NO-heme. The IR spectrum of NO-heme after exposure to sunlight and air for 24 h in comparison to the IR spectrum of hemozoin

Effects of the heme species in different in vitro assays

Prior to the analysis of potential toxic effects of hematin and NO-heme, their cellular uptake was determined using the heme-degrading protein heme oxygenase 1 (HO-1) as marker. The experiments showed nearly the same results for both test solutions, i.e. when compared to control samples, treatment with 50 and 100 µM hematin and NO-heme, respectively, resulted in an increased expression of HO-1 during the 24-h incubation period (Fig. ). Similar to the HO-1 expression analysis, a dose-dependent increase of cytotoxicity was seen with comparable effects in Caco-2 cells treated with both heme species (50 µM NO-heme and hematin reduced the relative cell viability to 43% and 45% of the control, respectively; Supplementary Fig. 3a).

Expression of HO-1 in Caco-2 cells exposed to NO-heme (50–100 µM) and hematin (50–100 µM) for 24 h. The solvent control of hematin (Ctrl 1) and NO-heme (Ctrl 2) were diluted with cell culture medium in the same way as the heme species, with the final test concentration being 2% acetone/NaOH in case of Ctrl 1 and 2% acetone/H2O in case of Ctrl 2. In addition, NaOH mixed with ultra-pure water instead of acetone was tested. Hsp90 served as loading control

The genotoxic potential of NO-heme and hematin was analyzed in the comet assay using BALB/c 3T3 and Caco-2 cells. Cell viability was assessed using a live/dead staining after the 1-h treatment, a necessary step for cell counting and seeding on the microscope slides. By doing so, no cytotoxicity was detected for any test substance (***data*** not shown). In the comet assay using BALB/c 3T3 cells, hematin led to a dose-dependent increase of the tail intensity with statistically significant effects in the concentration range of 10–100 µM (Fig. a), while the increase in tail intensity induced by NO-heme was generally lower than that induced by hematin and not statistically significant. In contrast, Caco-2 cells reacted more sensitively to the treatment, exhibiting genotoxic effects when exposed to increasing hematin and NO-heme concentrations: incubation of Caco-2 cells with 100 µM NO-heme thereby led to a tail intensity increase of 22%, while the same amount of hematin reached a mean tail intensity of 33% (Fig. b). For lower concentrations, a statistically significant DNA-damaging potential was not seen, although a dose-dependent tendency was noticed.

Toxicological characterization of hematin (white bars; 1–300 µM hematin dissolved in 80% acetone/NaOH [Ctrl 1]) and NO-heme (black bars; 1–300 µM NO-heme dissolved in 80% acetone/H2O [Ctrl 2]) using various in vitro assay systems. Shown is the mean and SD of at least three independent experiments, with the exception of the comet assay performed with Caco-2 cells (n = 4) and the BALB/c 3T3 cell transformation assay (n = 10). Statistical analysis was performed using the Kruskal–Wallis test followed by Dunn’s multiple comparison post-hoc analysis in the case of comet assay ***data*** as well as the Ames test performed with S. typhimurium strain TA1535. The Ames test performed with S. typhimurium TA100 as well as the HPRT and the BALB/c 3T3 cell transformations assays were analyzed by means of a one-way ANOVA followed by Tukey’s multiple comparison test. a Comet assay performed with BALB/c 3T3 cells. b Comet assay performed with Caco-2 cells. c Ames test performed with S. typhimurium strain TA100. d Ames test performed with S. typhimurium strain TA1535. e HPRT assay performed using CHO-K1-BH4 cells. f BALB/c 3T3 cell transformation assay. For all assays, the solvent controls Ctrl 1 and Ctrl 2 were adapted to the highest NO-heme or hematin concentration ranging from 2% in the comet assay to 4% in the HPRT as well as the BALB/c 3T3 cell transformation assays and 6.15% acetone/H2O or acetone/NaOH in the Ames tests. The concentrations of the control substances were as follows: 100 µM NaNO2, 61.54 µM DHAA, 100 µM H2O2, 100 µM FeSO4, 1.54 mM NaN3, 7.69% H2O in the Ames tests, 5 mM EMS, 0.1% DMSO, 14.91 µM MCA and 0.2% H2O in the case of BALB/c 3T3 cell transformation assay. \*p < 0.05, \*\*p < 0.01, \*\*\*p < 0.001, \*\*\*\*p < 0.0001. #Occurrence of cytotoxic effects visually determined by the absence of a background cell monolayer

Except for the positive control NaN3, no mutagenic effects were detected in the Ames test, although concentrations of up to 300 µM NO-heme and hematin were tested (Fig. c, d). Prior to the performance of the HPRT assay, the cytotoxicity of NO-heme and the solvent acetone/H2O was analyzed in CHO-K1 cells using the MTT assay. The treatment of CHO-K1 cells with NO-heme led to a dose-dependent decrease of the relative cell viability with values ranging from 87% viability for 50 µM NO-heme to 59% viability for 200 µM NO-heme, while increasing concentrations of acetone/H2O did not affect cellular viability (Supplementary Fig. b). The results of the HPRT assay are shown in Fig. e. 100 µM as well as 200 µM NO-heme and hematin induced significantly higher frequencies of mutations in CHO-K1 cells when compared to the solvent controls. The effects of both heme species were thereby similar, with a mutation rate of 56–71 mutations per 106 cells.

In a last step, the potential of both heme species under investigation to induce a malignant transformation of BALB/c 3T3 cells was analyzed. A concentration of 150 µM hematin, but not NO-heme, induced a significant increase in the amount of type III foci when compared to the corresponding solvent control (Fig. f). Moreover, treatment of cells with 150 µM hematin induced a significantly higher number of type III foci when compared to 150 µM NO-heme. In spite of these rather high concentrations, BALB/c 3T3 cells showed no sign of cytotoxicity up to the maximum concentration of 200 µM used for both heme species. In contrast, both DHAA and sodium nitrite showed no cell-transforming potential, although cytotoxicity was seen starting at fairly high concentrations of 750 µM and 6 mM, respectively (Supplementary Fig. c–f).

Discussion

To our knowledge, this is the first study describing a reliable method for the chemical synthesis of purified and stable NO-heme with a significantly reduced level of contaminants and by-products such as nitrite. The UV–Vis spectra of hemin and NO-heme measured herein were identical with the spectra measured by Hornsey (), Shahidi and Pegg () and Soltanizadeh and Kadivar (), with specific absorbance maxima at 476–480, 535–540 and 563–566 nm. IR spectra of hemin and NO-heme showed similar bands from 3000 to 1700 cm−1 and 1600 to 400 cm−1. Therefore, it can be concluded that these bands are specific for the heme molecule. In contrast, the intensities at 1662.64 cm−1 differ considerably between the two heme species, suggesting a difference in the iron ligand most probably due to the binding of a nitric oxide moiety to the heme molecule. In the case of hemin, the band at 1662.64 cm−1 may confirm the existence of multiple carbon–carbon double bonds within the heme structure (Morin et al. ; Silva et al. ), while in the case of NO-heme, this (low-intensity) band could be overlapped by a band specific to the Fe–NO bond and whose intense stretching appeared at the same wavenumber. These results are supported by several earlier studies analyzing heme nitrosylation, in which similar IR signals in the range of 1678–1659 cm−1 were reported, and in which the IR band was specifically attributed to the Fe–NO bond (Killday et al. ; Jankiewicz et al. ; Pegg and Shahidi ). Moreover, in the present study, the interference of bands by solvents and by-products was excluded by measurement of reference spectra, whereas sodium nitrite and DHAA as well as acetone showed no concurrent bands with the signal at 1662.64 cm−1 specifically attributed to the Fe–NO bond in the frame of the present study. Furthermore, the NO-heme solution was measured in the dry state and showed no band at 1774.51 cm−1, rendering the concurrent detection and thus the presence of acetone and/or DHAA unlikely, even more when considering that the starting NO-heme solution was purified prior to measurement. Ascorbic acid showed a band at 1654.92 cm−1; therefore, one could speculate that the NO-heme band seen at 1662.64 cm−1 is due to contamination of the NO-heme solution with ascorbic acid. However, the second band at 1753.29 cm−1, which is specific for ascorbic acid (Bichara et al. ), was not seen, greatly diminishing the possibility of interfering bands resulting from ascorbic acid contamination of the NO-heme solution. Therefore, the presented IR spectrum is most likely specific for NO-heme, strongly suggesting that the method used for its synthesis and purification described herein is suitable for the reliable production of purified NO-heme.

As described by Hornsey (), Soltanizadeh and Kadivar () and Haile et al. (), NO-heme is highly sensitive to UV light and oxygen; an exposure to these results in NO release from the molecule and leads to changes in the specific UV–Vis and IR spectra within 2 h. While the absorbance maxima of the UV–Vis spectra disappeared during photolysis, the IR spectra expanded with further bands appearing at 1554 and 1207 cm−1. In conjunction with the nitrosyl iron-related band at 1662.64 cm−1 as well as the emergence of brown crystalline structures, the appearance of these new bands support the assumption that the product of photolyzed NO-heme may be β-hematin or hemozoin. While the term “hemozoin” exclusively describes the heme species synthesized by parasites responsible for causing malaria (e.g. Plasmodium falciparum), synthetic hemozoin is termed β-hematin (Vanderesse et al. ). β-Hematin is a molecule that consists of two heme moieties joined by two ester linkages (chemical structure shown in Supplementary Fig. b) (Coronado et al. ; Vanderesse et al. ). While one propionate side chain of one heme molecule is connected to the iron atom of the other molecule, the second side chain can generate intermolecular hydrogen bonds with other β-hematin molecules (Egan ; Jaramillo et al. ). Thus, insoluble crystal structures are formed (Butykai et al. ; Coronado et al. ; Vanderesse et al. ), leading to the formation of the precipitate observed after NO-heme exposure to sunlight. In addition, β-hematin-specific IR bands in the range of 1664–1660 cm−1 as well as 1211–1207 cm−1 attributed to the ester linkages have been described in several previous studies (Slater et al. ; Egan et al. ; Basilico et al. ; Huy et al. ; Jaramillo et al. ; Coronado et al. ; Vanderesse et al. ). Therefore, in spite of the light-induced release of the NO moiety, the band at 1662.64 cm−1 is still detected due to ester bonds existing between the remaining heme molecules. Finally, the photolysis-induced formation of β-hematin was verified by comparison of sunlight-exposed NO-heme solutions with IR spectra of pure hemozoin, resulting in identical wavenumber bands for both substances. All in all, these results strongly suggest that β-hematin is formed after the light-induced release of NO from the NO-heme molecule, as reported by Ostera et al. (). Based on the analytical results presented herein, toxic effects induced by possible contaminants and by-products resulting from the nitrosylation reaction used to produce the NO-heme solution are highly unlikely. Hence, all the toxic effects described herein for the purified NO-heme solution can be attributed to the main molecule under investigation, i.e. NO-heme.

The cytotoxicity of NO-heme was analyzed prior to the in vitro examination of its genotoxic, mutagenic and cell-transforming potential. The analyses using BALB/c 3T3 cells showed either no cytotoxicity (for NO-heme and hematin) or a reduced cell viability being induced only by a more than tenfold higher concentration than that used in the comet assay and the CTA (in case of DHAA and sodium nitrite). In the CHO-K1 cells used for the HRPT test, NO-heme-induced cytotoxicity and reduced the relative cell viability to 59%. However, the OECD test guideline no. 476 (OECD ), describing the performance of the HPRT assay, allows for the use of test compound concentrations reducing cellular viability to 10–20% of control. Likewise, for the Western blot analysis on cellular uptake, Caco-2 cells were treated with hematin and NO-heme at concentrations that induced cytotoxicity after 24 h of incubation concurrently to the corresponding comet assays performed after 1 h of treatment with these compounds. Thus, the toxic effects seen may be interpreted as a consequence of DNA damage occurring at the early stages of the exposure of the cells to hematin and NO-heme, while the increased expression of HO-1 strongly indicates that both heme species were indeed taken up by the Caco-2 cells.

One may speculate that the DNA-damaging and mutagenic effects induced by both tested heme species is caused by increased lipid peroxidation. Generally, each lipid molecule found in the cell membrane consists of unsaturated fatty acids, which could react with reactive oxygen species (ROS) to form lipid hydroperoxides (Marnett ; Ayala et al. ). Besides these primary peroxidation products, reactive aldehydes like 4-hydroxynonenal (4-HNE) or malondialdehyde (MDA) can be formed as secondary products (Ayala et al. ). These can directly interact with DNA and form several DNA adducts (Stone et al. , ; Guéraud et al. ). Further genotoxic effects induced by 4-HNE are extensive DNA fragmentation, sister-chromatid exchanges and chromosome aberrations (Brambilla et al. ; Esterbauer et al. ; Eckl et al. ). A sum of all these toxic effects may finally result in the malignant transformation of cells exposed to 4-HNE. The heme molecule and especially the iron atom can indeed trigger the formation of hydroxyl radicals through the so-called Fenton reaction (Ayala et al. ) and may thus activate pathways leading to the above-mentioned genotoxic effects, as indicated by the increased formation of ROS in cells treated with different heme species (Goldstein et al. ). Moreover, in in vivo studies using rodents, the consumption of heme-enriched diets led to increased levels of thiobarbituric acid-reactive substances, whose content correlates with the MDA concentration (Tsikas ) in the colon and feces of the test animals (Pierre et al. , , ; Toden et al. ; Ijssennagger et al. ; Bastide et al. ) as well as with a significantly higher occurrence of DNA strand breaks in isolated colonocytes (O'Callaghan et al. ). Genotoxic effects previously seen in cells treated with heme (Glei et al. ; Glei et al. ; O'Callaghan et al. ) are in line with the results seen in the comet assay and suggest that these DNA strand breaks may arise from DNA adducts caused by heme-induced MDA and/or 4-HNE formation. This mechanism could also be responsible for the mutagenicity detected in the HPRT assay performed in the present study. In the case of MDA, Cajelli et al. () were able to show a mutagenic potential emanating from this compound in the HGPRT assay, which is a test system similar to the one employed herein, albeit using V79 Chinese hamster lung fibroblasts. Moreover, Gilsing et al. () previously described mutagenic effects resulting from heme intake derived from red meat consumption in an epidemiological study performed in The Netherlands and linked heme intake with a higher incidence of G → A transition mutations in colorectal tumors. ROS formation induced by heme species resulting in the formation of DNA adducts and mutations could also be responsible for the malignant transformation seen in the CTA. The hematin-induced formation of type III foci infers that this molecule may be involved in processes increasing cell proliferation and suppressing the cell–cell contact inhibition normally inherent to BALB/c 3T3 cells (Sasaki et al. ). Although the test compounds were able to induce genotoxic effects in test systems using mammalian cells, both NO-heme and hematin failed to induce any effects in the Ames test. An explanation for this finding could be either the absence of nitrosylable compounds in the treatment buffer needed for the formation of potentially mutagenic NOCs after NO release from NO-heme, or the absence of bacterial heme uptake mechanisms. The latter hypothesis is supported by ***data*** published by Arimoto et al. (), which showed that the original non-modified S. typhimurium strain is unable to take up heme, an ability most probably also lacking in the strains used in the present study (TA100 and TA1535).

It has been hypothesized that NO-heme induces stronger toxic effects when compared to non-nitrosylated heme, mostly due to the reactivity of the NO moiety. For example, during protein fermentation in the colon, NO might react with glycine, one of the most abundant amino acids in food (Harrison et al. ), to first form N-nitroso glycine and, in a next step, after a dehydration reaction, yield diazoacetate (Cupid et al. ; Gottschalg et al. ). Diazoacetate is highly reactive and may bind to DNA, resulting in the formation of DNA adducts such as O6-methylguanine or O6-carboxymethylguanine (Shuker and Margison ; Anderson et al. ; Cupid et al. ; Lewin et al. ; Gottschalg et al. ). However, as shown in the present study, the presence of an NO moiety in the heme molecule does not induce effects beyond those seen for heme alone, which questions our initial hypothesis and suggests that the observed effects are principally mediated by the heme moiety.

While heme and iron can act as pro-oxidants and may induce ROS formation (Sergent et al. ; Goldstein et al. ; Puri et al. ), nitric oxide can, interestingly, act as an antioxidant, which, upon reaction with an oxidizing agent, results in the generation of nitrite (Kanner ; Hogg and Kalyanaraman ; Sharpe et al. ). Moreover, the pro-oxidative effects of cysteine and hemoglobin can be easily modulated by nitrosylation processes emerging from the antioxidative compounds nitrosocysteine and nitrosohemoglobin (Kanner ; Kanner et al. ). Application of this concept to the experimental setup presented here may speculatively explain the results obtained, i.e. the fact that NO-heme does not induce stronger genotoxic effects than hematin. During the treatment of cells with NO-heme, denitrosylation may occur, thereby leading to the release of heme. This molecule may in turn increase ROS formation, while the released nitric oxide may counteract the deleterious effects of ROS, as has been shown for nitrosomyoglobin by Kanner et al. (). The genotoxic effects induced by NO-heme may thereby occur independently of the NO moiety, as the heme molecule may still induce DNA damage via heme or β-hematin-initiated lipid peroxidation processes as described above (Schwarzer et al. ; Carney et al. ; Schrimpe and Wright ; Ayala et al. ).

While nitrosylation processes promote the formation of NOCs, which may possess antioxidant properties (Kanner ; Kanner et al. , ), NO itself is known to induce DNA strand breaks and mutations in mammalian cells (Isomura et al. ; Nguyen et al. ; Tamir et al. ). In spite of positive results regarding genotoxicity and mutagenicity, both Nguyen et al. () and Tamir et al. () hypothesized that not NO, but rather more complex nitrogen oxides (NOx), formed in the presence of oxygen, could be responsible for these effects. Furthermore, Szaleczky et al. () questioned the toxicity of NO and suggested that genotoxic and mutagenic effects seen in cells upon treatment with NO may be attributed to the formation of NOCs or reactive ions such as the peroxynitrite anion (ONOO−), which can be formed by the reaction of NO with a superoxide radical (O2−; Liu and Hotchkiss ; Lundberg et al. ; Kundu and Surh ; Habermeyer et al. ). In the presence of oxygen, NO may also be converted to nitrogen dioxide (NO2), a reactive intermediate that subsequently may lead to the emergence of nitrite and nitrate (Liu and Hotchkiss ; Lundberg et al. ; Habermeyer et al. ). However, as summarized by Szaleczky et al. and reviewed by Habermeyer et al. , the mechanisms underlying the toxic and or carcinogenic effects of NO, nitrite, nitrate as well as their NO-related products are largely unknown, due to the instability of nitrous and oxygen radicals and their so far unexplored complex reactions leading to the formation of several DNA-reactive NOCs. Speculatively, the above-mentioned chemical reactions may have also occurred in the frame of the in vitro assays used in the present study. However, although a reaction of NO with oxygen species after release of the NO moiety from the heme molecule cannot be ultimately excluded, it is unlikely that the formation of complex nitrogen oxides underlies the effects described herein. For instance, at least a tenfold higher concentration of peroxynitrite (1 mM) is needed to induce DNA strand breaks when compared to NO-heme (100 µM; Tamir et al. ).

However, it has to be mentioned that nitrite, as a reaction product of NO with ROS, may be formed and trigger mutagenic effects similar to those caused by the intact NO-heme molecule. For example, it has previously been shown that nitrite is mutagenic in the HPRT assay and leads to the malignant transformation of BALB/c 3T3 cells at concentrations ranging from 1–10 mM (Kodama et al. ; Tsuda and Hasegawa ; Stevanovic et al. ), although it did not induce DNA single strand breaks in murine cell lines (Kodama et al. ; Görsdorf et al. ). Under the assumption that all existing NO moieties of NO-heme reacted with ROS to form nitrite, a maximum concentration of 1–300 µM nitrite could be reached in the different incubations of the present study. Therefore, mutagenic and cell-transforming effects such as those previously described are unlikely. In this context, it is important to mention that each assay included a 100 µM nitrite control, which showed no genotoxic, mutagenic or cell-transforming effects.

In summary, 10–150 µM heme, independently of the NO moiety, induced a dose-dependent formation of DNA strand breaks as well as gene mutations and was able to cause malignant cell transformation. An important factor in the overall assessment of these ***data*** is the comparability of the tested heme concentrations with dietary concentrations prevailing in the gut after red meat consumption. The amount of heme found in the gut after red meat consumption depends on the following factors: the colon volume as well as the amount and type of meat ingested, with the latter showing high variations in heme content depending on the animal species under study. In the case of beef, the heme content varies from 12 to 105 µg g−1 (Mistura and Colli ; Pretorius et al. ), while poultry meat contains 1.6–6 µg g−1 (Vanden Bussche et al. ; Pretorius et al. ), resulting in an average heme content of about 59 µg g−1 for beef and 4 µg g−1 for poultry. In order to calculate heme uptake, in which case additional influencing factors such as the bacterial uptake of heme are not considered (Yilmaz and Li ), an average colon volume of 561 ml is assumed (Pritchard et al. ). Therefore, the consumption of 100–500 g meat would theoretically result in an intestinal heme concentration of 1–6 µM for poultry and 17–85 µM for beef, which, in the case of the latter, is well in the range of the concentrations used in the present study (10–200 µM).

Conclusion

A reliable method for the synthesis of pure and stable NO-heme was established, which enabled a preliminary toxicological characterization of this cured-meat pigment. The initial hypothesis that the NO-heme molecule shows a higher pro-carcinogenic potential than non-nitrosylated heme could not be confirmed. The present results rather suggest that the heme molecule alone may promote tumor formation, especially when considering that heme concentrations inducing effects in vitro are in the lower range of concentrations occurring in the colon in vivo after the consumption of a typical amount of red meat. Heme thus appears to be one of the most important factors in the frame of red meat-associated CRC, although nutrition-related CRC should be considered a multifactorial event rather than being only attributed to a single causal element (reviewed by Demeyer et al. ).

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**Notes**

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**Body**

Zagreb,Hrvatska16 June 2020 (Hina) - Plenkovic: HDZ is going after election victory with Safe Croatia platform ZAGREB, June 16 (Hina) - Croatian Democratic Union (HDZ) president Andrej Plenkovic said on Tuesday, after submitting slates to the Electoral Commission, that the party was going after victory in the July 5 parliamentary election. "We are going after victory in this election with the Safe Croatia platform, which is based on our government's achievements. We believe we fulfilled numerous election promises from 2016, we dealt with a large number of crises, notably the last one, the biggest crisis, a pandemic," he told reporters. He said the measures adopted during the coronavirus epidemic had been timely and that they protected citizens' health, and that the government's bailout measures helped to retain 550,000 jobs. "This campaign will be a chance to present a vision of Croatia and of transformation in many areas.

Therefore, besides strengthened statehood, which is a key message of this HDZ campaign, the messages are that state institutions have shown that they work well when citizens need it the most." Plenkovic said they stood behind citizens and that they were striving for economic sovereignty, which meant self-sufficiency in ***agriculture*** and many other sectors. In that way, we will facilitate stronger economic growth and, with the concept of modern sovereignism which, thanks to Croatia's strong international standing, notably in EU institutions, enables us to utilise the funds that will be available in the next seven years for swift economic recovery and growth, we are pursuing our two goals, joining the Schengen and euro areas, he said. Asked why not one HDZ slate consisted of at least 40% of women, which is a legal obligation, Plenkovic said they regretted it but that making lists of candidates in such a big party was never easy. He reiterated that HDZ women held high positions in European institutions as well as Croatia's government and parliament. He went on to say that the HDZ's value system was based on state-building, the people and Christian democracy, and that its general platform reflected that. "In drawing up the new retail bill, we have sent a message on non-working Sundays with exceptions due to the fact that Croatia is a tourist country, we have put centre stage the family, family values and the possibility that families spend Sundays together as much as possible. That's the goal in line with our value system and it won't disrupt economic and financial processes," Plenkovic said, commenting on today's election message by the Croatian Bishops Conference. He said the HDZ was not doing that to come closer to the right and the Church but because it reflected the party's views. Plenkovic said the HDZ would try to win as many seats in parliament as possible. "Our main allies are Croatian citizens." Asked about Homeland Movement Miroslav Skoro's statement that he could guarantee that Plenkovic would no longer be prime minister, he said Skoro would certainly not be prime minister. Asked if Skoro would be part of his government, he said the HDZ was going after victory. Asked if Bridge was a possible partner or if a grand coalition with the SDP was possible, Plenkovic reiterated that the HDZ would win. The HDZ is running in the election independently and in some constituencies with the Social Liberals, the Croatian Christian Democratic Party, and independent candidate Marijana Petir. HDZ agrees lists of candidates for July 5 election Announcing the submission of lists of candidates for the July 5 parliamentary election late on Monday, after a five-hour meeting of the party's presidency and national council, Plenkovic saidthe meeting had taken so long because consultations had to be made on the 154 people on the lists. Plenkovic confirmed that Miro Kovac, Bozidar Kalmeta and Stevo Culej, who had opposed him at the last party election, were included at the bottom of the lists for their respective constituencies in order to show inclusiveness. "Regardless of the party election, this parliamentary election should mean synergy for the HDZ." He added that this was also a message to other members of the HDZ who had voted for someone else who they thought should lead the party. "I think this is good for the democracy, it is good both for Croatia and for the party's democracy." Plenkovic said that the HDZ was looking forward to the forthcoming election competition. He said that with their five-point election platform they wanted to give voters a chance to vote based on the government's achievements so far and clear position on job, pay and pension security, the absorption of EU funding and speedy economic recovery. "I think we also acquitted ourselves well in the latest coronavirus crisis," the prime minister said. Plenkovic: It's bizarre for someone who aspires to run country to refuse debate ZAGREB, June 16 (Hina) - Prime Minister and HDZ party leader Andrej Plenkovic has said that it is bizarre that Social Democrat leader Davor Bernardic, who wants to run the country, has refused a televised debate with him ahead of the July 5 elections. "He is evidently afraid, there is no other reason. I have to say that this is one of the most incredible situations in my term so far, there were many such situations but this takes the cake in terms of competence and courage to assume responsibility," Plenkovic said in an interview with the HRT public broadcaster. After Bernardic declinedHRT's invitation to face off against Plenkovic in a programme that was scheduled for today, HRT interviewed Plenkovic in line with its earlier decision under which if one of the invited guests cancelled their attendance, it would interview the other guest. Bernardic: Church should not be interfering in politics ZAGREB, June 16 (Hina) - The leader of the SDPand the Restart coalition, Davor Bernardic, said on Tuesday that the Church should not be interfering in politics and elections because Croatia is a secular country, commenting on the recommendations by the Croatian Bishops' Conference for the July 5 parliamentary election. "First of all, Croatia is a secular country and the Church should not be interfering in politics or in elections. This suggests that they are dissatisfied with the government because it failed to ban work on Sundays," Bernardic said at a presentation of the Restart coalition's education programme. Speaking of the position of prime minister within the SDP (Social Democratic Party) and the Restart coalition, he said that under a decision by the SDP's main committee the president of the SDP is the candidate for prime minister. Bernardic said that an interview with the head of the Homeland Movement, Miroslav Skoro, clearly showed that Skoro intended to form a coalition with the Croatian Democratic Union (HDZ) of Prime Minister Andrej Plenkovic, adding that a vote for Skoro was a vote for the HDZ and vice versa. Asked why he had declined an invitation to face off against Plenkovic in a debate on the public television service HRT, Bernardic reiterated that he had confirmed his participation in debates on the commercial television channels Nova TV and RTL during the official part of the election campaign. "There is an impression that this is a competition for the President of the Republic or a tennis match between me and Plenkovic. No, this is the presentation of the best team and the best programme for Croatia. I know it's embarrassing for Plenkovic to talk about his team because 15 people have left it," Bernardic said. As for Zeljko Sabo, who has been included on the SDP's election slate although he was found guilty of corruption by a court of law, Bernardic said that the rehabilitation period had passed. Restart Coalition: Investing in education, science is smartest investment The Restart Coalition today presented its education platform with emphasis on quality education, andBernardic said investing in education,science, technology and innovations was not an expense but the smartest investment in the future. Education isone of the most important policiesfor the Social Democratic Party, its president said. "It's also a key mechanism for transforming society into a modern economy and a progressive society." The education platform has three key goals - quality education for all onequal terms, support for education staff, and education for a sustainable and inclusive society. Bernardic said thatbecause of the current crisisthey would not touch teachers' salaries but improve their status. MP Sabina Glasovac said the coalition planned to continue thecomprehensive curricular reform andintroduce nine-year mandatory education as well ascivic and health classes, among other things. She said this year's budget for the Defence Ministry was HRK 465 million and for theScience and Education Ministry HRK 240 million. "There is money, the question is what our priorities are." SDP leader: 20% of cost of post-quake reconstruction to be covered by citizens ZAGREB, June 16 (Hina) - SDP party and RESTART coalition leader Davor Bernardic and the head of the SDP branch in Zagreb, Gordan Maras, said on Tuesday that if their coalition managed to form a government after the elections, it would have a law on the post-earthquake reconstruction of Zagreb adopted under fast-track procedure. Under the law, owners of propertiesdamaged in the March 22 quake would cover 20% of the cost of their property's reconstruction. "80% of funds to be invested in the reconstruction of destroyed houses and structural reinforcement of apartment buildings will be refunded - 50% will be covered by the state and 30% by the City of Zagreb - while 20% of the cost will be covered by the owners," Maras said while visiting with BernardicCucerje, a settlementat the foot of Mt Sljeme overlooking Zagreb, which suffered extensive damage in the earthquake. Bandic says ready to cooperate with anyone who has Croatia at heart ZAGREB, June 16 (Hina) - The leader of the Labour and Solidarity Party, Zagreb Mayor Milan Bandic, on Tuesday presented the party's slates to the State Electoral Commission (DIP) for the July 5 parliamentary election, sayingthat after the election he was prepared to cooperate "with everyone who has Croatia at heart." "I am prepared to cooperate with everyone who has Croatia at heart and a better life for our citizens. Just as we cooperated with this government - on projects and not seats - we will cooperate with the new government," Bandic said, adding that his party was offering a European Zagreb and a European Croatia. Bandic added that citizens were interested in the results of work on employment, demography andeducation. He said that his work until now would go in his favour at the election. The Labour and Solidarity Party presented slates for six electoral constituencies - first, second, sixth, seventh, third and ninth. Bandic announced that he would present them to the public on Thursday. Bridge party submits electoral slates ZAGREB, June 16 (Hina) - The Bridge party on Tuesday handed in to the State Electoral Commission its slates for the July 5 parliamentary election, with its representatives saying they offered the beginning of new, different politics. "This is the beginning of politics different than the politics that existed for the past 20 years... politics based on new, young people who will bring about change," Bridge leader Bozo Petrov said after submitting the slates. As for possible post-election coalitions, Petrov said that they would give a chance to those willing to change Croatia but that he did not see such a partner in either of the two biggest parties. Bridge political secretary Nikola Grmoja said they expected to win at least eight seats in the parliament. The most active MP in the last parliament, Bridge's Miro Bulj, called on voters not to fall for false promises and to wake up, stressing that it was time for Croat emigrants to return home. Election slates were submitted today also by Independents for Croatia leader Bruna Esih, who will run in the elections with the Croatian Party of Rights (HSP) and the Generation of Renewal. Esih described her coalition as uncompromising and HSP leader Karlo Starcevic said they expected to win between three and five parliamentary seats and that they were open to post-election cooperation with all who love a free and sovereign Croatia. Frano Cirko of the Generation of Renewal said they would advocate drastic tax cuts, radical downsizing of public administration, stronger protection of national borders based on the model of Hungary, keeping the kuna as the national currency, banning abortion, and repealing the law on same-sex partnerships. Slates for the July 5 election were also submitted by the Autochthonous Croatian Party of Rights, led by Drazen Keleminec. Mrsic hands in election slates ZAGREB, June 16 (Hina) - After submitting his party's slates to the State Electoral Commission on Tuesday, president of the Democrats partyMirando Mrsicsaid that he has gathered a coalition that can change Croatia and provide solutions. Croatia needs cuts, to review the Vatican agreements, and to remove veterans' pensions from the pension system, he said. "We think that our coalition is essential because it shows that people can gather together and change Croatia. Croatia needs cuts.Changes need to be made and we have gathered around the goal of making Croatia different. Cuts are essential. It is necessary to introduce a wealth tax andto remove veterans' pensions from the pension system. It is time to review the Vatican agreements and for Religious Education to be removed from schools," said Mrsic. Mrsic's Democrats will go to the July 5 polls in a coalition with the Croatian Labour Party, the Slate for Rijeka and the Green Party in all 11 electoral constituencies. "Big problems are waiting for us in the autumn and large parties, the HDZ and SDP, are offering a colourful, embellished picture of the autumn, yet we will be struck by crisis. More than 50,000 people will lose their jobs and neither the SDP nor HDZ are offering a solution for that,"Mrsic said. "All centre-left parties are acceptable for us in a post-election coalition. We will certainly not enter a coalition with Skoro's Ustashas or with the HDZ," said Mrsic. Independent MP Glasnovic hands in his slate in company of Skoro ZAGREB, June 16 (Hina) - Independent MP Zeljko Glasnovic on Tuesday handed in to the State Electoral Commission (DIP)his slate for the July 5 election in Constituency 11, intended for the Croat expatriate community. Glasnovic did so in the company of Homeland Movement leader Miroslav Skoro, who said that he did not care about officesbut about the welfare of the Croatian people. "I can live off my work quite well, I am not in this story for possible offices, I am independent and that is what bothers people the most," Skoro said when asked by reporters if he could guarantee that he would not be a minister in a government led by Andrej Plenkovic. "I can only guarantee that I willdo what needs to be done andbe at the service of the Croatian people," he said, repeating that he believed Plenkovic did not deserve to continue being Prime Minister. Skoro said that he supported Glasnovic's slate because he did not want to additionally fragment the Croatian diaspora. The Croatian diaspora are people who have been driven out of the country by bad governance in the past 20 years, and now efforts are being made to strip them of their basic constitutional right, the right to participate and vote in elections as Croatian citizens, said Skoro. Asked if he had recognised himself in messages by the Croatian Bishops Conference (HBK),which has called on voters to vote forpoliticians who advocate protection of marriage, a non-working Sunday and an education reform based on values of Christianity, Skoro said the HBK's position matched the values advocated by the Homeland Movement and that the party welcomed everyone's support, primarily that of the Croatian people. Glasnovic said that Croats living outside Croatia were discriminated against, that in Bosnia and Herzegovina they were disappearing as en ethnic group, and that that had to change. We Can!: We come to change politics and society ZAGREB, June 16 (Hina) - The political platform We Can! - Zagreb Is Ours! has published its election platform, saying that it is ambitious and that it will "change our common future". "We see this moment as a necessary turning point for our society to recover and become more resilient to future challenges that are certain to come. We bring the knowledge and fighting spirit with which We Can! do it. There is no going back to the old ways. The political elites have been trying for years to convince us that Croatia cannot do better. We can!" it said, stressing that Croatia can be transformed into "a just, green, solidary and prosperous society". The programme is based on three main pillars: a green resilient economy and dignified work conditions, social equality, and democratisation and international solidarity, and isthe result of a broad participatory consultation process. We Can! said that its election platform is the plan for the recovery of Croatia from the current crisis and from the HDZ and political elites that have been leading the country since its independence. "We come not just to change politics but to change this society," the group said. Theysaid that the crisis caused by thecoronavirus pandemic had laid bare old problems and that society had to change. "There is no going back to the old ways, but the burden of change must not be placed equally on everyone's shoulders because not all of us are equally responsible and not all of us equally benefited from the failed Croatian development model," We Can! said. "We should urgently abandon the harmful development model based on a clientelist and rent economy, erosion of workers' rights, devastation of the industrial base, and extraction of profit from untenable and speculative projects that do not correspond to the needs of the local population and our common long-term interests," theysaid. They also said that they do not want the fight against climate change to be delayed under the pretext of the ongoing pandemic or economic recovery,noting that this fight requires international solidarity and commitment to achieving European and global solutions. Zagreb Independent List supports Left-Green Coalition The Zagreb Independent List (NLZ) will support the Left-Green Coalition at the forthcoming parliamentary election, citing their long cooperation in the Zagreb City Assembly. "We have decided to publicly support the coalition led by the We Can! party at this parliamentary election. Our decision is to continue working for the benefit of the City of Zagreb, especially in light of post-earthquake reconstruction that is ahead of us, which is one of our fundamental goals," NLZ Marijana Sumpor told a press conference. On Monday, the NLZ left the coalition with the parties Pametno and Fokus over disagreement with the process of negotiation on the accession of the Party with a First and Last Name and moving away from their common values and programme principles. Sumpor cited a lack of democracy and transparency as the reasonfor leaving. The leader of the Left-Green Coalition, Tomislav Tomasevic, said he was pleased that the NLZ had joined their coalition. "This support is not subject to any conditions, but is the result of our good cooperation. We will continue to cooperate in the City Assembly to ensure the adoption of a good law on the reconstruction of Zagreb so that reconstruction begins as soon as possible and that it is as effective and fair as possible," he said. HBK calls on believers to vote in July 5 election ZAGREB, June 16 (Hina) - The Croatian Bishops' Conference (HBK) on Tuesday issued a message to the faithful ahead of the July 5 parliamentary election, saying that voting is not just a civil duty but also an expression of Christian responsibility and true love for the country. The HBK said that the ongoing coronavirus pandemic has shown how important qualified and competent people are. "This experience has shown how important qualified and competent people in public services and politics are because only wise and qualified, decent and selfless individuals can ensure that society progresses and grows. The epidemiological crisis has also shown how important the autonomy and independence of the state is, both in decision making and adopting regulations and economically in producing food, medicines and other necessities," the statement said. The HBK said that in the run-up to the election it is important to learn how individual candidates or political parties see Croatia's future. "In particular, it should be seen what measures they will take to stop the wave of emigration of young people and families, create conditions for the return of Croatian emigrants, prevent social fragmentation and the impoverishment of citizens, and promote the principles of welfare state," it said. The HBK went on to say that it should also be seen how political parties or independent slates intend to further democratise society by changing electoral legislation and developing civil society on the principles of plurality and religious freedom. It is also important to see how thecandidates look at the crimes of all ideologies in which members of our and other nations were killed during and in the aftermath of the Second World War. Also important is their treatment of the 1991-1995 Homeland War and whether they condemn all forms of totalitarianism and racial, religious and other forms of intolerance. "Believers will freely decide to give their vote of confidence to those advocating the protection of marriage as a union between a man and a woman, promoting the culture of life based on a long-term pronatal policy, and advocating a non-working Sunday as a day of family union and the Lord's day. It is also important to know how they intend to implement the education reform based on universal human values and in accordance with the Christian value system which is woven into the identity of our society," the HBK said. It called on all party and independent candidates to preserve their personal dignity during the election campaign and to try to win citizens' trust with the strength of their election platforms. Croatia registers one more COVID-19 case ZAGREB, June 16(Hina) - One new COVID-19 case has been recorded in Croatia over the past 24 hours, bringing the total to date to 2,255, the national civil protection authority said on Tuesday. Since the beginning of the outbreak, 70,526 samples have been tested for the novel coronavirus, including 272 over the past 24 hours. Four patients are hospitalised and none are on a ventilator. The number of patients who have recovered is 2,140 and the death toll is 107. Minister says EU countries to help cover cost of treatment of possible COVID-19 patients ZAGREB, June 16 (Hina) -By week's end it should be known who will cover hospital costs incurred if a tourist becomes infected with coronavirus, however, if visitorsare from the EU, their countries will help too, Tourism Minister Gari Cappelli said onTuesday in Split, where he signed a HRK 75 million grant agreement for a centre of competence. "By the end of this week we will have precise information onwho will cover the cost,however, if (visitors) are treated in our hospitals and if they are from an EU country, naturally their country will ensure help and will pay. There is also a possibility, for example, for a tourist from Slovenia staying in Opatija, to be transported back home within an hour so that problem can be resolved that way, too," Cappelli told reporters following queries by small renters as to who would pay for thestay ofa possibly infected tourist's family, who would have to spend 14 days in theapartment while the patientis being treated in hospital. The main reason for Cappelli's visit to Split was a project to develop aCentre of Competence for Split-Dalmatia County, and Cappelli signed aHRK 75 milliongrant agreement for the project with the director of the Split Hotel and Tourism Management and Hospitality School,Ivan Bilic. "Thisis an exceptionally important project for tourism and 85% of theHRK 75 million comes from EU funds while 15% will be provided bythe Tourism Ministry. Additional funds have been provided by Split-Dalmatia County, and an additional HRK 30 million has been provided from the regional fund. This project for the dual education of quality staff isin fact valued at HRK 170 million," Cappelli underlined. This is the sixthcompetencecentre in Croatia on which work has been under way and Cappelliunderscored that more than HRK 500 million had been secured from the European Social Fund and the Regional Development Fund for the concept of regional competencecentres. Krk island LNG terminal capacity booked, gas prices could go down, says minister ZAGREB, June 16 (Hina) - Environment and Energy Minister Tomislav Coric has saidthat, now that 98% of the capacity of the liquefied natural gas (LNG) terminal on Krk island has been booked, the LNG Croatia company's revenue in the next five years willexceed €100 million, and gas prices could go down. "The completion of this project and its inauguration on 1 January 2021 puts Croatia on Europe's energy map. The project primarily provides for the security of energy supply in Croatia andcontributes to the EU's energy supply security, and it helps avoid any additional costs for our citizens... we expect the price of natural gas in Croatia in the coming period to drop," Coric said on Tuesday. LNG Croatia's income in the next five years is estimated to exceed €100 million, Coric said, adding that this should provide the terminal's owners, the HEP power provider and the Plinacro gas company, with very decent revenues. "With this project, launched two and a half years ago, we have shown that big infrastructure projects, if managed well, indeedmake sense and that based on our energy development strategy for the period until 2030 Croatia is moving along the path of increasing energy self-sufficiency and energy system efficiency," said Coric. Asked about the participation of Hungarian companies in the project, given that Hungary was at one time interested only in ownership of LNG Croatia and not in renting its capacity, Coric said that in additionto an EU grant, Croatia had decided to finance a part of construction work on the terminal from the state budget while the rest was financed by corporate investments and loans. He said that he was glad the terminal's capacity had been leased to more than one client and noted that he did not see any reason for Hungary to enter the ownership structure of LNG Croatia. Coric said that the terminal was built in line with the highest environmental,security and other standards and that he believed resistance to it by the local population and environmentalorganisations would wane. LNG Croatia director Hrvoje Krhen said the terminal would be put into operation on January 1, 2021. The entire capacity of the LNG terminal on Krk Island has been booked for the next three gas years,LNG Croatiasaid on Monday, adding that part of the capacity has been reserved by Powerglobe Qatar LLC. Pursuant to the rules of use of the terminal for liquefied natural gas, all available capacities have been entirely booked with the latest reservation made byPowerglobe Qatar LLC,which has booked gas capacities up until the 2034/2035 gas season, the company said. The terminal has a technical capacity of 2.6 billion cubic metres a year. Vuckovic: Family farms remain Croatia's strategic interest ZAGREB, June 16 (Hina) - ***Agriculture*** Minister Marija Vuckovic on Tuesday presented a draft development strategy for Croatia's ***agriculture*** and aquaculture from 2020 to 2030, and said that OPGfamilyfarms continue to be the backbone of Croatia's farm sector. "OPG farms remain Croatia's strategic ***agricultural*** direction but they need to be strengthened and one of the measures to do that will be to more efficiently and justly distribute direct income support payments," Vuckovic said presenting the strategy in Vukovar. "Capital support, new technology for all and income supportneed to go to those who are smaller and more sensitive and who are the true farmers," she said. With regard to Slavonia, the strategy aims to better connect farming with the manufacturing industry and cattle breeding. "That will be preceded by a final solution forthe basic ***agricultural*** resource - land. When speaking about animal husbandry,it is worth mentioning that our objective is to increase pig farming by 35% by 2030 and cattle breeding, which is probably the most vulnerable, particularly with regard tothe loss of dairy farms, by 20%," Vuckovic said. None of that will be possible unless productivity is increased by as much as 125%, she said. Vuckovic said that projects worth a total of HRK 13 billion hadbeen agreed through the Rural Development Programme and that more than HRK 8 billion of the amount had been paid out. "Payments have exceeded more than 55%, which makes this programme perhaps the most efficient compared to other structuralprogrammes financed by the EU," she added. Vuckovic in particular underlined Vukovar-Srijem County, which, as she said, had agreed projects worth HRK 2.7 billion over the past few years, withstructural investment measures for rural development amounting to more than HRK 700 million, while a little more than HRK 1.2 billion refers to the guarantee fund for income support for farmers. The rural development fund for Croatia has resulted in17 irrigation projects that will be sufficient to irrigate 7,000 hectares of farmland and the aim in the next four years is to double the amount of farmland under irrigation, with investments to be financed with EU funds as well as fromthe state budget. During her visit toVukovar-Srijem County, Minister Vuckovic will attend a ceremony launching theBlato-Cernairrigation system that will irrigate 550 hectares of farmland. FM: Croatia has done its utmost in Zagreb quake response ZAGREB, June 16 (Hina) - Croatia has accomplished the set priorities while chairing the EU during COVID-19 and done the most it could in response to the Zagreb earthquake, Foreign Minister Gordan Grlic Radman said on Tuesday. Due to the coronavirus pandemic, the presidency has been held at a physical distance, but communication channels were retained, he said at a ceremony two weeks before the end of Croatia's rotating EU presidency. "Weheld everything we set out in the Croatian priorities but in a different way. Not one priority that was defined in the presidency programme has gone unmentioned," he said. "The biggest achievements are the opening of accession negotiations with North Macedonia and Albania and the Zagreb Summit with Western Balkan countries," which have been given the message that they have a European perspective and a future in the EU, he added. Asked by the press if Croatia failed to do more to help the people of Zagreb and its environs after the March 22 earthquake, Grlic Radman said Croatia was successful."Croatia did its utmost," he said, adding that "the European Union hasn't forgotten Croatia." Croatia is perceived as a developed country and it can count on the solidarity of the member states in such situations, he said. "We managed to apply for the (EU Solidarity) Fund." "The damage estimate is€11.5 billion. That had to be established and supported bycredible documents," he added. The EU responded by sending humanitarian and other aid, the EU is a family which has appropriate mechanisms and funds, he said, adding that a donor conference was not held for Zagreb as they were envisaged for third countries, as was done for Albania after the earthquake in late 2019. The day after it was officially confirmed that the US is withdrawing 9,500 of its troops from Germany, because it is not contributing at least 2% of its GDP for defenceas promised, the minister reiterated that he and his EU counterparts spokewith US Secretary of State Mike Pompeo. "Transatlantic peace has no alternative," he said, reiterating that Croatia had demonstrated its commitment to peace, including transatlantic peace, as "peace is indivisible." "That should all be considered in view ofstrengthening the defence forces of NATO member states," said Grlic Radman. Cravat, neckerchief presented as Croatia's EU presidency protocol gifts ZAGREB, June 16 (Hina) - Protocol gifts made for Croatia's EU presidency were presented on Tuesday with a symbolic gifting of a cravat and a neckerchiefto the founder of the brand and director of Academia Cravatica. Croats gifted this globally accepted piece of clothing to the world.It is a symbol of elegance which originated from the neckerchief worn by Croatian soldiers who fought in the Thirty Years War, said the speakers at an event organised by Academia Cravatica and the Foreign Ministry. "The history of this item is so layered thatan exhaustive narration aboutit could encompass a narration of European history, first and foremost, but also world history," said professor Nikola Albaneze. "The cravat and the neckerchief as its origin havebecome a steadily present symbol of the European Union as well as anidentity mark of Europe itself," he added. Academia Cravatica has been collectingneckerchiefs and neckties of the countries chairing the EU for yearsas each presents them as a gift during their presidency, he said. The ***collection*** now includes "the Croatian cravat and neckerchief", whose design includes the squares in Croatia's coat-of-arms, he added. Foreign Minister Gordan Grlic Radman symbolically gave the two protocol gifts to Academia Cravatica director Marijan Busic. The minister recalled that in 2008 the Croatian parliament unanimously declared October 18Cravat Day, and mentioned events such as the tying of cravats around statues of Croatian greats and around buildings as well as cravat exhibitions. "The cravat is an institution," said MihovilBogoslav Matkovic, who runs the Cravat Museum project. He reiterated Grlic Radman's statement that "Europe does not eradicate identities but affirms them." Split-Dalmatia County awarded 22 contracts worth HRK 63 million ZAGREB, June 16 (Hina) - Twenty-two agreements worth HRK 63 million whereby development and infrastructure projects in Split-Dalmatia County will be financed with national and EU funds were awarded to beneficiaries on Tuesday. Regional Development and EU Funds Minister Marko Pavic said the projects to be funded under those agreements referred to the development of islands and underdeveloped areas, infrastructure, deinstitutionalisation, assistance to NGOs and local projects in Split. He noted that Split-Dalmatia County was one of the more successful ones in terms of absorption of EU funds, having absorbed around 5.6 billion kuna to date. Croatia ranks 60th on IMD world competitiveness ranking 2019 ZAGREB, June 16 (Hina) -According to the World Competitiveness Rankings by the Institute for Management Development (IMD) from Lausanne, Croatia ranks 60th among 63 economies analysed, the National Competitiveness Council (NVK) said on Tuesday. The IMD World Competitiveness Ranking is based on 255 criteria, with 163 relatingto statistical indicators and 92 based on comprehensive research and feedback from the business community. The survey of businesses was conducted in February, March and April 2020 while statistical ***data*** refers to 2019. The IMD competitiveness yearbook reports on how well a country manages its resources and competencies in order to create long-term added value. IMD's methodology is based on four categories of competitiveness: economic performance, government efficiency, business efficiency and infrastructure, using 20 indices, five for each factor. Health,environment andprices among Croatia's strengths, labour market and management among weaknesses A detailed analysis of Croatia's position shows good ranking in the areas of international trade, prices, health and environment, and education (ranking between 19th and 40th places). It also ranked fairly well on international investment. Croatia is seen to have a lot of problems with its potential for change in 10 out of 20 indices and ranksat the bottom of the ladder (63rd) in three areas: labour market, management practices, and attitudes and values. On the other hand, in three areas that are often referred to as a priority for reforms (tax policy, institutional framework and technological infrastructure), Croatia is not at the bottom of the list and ranksbetween 52nd and 55th places. NVK underscored that areas that are not in particular focus in development policies include scientific and basic infrastructure. "Events during the pandemic and global expectations in the post-pandemic periodprovide hope that necessary structural changes could accelerate. We seem to fare better in difficult times than in peace time which we have shownseveral times while awareness of the need for comprehensive changes is all the more present, and I believe that society will review the existing paradigms and accelerate the implementation of new ones," NVK president Ivica Mudrinic said. Challenges include reforming public administration and territorial organisation Challenges facing Croatia in 2020 include reforming public administration and the territorial organisation of the country along with digitising public administration and its services; strengthening those sectors that are significant for self-sufficiencyregarding national security, primarily the food, medicines and public health sectors; strengthening investments by the private sector through capital risk funds, business angels andcrowdfunding;reforming the judiciary and establishing cooperation between the academic, business and government sectors to strengthen innovativeness and competitiveness. The survey conducted among businesses indicates that the most favourable indicator of Croatia's competitiveness is its qualified labour force, reliable infrastructure, high level of education, price competitiveness, access to financing, while the downside is legislation efficiency, government capabilities, stability and foreseeable policies, taxpolicy and business-friendly environment. Milanovic meets with delegation of Voice of Entrepreneurs association ZAGREB, June 16 (Hina) -President Zoran Milanovicon Tuesday received a delegation of the Voice of Entrepreneurs associationwho informed him of its activities and objectives, the president's office said in a press release. During the meeting, the association's representativessaid that they established the association as a response to thegovernment's measures during the coronavirus pandemic and that now they are continuing to act as the voice of micro, small and medium-sized enterprises,trades and their employees, the press release said. The delegation said that the association'smotto is more work and justice, lower taxes and absolute transparency, and that theywished to be the driver of change aimed at creating a better and wealthier society in Croatia. The delegation was headed by Voice of Entrepreneurs presidentHrvoje Bujas, its executive director Drazen Orescanin, coordinator Marusa Stamac, and economic analystVuk Vukovic, the press release said. Bet Israel slams incitement to violence against Serbs ZAGREB, June 16 (Hina) - The Bet Israel Jewish community of Croatia on Tuesday condemned in the strongest terms a public incitement to violence and hate against Serbs in Croatia by a dozen young men in a Zagreb neighbourhood last week. We believe that after the criminal complaints, legal institutions will punish the culprits in line with the law. Our wish is to live in Croatia in a cultured, humane and civilised environment which respects every man's right to safety and a dignified life regardless of ethnic, religious, minority, racial or any other affiliation, a press release said. It was signed by chief rabbi Kotel Dadon and the community's president Aleksandar Sreckovic. Ambassador says Italians feel at home in Croatia ZAGREB, June 16 (Hina) - Italian Ambassador to Croatia Pierfrancesco Sacco said in Pula on Tuesday that Italians in Croatia felt at home, as did Croats in Italy, and that this was especially evident in Istria County. "This is especially evident in Istria and Pula, where there is a deep friendship and adesire to find new avenues of cooperation. There is a lot of potential for development in new areas between neighbouring states and regions which are close, and between historically close nationssuch as Croats and Italians," Sacco said. Talks held with local officials addressed cooperation with Italy, the status and rights of the Italian ethnic minority in Istria, and the effects of COVID-19 on the economy and tourism. Pula Mayor Boris Miletic said openness, multiculturalism and coexistence were the fundamental values that havebeen nurtured in Istria for decades. "We have lots of room for further progress," he said, adding that he was looking forward to meetings and cooperation between Pula and Istria and Italy and its regions. Croatian firefighting aircraft to participate in RescEU missions again this year ZAGREB, June 16 (Hina) -For the second year in a row Croatia's firefightingaircraft will be on stand-by as part ofthe European Civil Protection and Humanitarian Aid Operations (RescEU) mechanism, the Defence Ministry said on Tuesday. Croatian firefighting planes will be prepared to participate in the RescEU mission from June 15 to October 31,based on two models. Under the first model, two aircraft would fly to neighbouring Italy, Bosnia and Herzegovina, Montenegro and Albania and would return to Croatia each day, while the second model envisagesmissions of several days to more distant countries like Spain, France and Israel. A third model also exists where aircraft can be deployed to countries with a high wildfire risk and will be prepared to intervene if necessary. The commander of the 855th firefighting squadron, Colonel Tomislav Vacenovski, said that together with other sections of homeland security, Croatia's firefightingsystem has also been strengthenedand is capable of providing assistance to other countries. "We have had 19 international missions in seven countries which confirms our high potential and preparedness to promptly deploy our forces not only in Croatia but in countries that request assistance," Vacenovskisaid. RescEUis a project that reinforced and strengthened the EU's disaster risk management by upgrading the EU Civil Protection Mechanism andhas the objective of enhancing both the protection of citizens from disasters and the management of emerging risks. State secretary attends video conference of EU defence ministers ZAGREB, June 16 (Hina) - Croatian State Secretary Zdravko Jakop on Tuesday attended a video conference of EU defence ministers and the European Defence Agency Steering Board focusing on the implementation of EU missions and operations and the progress of strategic defence initiatives, the Defence Ministry said. The ministers underlined the importance of making EU missions and operations fully operational as soon as possible to accomplish their primary goals - the EU's contribution to international stability and security and strengthening partner capacity. Jakop informed the ministers of the implemented national procedure of Croatia's joining the IRINI naval operation, launched during Croatia's presidency of the EU and the coming deployment of a Croatian AVPD team to Operation ATALANTA. The conference continued a discussion on strategic issues related to European security and defence, launched at an informal ministerial meeting held in Zagreb in March. The meeting stressed the need to continue working on the Permanent Structured Cooperation (PESCO) and its coming strategic revision and on the European Defence Fund and military mobility. Jakop welcomed the development of European defence initiatives, with work on the Strategic Compass as a new initiative expected to give impetus to analysing existing documents and procedures in the field of EU defence and to proposals for their advancement while preserving coherence and complementarity and strengthening cooperation with NATO. Also stressed at the meeting was that the launching of the European Defence Fund within the existing Multiannual Financial Framework had created significant possibilities for the development of defence capabilities, with Croatia advocating the involvement of small and medium-sized companies. Three new coronavirus cases confirmed in Slovenia ZAGREB, June 16 (Hina) - Three new cases of coronavirus infection have been confirmed in Slovenia after 567 tests carried out in the last 24 hours, the Slovenian government said on Tuesday. The new cases were registered in Krsko, Piran and Postojna, where a very small number of infections had been recorded before. They increased thetotal number of cases to 1,499, with the death toll standing at 109. Twenty-four cases are still active, and seven of them are receiving hospital treatment, including one who is in intensive care. A total of 1,366 people have recovered from the disease to date. Prime Minister Janez Jansa warned in parliament on Monday that the result of this year's tourist season, especially when it comes to foreign tourists, would largely depend on the readiness to isolate smaller hotspots of the virus in the months head. Montenegro reports two new coronavirus cases in last two days ZAGREB, June 16 (Hina) - Montenegro's health authorities confirmed a new coronavirus case on Monday, a second in the last two days, after no cases had been registered for 42 straight days. Both cases are people who recently spent time in neighbouring Bosnia and Herzegovina. The authorities are now trying to identify their contacts. A total of 326 cases of infection with the novel COVID-19 coronavirus have been discovered in Montenegro since mid-March. On June 1 the country opened its borders to 130 countries where the number of active cases is below 25 per 100,000 inhabitants, including Croatia, and lifted most of the restrictions imposed to the contain the virus. At the start of June, Montenegro declared the end of the coronavirus epidemic on its soil after no new cases were identified for 28 days in a row. On May 24 it became the first coronavirus-free country in Europe. Bosnia reports 45 new coronavirus cases ZAGREB, June 16 (Hina) - Forty-five new cases of coronavirus infection have been identified in Bosnia and Herzegovina in the last 24 hours, the country's health authorities said on Tuesday. In the last 24 hours, 814 samples have been tested and the infection has been found in 33 people in the Bosniak-Croat entity and 12 in the Serb entity. Six cases were confirmed in Sarajevo and five in Bosanska Kostajnica. Since the start of the epidemic in the country, the total number of cases has reached 3,085, and 165 people have died. Double-digit daily increases in the case count have been recorded for nearly three weeks, but the authorities estimate that the situation is under control and that apart from observing physical distancing rules, wearing protective face masks and using hand sanitiser, there is no need for reinstating previous restrictions. Serbia still with more than 50 COVID-19 cases on daily basis ZAGREB, June 16 (Hina) - Serbia continues to register more than 50 cases of COVID-19 on a daily basis, and of the 5,470 persons tested in the last 24 hours, 59 have tested positive for the novel coronavirus, show official ***statistics*** from the country's health ministry, published on Tuesday. One person has died since Monday, putting the death toll at 256, the mortality rate being 2.06%. In the period since the epidemic was declared on March 6, 313,483 people have been tested and 12,426 have tested positive. Currently 546 people are hospitalised and 15 patients are on ventilators. These ***statistics*** still keepSerbia on the list of countries whose citizens cannot freely cross the borders of most European countries and EUmember-states. In other news: AD Plastik lands €60.7M contracts in Russia ZAGREB, June 16 (Hina) - The AD Plastik group has landed new contracts with Russia's AvtoVAZ worth €57.7 million for the new Lada Niva car, and €3 million for the manufacturing of parts for Nissan Qashqai, also in Russia, the Solin-based company said on Tuesday. The new, completely redesigned Lada Niva, the oldest car on the Russian market, will be manufactured at AvtoVAZ's factory in Togliatti.Serial production is expected to begin in the first quarter of 2023 and last ten years. The start of car parts production for NissanQashqaiis planned for the lastquarter of 2022and will last sixyears. Croatia had weakest growth in labour costs in EU in Q1 ZAGREB, June 16 (Hina) - In the first quarter of 2020 Croatia was the only EU country to see a drop in the cost of social contributions, which put it among countries with the lowest growth of totalhourly labour costs, shows a report by the EU's statistical office ***Eurostat***. In the EU27, working day adjusted hourly labour costs grew by 3.7% in Q1 compared to the same period of last year, reflecting a 3.7%increase in wages and salaries and contributions, ***Eurostat*** said. In the last quarter of 2019 total hourly labour costs in the EU were up 2.7%. In the EU, labour costs per hour grew by 3.1% in industry, by 3.2% in construction, by 3.6% in services and by 4.3% in the (mainly) non-business economy. In the first quarter of 2020, compared with the same quarter of the previous year, hourly labour costs in the euro area rose by 3.4%, after a 2.3% increase in the previous quarter. The cost of wages and salaries rose by 3.4% and the cost of contributions by 3.6%. In the euro area, total labour costs grew the most in services, by 3.4%, followed by the construction sector, with a 3% increase, and industry, with a 2.6% increase. Croatia at bottom of EU ranking Among the EU countries whose ***data*** were available to ***Eurostat***, the strongest growth of hourly labour costs was reported by Lithuania,11.4%, followed by Bulgaria, with an increase of 10.2%. Croatia was at the bottom, with a 0.3% increase in hourly labour costs in Q1. In Q4 2019 those costs grew 3%. The cost of wages and salaries grew 1.1% while the cost of contributions dropped by 4%.All the other EU countries saw an increase in the cost of contribution. In the last quarter of 2019 the cost of wages and salaries in Croatia grew 3.4% and the cost of contributions by 0.7%. Apart from Croatia,an increase in hourly labour costs of below one percent was also reported by Luxembourg (0.4%),Finland (0.7%),and France (0.9%). Consumer prices drop 0.6% in May ZAGREB, June 16(Hina) - In May 2020, consumer prices decreased 0.6% on the year, falling for the second consecutive month, the national statistical office said on Tuesday. In April 2020, consumer prices decreased 0.2% on the year, which was their first annual decrease since the end of 2016. The annual decrease in May was primarily due to transport prices, which account for over 15% of the consumer basket. Prices of housing, water, electricity, gas and other fuels decreased annually by 1.9%. On the other hand, prices of alcoholic beverages and tobacco recorded the highest annual increase, by 4.3%, followed by prices of food and non-alcoholic beverages (+2.5%). In May 2020, as compared to April 2020, consumerprices increased by 0.1%. The highest increases were recorded in prices of clothing and footwear,by 1.3%, andprices of recreation and culture,by 0.7%, while the largest decrease was recorded in prices of restaurants and hotels, by 0.9%. Thanks to inflationary pressures at the beginning of the year, consumer prices in the January-May period were 0.7% higher on average year on year. ZSE main indices rise ZAGREB, June 16 (Hina) - The main Zagreb Stock Exchange (ZSE) indices increased on Tuesday, the Crobex by 0.53% to 1,653.04 points and the Crobex10 by 0.37% to 1,025.94 points. Regular turnover was HRK 6.2 million. The most traded stock was Altantska Plovidba, turning over HRK 1.55 million. It closed at HRK 225 per share, a jump of 12.50%, making it the day's biggest gainer. Next was Dalekovod, which turned over HRK 1.1 million, closing at HRK 4.90, a jump of 10.36%. They were the only two stocks to cross the million kuna mark. (€1 = HRK 7.565476) THIS BULLETIN INCLUDES ITEMS RELEASED BY 2100 HRS TUESDAY. (Hina) rml Masthead Brief News Bulletin is published by the Croatian News Agency HINA Marulićev trg 1610 000 ZagrebCroatia web:[*www.hina.hr*](http://www.hina.hr) mail: [*hina@hina.hr*](mailto:hina@hina.hr) phone: (+385 1) 48 08 660; fax (+385 1) 48 08 822 Publisher: Branka Gabriela Valentić, DirectorEditor in Chief: Serđo Obratov Bulletin Editor: Marija Šestan

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6225/1/20 REV 1 JLF/mfECOMP.1.B ENCouncil of theEuropean UnionBrussels, 2 March 2020(OR. en)6225/1/20REV 1EF 28ECOFIN 95FISC 66CRIMORG 16COVER NOTENo. Cion doc.: SWD(2020) 39 final/2Subject: COMMISSION STAFF WORKING DOCUMENT ON THE MOVEMENT OFCAPITAL AND THE FREEDOM OF PAYMENTSDelegations will find attached document SWD(2020) 39 final/2.Encl.: SWD(2020) 39 final/2EN ENEUROPEANCOMMISSIONBrussels, 28.2.2020SWD(2020) 39 final/2CORRIGENDUMThis document corrects document SWD(2020) 39 final of 18.2.2020 Added the footnote 47.The text shall read as follows:“Latvia has made amendments to the Law on Payment Services and Electronic Money in thisrespect that came into force on 12 November 2019.”COMMISSION STAFF WORKING DOCUMENTON THE MOVEMENT OF CAPITAL AND THE FREEDOM OF PAYMENTS1This Commission staff working document is for information purposes. It does not represent an official position of the Commission on this issue, nor does it anticipate such a position. It presents these topics in a non-technical format that is accessible to a non-specialist audience.2Contents1 EXECUTIVE SUMMARY ......................................................................................... 42 TRENDS IN EU CAPITAL FLOWS IN THE GLOBAL CONTEXT, 2018-2019 ............................................................................................................................. 62.1 Global and EU capital flows .............................................................................. 62.2 Foreign direct investments developments ......................................................... 72.3 Portfolio investment developments ................................................................. 112.4 Indicators for financial integration: home bias in EU’s equity and bond markets ............................................................................................................ 122.5 Risk diversification within the EU through portfolio investments .................. 143 LEGAL FRAMEWORK UNDERLYING THE FREE MOVEMENT OF CAPITAL AND PAYMENTS .................................................................................. 153.1 Legal framework ............................................................................................. 153.2 Infringement proceedings ................................................................................ 173.3 Monitoring ....................................................................................................... 193.3.1 Framework for investment protection ............................................... 193.3.2 Investments in real estate and ***agricultural*** land ................................ 203.3.3 Lending in foreign currencies ............................................................ 213.3.4 Capital controls .................................................................................. 224 MAIN DEVELOPMENTS IN THE AREA OF FREE MOVEMENT OF CAPITAL AND THE FREEDOM OF PAYMENTS ............................................... 244.1 Addressing national barriers to the free movement of capital ......................... 244.1.1 Capital Markets Union ...................................................................... 244.1.2 Withholding tax ................................................................................. 254.1.3 Cross-border distribution of funds ..................................................... 264.2 The international role of the euro .................................................................... 274.3 Payment services in the single market ............................................................. 284.3.1 Retail payments ................................................................................. 284.3.2 Cross-border payments in euro .......................................................... 294.3.3 Single Euro Payments Area ............................................................... 294.4 Direct taxation and free movement of capital ................................................. 304.5 Macroprudential measures ............................................................................... 324.6 Anti-money laundering and countering the financing of terrorism ................. 364.6.1 Increasing law enforcement authorities' access to financial information ........................................................................................ 364.6.2 Supervision and regulatory technical standards (RTS) ..................... 374.6.3 Adoption of an anti-money laundering package ............................... 3834.6.4 EU list on high-risk non-EU countries .............................................. 394.6.5 Application of the Regulation on information accompanying transfers of funds ............................................................................... 405 GLOBAL DEVELOPMENTS IN CAPITAL MOVEMENTS/PAYMENTS .......... 415.1 Free trade agreements and stand-alone investment agreements ...................... 415.2 Member State bilateral investment treaties with non-EU countries ................ 425.3 Investment screening ....................................................................................... 425.3.1 Member States’ screening mechanisms ............................................. 435.3.2 EU framework for screening of extra-EU investment ....................... 455.4 Free movement of capital and the OECD ........................................................ 455.5 Economic and financial sanctions for non-EU countries ................................ 466 CONCLUSIONS ....................................................................................................... 4841 EXECUTIVE SUMMARYThe free movement of capital is essential for integrated, open and efficient European financial markets that benefit businesses and people in the EU. It is a key element of the European single market. This document reports on capital movements and policy initiatives on the free movement of capital in 2018-2019. It will feed into the Economic and Financial Committee's annual discussions on capital movements and the freedom of payments under Article 134 of the Treaty on the Functioning of the European Union.The first part of this report reviews global and EU capital flows and related economic developments. The second part sets out the legal framework, details recent policy initiatives and important challenges, and reviews global initiatives on the free movement of capital and the freedom of payments.A key takeaway is that in 2018 financial account surpluses and deficits have continued worldwide. This is consistent with their medium-term redistribution away from emerging economies and towards developed economies — an ongoing trend since 2014. Although both the surpluses and the deficits of emerging economies are decreasing, there has been a shift in the distribution of global surpluses away from China and towards oil exporters throughout 2018. This is mainly because of the increase in the price of oil over that same period. Meanwhile, the financial account imbalances of developed economies continue to be polarised between the surpluses of the euro area and Japan and the deficits of the US, the UK, and a group of advanced deficit economies.From an EU perspective, the main development in 2018 has been the fall in the EU’s financial account surplus, driven by a relatively broad-based fall in its Member States’ financial accounts’ surpluses. Nevertheless, the EU remains the biggest net exporter of capital globally, with a financial account surplus of 2% compared vis-à-vis the rest of the world.Economic growth and trade tensions weighed on capital flows during 2018, and will likely do the same in 2019. The International Monetary Fund (IMF) has recently revised both the EU and the global growth forecast for 2019 further downward1 to 0.6 and 0.9 percentage points, respectively, lower than the projections made in April 2018. The moderation of trade flows is also expected to negatively affect capital flows in the future.The free movement of capital is one of the four fundamental freedoms enshrined in the EU treaties. The second part of this staff working document presents how the Commission — the guardian of these treaties — monitors potential barriers arising from Member States' non-compliance with EU law and takes enforcement action if needed.But there are also national measures or practices that, despite being compatible with EU law, create barriers to the free movement of capital. This can be due to a lack of harmonisation of national rules, the behaviour of private sector actors or structural1 ‘World Economic Outlook’ (WEO), IMF, April 2018 and October 2019.5factors. The Commission is working to address these barriers with the Capital Market Union (CMU) whose main objectives include removing any remaining cross-border barriers to capital markets investments in the EU in order to foster investments and create a genuine single market for capital. Although the Commission has delivered all the announced legislative measures, more work is needed to achieve a fully-fledged CMU. A High-level Forum on capital markets was created to engage with market participants, civil society and academics, with a view to proposing targeted policy recommendations for future CMU actions.The free movement of capital is the only fundamental freedom that is extended to non-EU countries. The Commission promotes it actively on the global stage to ensure a level playing field. It does so by negotiating investment and free trade agreements and participating in international fora such as the OECD (Organisation for Economic Co-operation and Development), which recently revised its code of liberalisation of capital movements.Although the free movement of capital is necessary to the single market, it also carries risks that cannot be overlooked. Large and volatile capital flows can carry risks for macroeconomic stability. As recent scandals have shown, uncontrolled capital flows can cover up money laundering activities. In the last year, several initiatives were introduced to improve the EU's anti-money laundering framework, including ones that improve supervision and cooperation with law enforcement authorities.The Commission published several reports on the Member States' implementation of the anti-money laundering framework. These highlighted that risks related to public order and security may arise when foreign investors seek to acquire strategic assets that allow them to access, for example, critical technologies, infrastructure or sensitive information.In 2019, the EU adopted a screening framework to help all Member States and the Commission identify and effectively mitigate possible risks that certain foreign investments may pose. It will be fully applicable in October 2020.Capital controls are another tool to prevent possible risks deriving from free movement of capital. These may be necessary to prevent disorderly outflows from causing a financial and economic meltdown. Greece and Iceland applied such controls in recent years. However, Greece has now lifted them all and Iceland lifted most of them in 2019.The EU may also take restrictive economic and financial measures against non-EU countries, or individuals, groups or non-state entities under its common foreign and security policy. In 2018 and in 2019 two new thematic sanctions regimes were put in place (against chemical weapons and cyberattacks respectively). Current geographical sanctions include, amongst others, measures against Turkey, Nicaragua, Russia and North Korea.62 TRENDS IN EU CAPITAL FLOWS IN THE GLOBAL CONTEXT, 2018-20192.1 Global and EU capital flows2The two main patterns that have shaped the global distribution of net capital flows3 in recent years continued in the reporting period. First, although capital flows balances remain elevated, their magnitude is smaller compared to the pre-crisis period and they have continued to narrow recently (see Figure 1). Second, relative to the period immediately after the crisis, they have shifted towards advanced economies. Surpluses are mainly concentrated in the euro area and Japan, as the surpluses of China and oil-producing countries (Norway, Russia and Saudi Arabia) have significantly shrunk. At the same time, the distribution of deficits became more concentrated around the US, the UK and some other advanced economies (Australia, Canada and New Zealand) as the deficits in emerging countries, Latin America and elsewhere, declined.Both patterns continued to play out in 2018: overall surpluses and deficits remained at levels similar to those observed in recent years and their composition did not change substantially.In 2018, capital continued to be mainly exported from the euro area, Japan, financial centres, oil producers and other surplus countries in Asia, primarily towards the US and, to a lesser extent, to the UK and other large economies, both advanced and emerging. Apart from the euro area and the UK, the non-euro Member States reported — small external positions by world economy standards — surplus for non-euro area (NEA) Nordic economies (Denmark and Sweden) and deficit for the NEA Central and Eastern Europe (CEE).2 For more details on the latest developments in capital movements, see the study ‘Analysis of EU capital flows in the global context’, prepared by Bruegel for the European Commission.3 Net flows correspond to the difference between (net) acquisition of assets, often referred to as gross asset flows, and (net) incurrence of liabilities referred to as gross liabilities flows. A positive net flow (i.e when the flow of acquisition of foreign assets exceeds the flow of incurrence of liabilities to non-residents) therefore translates into net outflows of capital. It is important to note that the underlying ‘gross’ flows can be negative: a net outflow could therefore be the result of foreign assets being acquired faster than liabilities that are incurred to non-residents, but it could also mean that foreign liabilities are being reduced faster than foreign assets, or that assets increase while liabilities decrease. Equivalently, a negative net flow means an inflow of investment.7Figure 1: Financial account balances, % of world GDPSource: IMF, International Financial ***Statistics*** (IFS) and World Economic Outlook (WEO), April 2019.Notes: Left-hand side panel shows a 4Q lagged moving average, whereas the right-hand side panel shows the unsmoothed series over the year preceding the last ***data*** point available. Both the financial account balance and GDP are measured in USD.2.2 Foreign direct investments developmentsForeign direct investments (FDI) in net terms4 tend to flow out of advanced economies towards emerging economies. From a global perspective, while Japan and the euro area are consistent sources of net FDI outflows into the rest of the world, Latin American countries and other emerging economies running current account deficits as well as CEE countries constantly receive flows of direct investment.Against this backdrop, the first main development in 2018 has been the spike in FDI inflows into the US which until now has traditionally been a source country for FDI flows. Between 2007 and 2014, the US was a major source of net FDI outflows and China was the main destination of net FDI flows. In the aftermath of the 2008 financial crisis, net flows of FDI shrank and, reflecting the double-dip recession in the euro area, shifted away from the euro area towards the US in the case of outflow, and away from non-euro area, CEE towards Latin America in the case of inflow.Yet, the biggest spike in US FDI inflows took place in 2015. Initially, the US balance swung to inflows while the outflows from the euro area strengthened substantially. The timing of the shift coincided with a wave of US multinationals moving their headquarters to the EU, particularly to euro-area countries. Finally, the 2018 increase in US FDI inflows is partly related to some repatriation of previous earnings from US multinationals after the enactment of the Tax Cuts and Jobs Act (TCJA) from 2017.The second global shift in capital flow patterns since 2015 relates to China. Net FDI inflows gradually decreased and temporarily reversed into outflows in 2016. This4 FDIs in net terms are equal to the difference between the acquisition of gross FDI external assets and the incurrence of gross FDI liabilities.8reversal in FDI was partly linked to the general capital flight out of China, but also to its longer-term economic transition, which is leading to outbound FDI to the rest of the world.The US and the euro area mainly drove the decline in global gross FDI asset flows in 2018. Traditionally one of the major sources of direct investment worldwide, the US saw a decrease in its FDI asset flows in 2018 for the first time since 2005. Later on in 2019, US FDI asset flows towards the EU recovered and returned to their historical average levels. The euro area’s drop in gross FDI asset flows in 2018 was even bigger than the American one and mostly driven by decreases in Luxembourg, Germany and the Netherlands. The drop in CEE countries was driven by the decrease in Hungary, which can be attributed — as is the case in Luxembourg and the Netherlands — to the recent trend of declining flows to and from special purpose entities (SPEs). While the EU as a whole was one of the major sources of FDI globally, the individual economies that were major sources of FDI worldwide in 2018 were Japan, China as well as some global financial centres.The slowdown in liability accumulation follows the same pattern as the assets, and is largely driven by the euro area, which records negative net accumulation of foreign claims or a reversal of investments previously made by foreigners. In terms of size, the decrease in the US gross liability flows is smaller than the change on the asset side. However, the worldwide decrease in liability flows started somewhat earlier — already in the first half of 2018.Recently, both intra-EU and extra-EU FDI inflows have been decreasing (see Figure 2). The recent declines in FDI flows seem mostly driven by the slowdown of flows from non-EU ultimate investing country (UIC)s to non-EU ultimate host country (UHC), that pass mainly through SPEs5. Another factor thought to have partially influenced the fall in FDI is recent trade tensions. FDI can be closely interrelated with trade as it provides foreign companies with a marketing, financial and physical infrastructure that helps them trade internationally. FDI can also be a substitute to trade, providing a more cost effective way of producing and selling products in a particular country. Pessimism surrounding trade can dis-incentivises these operations, especially as FDI is usually planned in a medium- to long-term time horizon. Trade tensions and policy uncertainties are likely to weigh on both intra-EU as well as extra-EU investment given their effects on the overall business confidence and risk aversion and the importance of conduit FDI for intra-EU investment flows.The decline of both intra-EU and extra-EU FDI flows seems to be much less pronounced if flows through SPEs are not taken into account.5 FDI flows also include conduit FDI, i.e FDI that does not flow directly from the ultimate investing country (UIC) to the ultimate host country (UHC), and can be, thus, counted multiple times in the gross flow ***statistics***. In other words, conduit FDI can lead to an overestimation of gross ‘genuine’ flows.9Figure 2: Intra and extra-EU28 gross FDI inflows, 4-quarter moving sumsSource: DG FISMA based on ***EUROSTAT*** Balance of Payments quarterly ***data*** (BPM6). [amounts in EUR million]MERGERS AND ACQUISITIONSInward mergers and acquisitions (M&As) in EU-28 are expected to decline by almost 12% in 2019 for the second year in a row, following a more than 10% decrease in 2018 (see Figure 3, Panel A). Both domestic and cross-border transactions declined with the latter recording a slightly slower decline than the former. Among international transactions, extra-EU M&As contributed the most to the overall decline in 2019.Chinese M&As into the EU continued to decrease as the reversal of the previously rapid growth in inward transactions that started in 2016 continued in 2019. US M&As in EU-28 also declined in 2019. The declines of the US and Chinese M&As in the EU contributed to respectively 12% and 27% of the overall reduction in the number of transactions in 2019.10Figure 3: Inward mergers and acquisitions in EU-28number of transactions, 1995-2019Panel A, Cross-border and domestic transactionsPanel B, Chinese and US M&As in EU-28Source: DG FISMA based on DEALOGIC M&As ANALYTICS. Note: Latest ***data*** – as of 31 January 2020.The value of international divestment through mergers and acquisitions6 picked up in 2018 reaching levels close to those in 2007, but then normalised in 2019. The spike in the value of international divestment was caused by a few very large divestments of both intra-EU and extra-EU sellers.Figure 4: International divestment through mergers and acquisitionsvalue of transactions in millions of eurosSource: DG FISMA based on DEALOGIC M&As ANALYTICS. Note: Latest ***data*** – as of 31 January 2020.EU investors' preference for the single market also continued to strengthen in 2018-2019 with the number of intra-EU outbound M&As transactions7 decreasing slower than that of extra-EU outbound transactions (see Figure 5).6 M&As in which a previously foreign-owned company within the EU is sold either to another foreign company or to domestic investors.7 Cross-border M&As in which the acquiring company is in the EU, while the target company is either in the EU or outside the EU.11Figure 5: Preference for the single market in outbound mergers and acquisitionsnumber of transactionsSource: DG FISMA based on DEALOGIC M&As ANALYTICS. Note: Latest ***data*** – as of 31 January 2020.2.3 Portfolio investment developmentsGlobal portfolio investment trends in recent years have been largely driven by the interest differential between the euro and the dollar, which widened again after a period of euro optimism in late 2017 and early 2018.In the first half of 2018, the size of the acquisition of EU and euro area net foreign assets — in particular of portfolio debt outflows — fell in comparison to previous years (see Figure 6). This was motivated by the expectation of better economic prospects for the euro area and an eventual monetary tightening by the European Central Bank (ECB) which had increased yields. At the same time, the actual interest rate differential between the US and the euro area pushed the cost of hedging dollar investments higher. As a result, the hedged yield of (risk-free) dollar investments became less appealing than the euro equivalent over time.Due to worsening economic prospects and a widening interest rate differential, net portfolio debt outflows from the euro area intensified in the second half of 2019. Given the difference in the speed of the economic recovery between the two regions during 2013-2014 and actual and expected Fed rate hikes, the interest rate differential between the US and the euro area has been the biggest driver of the net portfolio investment outflows from the euro area in recent years.At the same time, the strengthening of the US dollar throughout 2018 had a major effect on global trends, similar to the appreciating euro the year before. Partly due to this, emerging market currencies severely depreciated in the course of the year, but their value seemed to have stabilised in the first half of 2019. This was partly due to the weakening global outlook of the previous several months which altered expectations about the monetary policy of both the Federal Reserve and the ECB.12Figure 6: Euro area net and gross portfolio investment flowsSource: DG FISMA based on ECB.2.4 Indicators for financial integration: home bias in EU’s equity and bond marketsHome bias refers to the preference of investors to invest a part of their portfolios in domestic equities or debt instruments, regardless of the advantages of having an internationally diversified portfolio as described by the theory on capital asset pricing model.Intra-EU and global home bias with macro dataFigure 7 and Figure 8 present two indicators for home bias in portfolio investment8. The first (intra-EU home bias, Figure 7) captures the propensity to invest in rest of the EU-28 countries as compared with investing domestically, while the second (extra-EU home bias, Figure 8) shows the propensity to invest outside the EU rather than domestically. The first measures the attractiveness of the intra-EU capital market, while the second captures the interconnection of EU Member States with global markets. A decline in intra-EU home bias represents a rise in financial integration among EU countries. The lower the home bias, the higher is the share of investment within the EU as compared to the domestic market.The intra-EU home bias (Figure 7) increased from 77% in 2009 to 79% in 2011 and then went back down to the 2009 level in 2018. Euro-area countries account for most of the reduction. In 2018 the home bias of euro-area countries was 20 points below that of the non-euro ones whose intra-EU home bias stood at 91%. Home bias in both groups of countries was highly stable in 2017.8 Details on the computation are available in Nardo, M., Ndacyayisenga, N., Pericoli, F. and Poncela, P., Commission SWD on the Movement of Capital and the Freedom of Payments, EUR 29191 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-81827-1, doi:10.2760/322204, JRC110773.13The intra-EU home bias is the average of equity and debt portfolio instruments, whicheach have different patterns. Compared with debt, equity is more biased towardsdomestic investment though this trend is decreasing. During the last 4 years intra-EUequity home bias for euro-area countries dropped from 88% in 2014 to 83% in 2018.However, intra-EU home bias for debt peaked at 59% during the sovereign crisis andthen stabilised at 56% for euro-area countries. For non-euro area countries the trend isdifferent. Debt home bias reached a high of 88% in 2018 up from 86% in 2014, whileequity remained almost unchanged at around 94-96% for the entire observation period.Figure 7: Intra-EU home bias for EU-28, yearly average for debt and equitySource: JRC computations based on the JRC-ECFIN FinFlows database.Notes: Only portfolio debt and equity investment positions as defined in the national accounts are taken into account. Cross-borderbanking flows and FDI are excluded from the computation.For EU-28 the integration with global markets is, on average, 15 percentage points lowerthan the integration within Europe. The extra-EU home bias was as high as 89% in 2018for the EU-28, falling gradually from 91% in 2009, with both euro and non-eurocountries following a similar trend. The high value of extra-EU home bias is mainly dueto equity — with a steady decrease in the last 3 years reaching 91% in 2018. There is alsoa decreasing trend in the debt market, where most of the reduction relates to euro-areacountries (from 86% in 2013 to 83% in 2018).14Figure 8: Intra and extra-EU home bias indicator for EU-28, yearly average for debt and equitySource: JRC computations based on the JRC-ECFIN FinFlows database.2.5 Risk diversification within the EU through portfolio investmentsForeign portfolio investments are an important factor in risk sharing. These investments are expected to smooth domestic income changes when there are domestic shocks and to allow investors to hedge domestic risk by holding a cross-border portfolio. Figure 9 shows the diversification of cross-border portfolio assets and liabilities within the EU9 for each Member State. Diversification of liabilities (assets) is a measure of the attractiveness of domestic assets (foreign liabilities) in the remaining EU portfolios and is evaluated based on: (1) the number of cross-border links; and (2) the relative size (within the EU) of the country where the investment is done. Higher diversification implies, other things being equal, a wider and stronger pool of cross-border partnerships and a lower dependency on common economic cycles.Figure 9 compares the levels of risk diversification that Member States have achieved through portfolio assets and liabilities10. It also illustrates whether Member States achieved higher diversification through their portfolio assets or through their portfolio liabilities11.It shows essentially two groups of EU Member States. The first group, mostly composed of euro-area countries plus Denmark, Sweden, and the UK, have strong diversification in both portfolio assets and liabilities. The remaining non-euro area countries as well as9 Details on the computation are in Nardo, M., Ndacyayisenga, N., Pericoli, F. and Poncela, P., JRC.B1 contribution to the SWD on the Movement of Capital and the Freedom of Payments, EUR 29191 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-81827-1, doi:10.2760/322204, JRC110773.10 Member States that are further away from the intersection of the axes at the zero level have achieved higher levels of diversification through their portfolio investments.11 Member States that are above the 45 degrees line achieve higher diversification through their foreign portfolio assets (holdings abroad) than from their foreign portfolio liabilities (foreign holdings of domestic securities).15Slovakia, Malta, Cyprus, Latvia, Lithuania and Estonia have lower diversification in both assets and liabilities with a difference of 20 percentage points on average.Trends show that for the EU as a whole, diversification measures were relatively stable in 2016-2018 compared to 2013-201512. Looking at country-level dynamics, Estonia, Malta and Romania increased their diversification in liabilities by more than 8 percentage points, while Poland and Estonia improved their asset diversification by 9 percentage points.Figure 9: Intra-EU diversification for portfolio assets and liabilitiesaverage 2016-2018, EU-28Source: JRC computations based on the JRC-ECFIN FinFlows database.Notes: Diversification is computed as the average, 2016-2018, of portfolio debt and equity investment assets and liabilities positions as defined in the national accounts. Cross-border banking flows and foreign direct investment (FDI) are excluded from the computation.3 LEGAL FRAMEWORK UNDERLYING THE FREE MOVEMENT OF CAPITAL AND PAYMENTS3.1 Legal frameworkThe principle of free movement of capital lies at the heart of the single market and is one of its four fundamental freedoms. The Treaty on the Functioning of the European Union (TFEU) does not contain an explicit definition of capital movements. However, in its jurisprudence the Court of Justice of the European Union (CJEU) has consistently established a broad definition of capital movements13. According to this jurisprudence, capital movements cover many operations, including:12 In EU-28 diversification of liabilities were at 50% while diversification of assets’ were at 42%.13 Based on the nomenclature annexed to Council Directive 88/361/EEC.16• FDI, real estate investments and purchases;• securities investments (e.g in shares, bonds, bills and unit trusts);• transactions in securities on capital markets, admission of securities to capital markets;• operations in units of ***collective*** investment undertakings;• premiums and payments in respect of life and credit assurance; and• granting of loans and credits and other operations, including personal capital operations such as dowries, inheritances and legacies, gifts and endowments.As a rule, all restrictions on the movement of capital between Member States and between Member States and non-EU countries are prohibited (Article 63 TFEU). The CJEU has interpreted the term ‘restriction’ to mean all measures liable to make cross border capital movements less attractive14. However, the TFEU provides for the possibility to restrict capital movements, for the reasons referred to in Article 65 TFEU and, for non-discriminatory restrictions, for overriding reasons in the public interest. In particular, Article 65 TFEU provides that the free movement of capital is without prejudice to certain powers of Member States. These include: a) the power to apply the relevant provisions of their tax law that distinguish between taxpayers who are not in the same situation with regard to the place of residence or the place where the capital is invested, and b) the power to take precautions and supervisory measures, especially in the fields of taxation and the prudential supervision of financial institutions. Moreover, Article 65(1)(b) TFEU preserves the power of Member States ‘to take measures which are justified on grounds of public policy or public security’.In any case, restrictive measures must respect the principle of proportionality. As such, they must be suitable for attaining the objective sought, they must not go beyond what is necessary to achieve that objective and cannot be replaced by less restrictive alternative means15. Moreover, national measures must comply with other general principles of EU law, such as legal certainty, and with the fundamental rights16. Furthermore, the14 Judgment of 26 April 2012, Van Putten, Joined Cases C‑578/10 to C‑580/10, paragraph 40 and case law cited therein. See also judgment of 13 mai 2003, Commission v Spain («golden shares»), C-463/00, ECLI:EU:C:2003:272, para 58.15 Judgments of 6 March 2018, SEGRO, C‑52/16 et C‑113/16, EU:C:2018:157, paragraph 76; of 21 May 2019, Commission v Hungary ('usufruct'), EU:C:2019:432, paragraphs 59-61.16 Judgment of 5 July 2012, SIAT, C-318/10, EU:C:2012:415, paragraph 58; Judgment of 30 April 2014, Pfleger, Case C‑390/12, EU:C:2014:281, paragraph 35; Commission v Hungary ('usufruct'), cit., paragraph 63. See also Judgment of 12 June 2003, Schmidberger, C-112/00, EU:C:2003:333, paragraphs 79 et seq.17exceptions provided in the TFEU must not be invoked as cover for arbitrary discrimination or a disguised restriction on the free movement of capital and payments (Article 65(3) TFEU).Partly different considerations apply to the movement of capital to and from non-EU countries. The CJEU has stressed that it ‘takes place in a different legal context’ from that which exists within the EU. Consequently, under the Treaty additional justifications may be acceptable in the case of non-EU country restrictions17. Justifications may also be interpreted more broadly18. Moreover, any restrictions on certain capital movements (direct investment, real estate, the provision of financial services and the admission of securities to capital markets) existing before the liberalisation of capital movements are grandfathered under Article 64(1) TFEU. The relevant date is 31 December 1993 for all Member States except Bulgaria, Estonia and Hungary (31 December 1999) and Croatia (31 December 2002). This means that restrictions on certain capital movements in place before these dates that affect nationals of non-EU countries cannot be challenged on the basis of the principle of the free movement of capital under the Treaty.The Treaty also provides for certain restrictions that can be adopted by the EU under certain specific conditions. The Council may, by means of a Regulation, interrupt or reduce, in part or completely, the economic and financial relations with one or more non-EU country if deemed necessary to achieve the objectives of the common foreign and security policy (Article 215(1)). Such restrictive measures or sanctions may particularly affect exports, imports, transfers of funds, investment and access to the EU’s capital markets. Furthermore, Article 75 TFEU provides for a derogation from the free movement of capital and payments in order to meet objectives in the area of freedom, security and justice related to preventing and combating terrorism. Such restrictive measures (sanctions) may include freezing the funds, financial assets or economic gains of companies, individuals, groups or non-state entities. Finally, the Council may take temporary safeguard measures in exceptional situations when movements of capital with non-EU countries cause, or threaten to cause, serious difficulties for the operation of the economic and monetary union. The general principles of EU law, including the principle of proportionality and the respect for fundamental rights, also apply in this context.3.2 Infringement proceedingsIn its Communication on EU law titled 'Better results through better application'19, the Commission clarified its approach to its infringement policy, namely that it should17 Judgment of 18 December 2007, Skatteverket, cases C-101/05, paragraph 36; Judgment of 12 December 2006, Test Claimants in the FII Group Litigation, C-446/04, EU:C:2006:774, paragraph 171.18 See, for example, Judgment of 12 December 2006, Test Claimants in the FII Group Litigation, C-446/04, EU:C:2006:774.19 [*https://ec.europa.eu/info/publications/communication-commission-eu-law-better-results-through-better-application\_en18support*](https://ec.europa.eu/info/publications/communication-commission-eu-law-better-results-through-better-application_en18support) the achievement of EU policy objectives. The Commission targets problems where its enforcement action can make a real difference and provide real added value to individuals and businesses.In line with the Commission’s priorities and its political commitment to be more strategic in enforcing EU law, the Commission decided to act firmly on infringements that risk undermining the four fundamental freedoms.In 2019, the Court of Justice found in its judgment that Hungary has failed to fulfil its obligations arising from the free movement of capital and the right to property guaranteed by the EU Charter of Fundamental Rights20. The Commission referred Hungary to the Court of Justice of the EU for failure to bring national rules terminating certain usufruct rights on ***agricultural*** land in line with EU law.During the reporting period, the Commission decided to close three infringement cases related to free movement of capital, following action by the concerned Member States in remedying the contested violation of EU law: two against Lithuania and Slovakia related to the acquisition of ***agricultural*** land, and one against Croatia, linked to special rights of the state in a private company.Another area where the Commission has taken action as guardian of the Treaties to ensure free movement of capital is direct taxation. Member States must act in compliance with EU law, including the principle on the free movement of capital. During the reporting period21, the Commission launched seven infringement proceedings under Article 63 TFEU and Article 40 of the European Economic Area Agreement against Spain, Italy, Hungary, Latvia and the United Kingdom by sending letters of formal notice.During the same period, the Commission closed 16 infringement proceedings on tax restrictions to the free movement of capital. By 31 December 2019, there were 25 open infringement proceedings against Member States for violations in the field of direct taxation in relation to the free movement of capital.In 2018, the Court of Justice delivered two judgments on actions brought by the Commission against France and Belgium for violations of the principle of free movement of capital in the field of direct taxation.In the first case, the Court decided that France had failed to fulfil its Treaty obligations by refusing to take into account the tax incurred by a non-resident subsidiary in the mechanism for the avoidance of economic double taxation, which permits offsetting the tax levied at every level of the distribution of dividends22.20 See footnote 15.21 From 1 January 2018 to 31 December 2019.22 Judgment of 4 October 2018, Commission v France, Case C-416/17, EU:C:2018:811.19In the second case, the Court declared that Belgium had failed to fulfil its obligations by retaining provisions under which the rental income of Belgian taxpayers from foreign immovable property is calculated on the basis of the actual rental value, but from property located in Belgium — based on the cadastral value23.3.3 Monitoring3.3.1 Framework for investment protectionIn July 2018, the Commission adopted a Communication on the protection of intra-EU investment24, which gives an overview on the rules on available remedies for investment protection.The Commission's aim was to underline the protection enjoyed by investors under existing EU law and explain the implications of the Achmea judgment25 of March 2018 whereby the Court of Justice found the arbitration clauses in intra-EU bilateral investment treaties (intra-EU-BITs) incompatible with EU law.In the Declarations of 15 and 16 January 201926 on the legal consequences of the judgment of the Court of Justice in Achmea and on investment protection in the European Union27, all Member States committed to a coordinated approach for the implementation of the Achmea judgment by terminating their intra-EU BITs by means of a single plurilateral agreement. The declarations still acknowledge that bilateral terminations are possible ‘where that is mutually recognised as more expedient’.Member States’ experts, with the Commission’s assistance, worked on the text of a plurilateral termination agreement in the framework of an ad hoc special group for the termination of intra-EU BITs. The group met nine times between November 2018 and June 2019 and prepared a draft agreement, which fulfils the commitment to coordinated termination, while taking account of the different interests involved and ensuring legal certainty and compliance with EU law.23 Judgment of 12 April 2018, Commission v Belgium, Case C-110/17, EU:C:2018:250.24   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018) %3A547 %3AFIN25 Judgment of 6 March 2018, Slowakische Republik v Achmea BV, Case C-284/16, EU:C:2018:158.26 Declarations of 15 and 16 January 2019: i) Declaration of the Representatives of the Governments of the Member States of 15 January 2019 on the legal consequences of the judgment of the Court of Justice in Achmea and on investment protection in the European Union; ii) Declaration of the Representatives of the Governments of the Member States of 16 January 2019 on the enforcement of the judgment of the Court of Justice in Achmea and on investment protection in the European Union, signed by Finland, Luxembourg, Malta, Slovenia and Sweden; iii) Declaration of the Representative of the Government of Hungary of 16 January 2019 on the legal consequences of the judgment of the Court of Justice in Achmea and on investment protection in the European Union.27   [*https://ec.europa.eu/info/publications/190117-bilateral-investment-treaties\_en20On*](https://ec.europa.eu/info/publications/190117-bilateral-investment-treaties_en20On) 24 October 2019, the vast majority of EU Member States endorsed the draft text of the plurilateral termination agreement at a meeting of their Ambassadors and Permanent Representatives to the European Union28. The agreement will be signed in early 2020 once the applicable national empowerment procedures have been completed.3.3.2 Investments in real estate and ***agricultural*** landThe free movement of capital includes investments in real estate according to the nomenclature annexed to Directive 88/361/EEC on the liberalisation of capital movements. Although the Directive is no longer applicable, the annex may still be used to determine what is covered by the free movement of capital (Article 63 TFEU)29. According to the explanatory notes of that Directive, investment in real estate covers purchases of buildings and land, the construction of buildings as well as rights of usufruct, easements and building rights30. In addition, the CJEU has clarified that the free movement of capital includes the right to acquire, use or dispose of immovable property31.Within the scope of Article 63 TFEU, cross-border investments must not be restricted by national law, unless the restrictions are proportionate to pursue a legitimate objective and respect fundamental rights32. Hence, restrictions may differ from one Member State to another. The Commission is assessing national restrictions to the free movement of capital on a case-by-case basis.In recent years, the Commission has had to look into restrictions on investments in ***agricultural*** land. Some Member States adopted new laws on the acquisition of ***agricultural*** land following the expiry of transition periods during which they were allowed to derogate from the free movement of capital rules33. The new land laws generally pursue policy objectives such as keeping land in ***agricultural*** use and preventing excessive land speculation and concentration. However, the Commission has found some of these laws to be discriminatory and overly restrictive. As from 2015, it therefore took legal action against Bulgaria, Hungary, Lithuania, Slovakia and Latvia34.On 27 April 2017 the European Parliament adopted a resolution on the ‘State of play of farmland concentration in the EU — how to facilitate access to land for farmers’. The28   [*https://ec.europa.eu/info/sites/info/files/business\_economy\_euro/banking\_and\_finance/documents/*](https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/) 191024-bilateral-investment-treaties\_en.pdf29 CJEU Joint cases C‑52/16 und C‑113/16, ECLI:EU:C:2018:157 n 56 — SEGRO und Horváth.30 CJEU C‑235/17, ECLI:EU:C:2019:432 n 55 — Commission v Hungary.31 CJEU, C-567/07, ECLI:EU:C:2009:593, n 20 — Woningstichting Sint Servatius.32 CJEU C‑235/17, ECLI:EU:C:2019:432 n 59, 63 — Commission v Hungary.33 The transitional derogations granted to Bulgaria, Romania, Hungary, Slovakia, Latvia and Lithuania under their respective Accession Treaties expired in 2014, and for Poland in 2016.34   [*http://europa.eu/rapid/press-release\_IP-16-1827\_en.htm21Parliament*](http://europa.eu/rapid/press-release_IP-16-1827_en.htm21Parliament) called on the Commission to provide guidance to Member States on how to regulate ***agricultural*** land markets in line with EU law. The Commission responded to this resolution by adopting an 'Interpretative Communication on the Acquisition of Farmland' on 12 October 201735. Following the adoption of the Communication, Lithuania and Slovakia aligned their land laws with EU law so that the Commission could close the respective infringement procedures in 2019. Some Member States are in the process of acting similarly, while others have not yet taken any initial step in this direction. The Commission continues to engage with the Member States and stakeholders on the farmland challenges36.The transition period, during which Croatia can derogate from free movement of capital with respect to ***agricultural*** land, will expire on 1 July 2020. Under the Accession Treaty, the country has the possibility to apply for a 3-year extension of the transition period.3.3.3 Lending in foreign currenciesIn the years before the financial crisis, banks in several Member States issued substantial numbers of foreign-currency (mostly CHF) loans to private households, largely due to the more favourable LIBOR interest rates at that time. However, following the global financial crisis and because of unfavourable exchange rate movements, in some Member States a large number of those loans became non-performing, as many borrowers could no longer pay back the significantly increased monthly instalments. Many consumers and consumer organisations challenged the validity of certain clauses contained in foreign-currency loans as unfair and not compliant with EU consumer protection law.In recent years, the CJEU has developed a substantive body of case-law on the level of consumer protection under EU law relating to those foreign-currency loans and on the criteria to be applied by the national courts when they assess the unfairness of certain clauses and the legal consequences for those contracts. It is for the competent national judge to assess whether a certain contract term is unfair and needs to be removed from the contract and, if that unfair term defines the main subject matter of a contract, such as terms relating to the exchange risk for a loan indexed to a foreign currency, whether the contract can be upheld without that term37.Several Member States have adopted or are planning to adopt national regulatory measures to provide a systemic solution to remaining issues linked with foreign-currency retail loans. The Commission is closely monitoring these developments to ensure that any such measures comply with EU law. National measures that restrict the fundamental single market freedoms need to be duly justified by public interest objectives, must be35   [*https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=OJ:C:2017:350:TOC36*](https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=OJ:C:2017:350:TOC36) On 3 June 2019, the Commission held a workshop on farmland market challenges and best practices.37 See the latest judgment of the Court in Case C-260/18 of 3 October 2019, Kamil Dziubak and Justyna Dziubak v Raiffeisen Bank International AG.22suitable, not go beyond what is necessary to attain these objectives and not be replaceable by equally efficient but less restrictive means.Whenever the Commission has doubts about whether a national measure complies with EU law, it seeks to engage in a dialogue with the Member State concerned. This is to find a solution that not only fully ensures compliance with EU consumer protection rights, but also takes into account financial stability and the general principles of EU law.All credit agreements signed after 21 March 2016 are bound by the Mortgage Credit Directive38 (MCD) which contains specific provisions that address the risks associated with foreign-currency loans.3.3.4 Capital controlsCapital controls are one of the most severe exceptions to the principle of free movement of capital. However, they are necessary to prevent disorderly outflows from causing a financial and economic meltdown. The restrictions imposed recently in Greece and Iceland are examples of necessary restrictions on the free movement of capital within the EU/European Economic Area (EEA).GREECEGreece introduced capital controls in June 2015. At the time, the Commission found that the temporary restrictions imposed by the Greek authorities were justified because of the need to preserve the stability of the financial and banking system in Greece. The Greek authorities adopted a roadmap in May 2017 on the gradual relaxation of capital controls with a view to abolishing them, while at the same time safeguarding financial and macroeconomic stability.Greece fully lifted capital controls on 1 September 2019, ending 4 years of restrictions on transfers abroad by companies and individuals.ICELANDArticle 40 of the EEA Agreement establishes the principle of free movement of capital in the EEA. However, Article 43 expressly permits a contracting party to take ‘protective measures’ if there are disturbances in the functioning of its capital market, or if it is having difficulties with its balance of payments.Capital controls were introduced in November 2008, after Iceland was struck by an unusually severe banking crisis in October 2008. Since then, the Commission has been monitoring the situation and discussing the best way forward with the Icelandic authorities and the European Free Trade Area Surveillance Authority. The Icelandic38 Directive 2014/17/EU of the European Parliament and of the Council of 4 February 2014 on credit agreements for consumers relating to residential immovable property and amending Directives 2008/48/EC and 2013/36/EU and Regulation (EU) No 1093/2010,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0017.23authorities*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0017.23authorities) aim to remove restrictions on the free movement of capital in the EEA while safeguarding Iceland’s financial and economic stability.After several rounds of relaxation measures adopted in the years leading up to 2017, on 14 March 2017, Iceland was granted full exemptions from nearly all restrictions. However, some minor capital controls remain in place — to prevent carry trade39 for example. Households and businesses are generally no longer subject to the restrictions that the Icelandic Foreign Exchange Act imposed on foreign exchange transactions, foreign investment, hedging and lending activity in Iceland. The requirement that residents repatriate foreign currency has also been lifted. Foreign investments by pension funds, ***collective*** investment funds (UCITS) and cross-border transactions with Icelandic króna have been authorised. Foreign financial undertakings have been authorised to transfer króna and financial instruments issued in domestic currency to and from Iceland. An agreement was reached in 2017 with some owners of offshore Icelandic króna (which were subject to restrictions), whereby they sold approximately ISK 90 billion to the Central Bank of Iceland at ISK 137.5 per EUR.In March 2019 the Icelandic authorities notified the Commission of further steps taken to relax capital controls. Now owners of offshore króna assets are given permission to release their assets from accounts subject to special restrictions:(1) There is a general authorisation for offshore króna holders to release their króna assets in order to purchase foreign currency and export it to an account abroad.(2) An authorisation has been granted for offshore króna holders that have owned offshore króna assets continuously since the introduction of the capital controls to release those offshore króna assets from the legal restrictions.(3) There is an authorisation for individuals to withdraw up to ISK 100 million from accounts, subject to special restrictions.The authorities expect that as much as half of the remaining ISK 84 billion in offshore króna assets could be withdrawn due to these new authorisations.Rules on special reserve requirements for new foreign-currency inflows were amended in parallel, decreasing the special reserve requirement from 20% to 0%. Other provisions — for example on the special reserve base, interest rates on capital flow accounts and the holding period — remained unchanged.39 A carry trade is a strategy in which an investor borrows money at a low interest rate in order to invest in an asset that is likely to provide a higher return. This strategy is very common in the foreign exchange market.244 MAIN DEVELOPMENTS IN THE AREA OF FREE MOVEMENT OF CAPITAL AND THE FREEDOM OF PAYMENTS4.1 Addressing national barriers to the free movement of capital4.1.1 Capital Markets UnionThe Capital Markets Union (CMU) continues to be a very important priority for the EU. It is necessary to complement the Banking Union and to strengthen the economic and monetary union and the international role of the euro. The CMU is also an important single market project. One of its main objectives is to remove the remaining cross-border barriers to capital markets investments in the EU in order to create a genuine single market for capital. This should enable savers and companies to access investment opportunities and funding at similar terms anywhere in the EU, irrespective of their location or the state of development of their local capital markets.All of the legislative measures announced in the 2015 CMU action plan and in the 2017 midterm review of the CMU action plan have been delivered by the Commission, including the legislative proposals that contribute to removing barriers to cross-border investments. The Commission presented an overview of the progress achieved in its Communication of 15 March 2019 entitled ‘Capital Markets Union: progress on building a single market for capital for a strong Economic and Monetary Union’40.Since September 2015, the Commission, the European Parliament and the Council have agreed on a number of legislative acts that put in place the building blocks of a CMU. Together they seek to:(1) promote access to pan-European products and labels via the reviewed venture capital (EuVECA) Regulation, cut red tape for companies seeking public listing (Prospectus review), and help establish a pan-European market for personal pension products;(2) increase the transparency and integrity of the markets via new rules on simple, transparent and standardised (STS) securitisation, introduce more proportionate prudential treatment of investment firms and a harmonised framework on covered bonds; and(3) remove cross-border barriers to the integration of capital markets by harmonising key pre-insolvency procedures and strengthen the supervisory convergence role of the European supervisory authorities.While it is still difficult to assess the impact of the recently adopted legislative proposals as most of them have not been in force for long enough, more work will certainly be needed to achieve a fully-fledged CMU. Long-term trends, such as those triggered by technological development, Brexit and the need to transition towards a climate-neutral40   [*https://ec.europa.eu/finance/docs/policy/190315-cmu-communication\_en.pdf25economy*](https://ec.europa.eu/finance/docs/policy/190315-cmu-communication_en.pdf25economy), will affect the future of Europe’s capital markets. More work will also be needed in areas where progress has so far been slower, such as: (i) access to financing and development of adequate ecosystems for SMEs; (ii) efficient and better integrated market architecture; (iii) retail investor participation; and (iv) structural cross-border barriers due to, for example, divergent national insolvency regimes and inefficient withholding tax procedures.For this purpose, the Commission has created a High-level Forum on capital markets (HLF) to engage with market participants, civil society and academics. The HLF will propose targeted policy recommendations for future CMU actions, to ensure that and businesses and individuals reap the full benefits of the single market.4.1.2 Withholding taxBurdensome procedures for recovering tax withheld on portfolio investments have long been identified by Member States and the Commission as a barrier to a true EU capital market. They penalise cross-border investments, disrupt financial processes such as clearing and settlement, and increase the cost of cross-border trading. The resulting misallocation of financial resources undermines cross-border investments, which in some cases result in double taxation (as long as the due refunds are not carried out according to bilateral taxation treaties). The 2017 report on national barriers to capital flows41 and its follow-up, the 2017 joint roadmap42 identified a series of best practices on withholding tax (WHT) recovery proceedings (in addition to relief at source). The Code of conduct on withholding tax43, published in 2017, is a first non-binding deliverable of the CMU action plan in the area of taxation. It seeks to address on a voluntary basis the long-standing problem of long delays and costs in recovering taxes withheld in the country of investment.The 2017 Code calls for voluntary commitments by Member States and it should be considered as a compilation of approaches to improve the efficiency of current WHT procedures. Its main goal is to seek alignment between the approaches laid down by the Code and Member States’ tax administrations practices on withholding tax procedures. In particular, the approaches set in the Code to improve the efficiency on WHT procedures are, among others, easy access to the refund process, encouraging digital procedures, use of user-friendly forms, no delay in refund periods or appointing single points of contact in each Member State. A public hearing took place in January 2018 to present the Code and raise awareness among key stakeholders.In the reporting period, there were two implementation meetings on the state of play of the Code (on 21 June and 18 November 2019), which showed some progress overall.41   [*https://ec.europa.eu/info/files/170227-report-capital-barriers\_en42*](https://ec.europa.eu/info/files/170227-report-capital-barriers_en42)   [*https://ec.europa.eu/info/files/170519-roadmap-national-capital-barriers\_en43*](https://ec.europa.eu/info/files/170519-roadmap-national-capital-barriers_en43)   [*https://ec.europa.eu/taxation\_customs/sites/taxation/files/code\_of\_conduct\_on\_witholding\_tax.pdf26Most*](https://ec.europa.eu/taxation_customs/sites/taxation/files/code_of_conduct_on_witholding_tax.pdf26Most) Member States have national relief at source systems, but only a few of them apply it to every situation. The average time between a claim and refund still varies widely between Member States however, most of them, process the tax refund on average within six months, in line with the Code of Conduct. In the area of digital withholding tax procedures little progress has been recorded since the Code was published. Therefore, there is still significant scope for improvement, especially in the area of the standardisation of withholding tax procedures where the Code has proven to be insufficient.4.1.3 Cross-border distribution of fundsFacilitating cross-border distribution of investment funds is one of the CMU's priority actions. A truly open single market for European investment funds is expected to offer investors a better choice. This is because the removal of administrative and regulatory obstacles will reduce market fragmentation, bring greater economies of scale and increase competition across the EU. The legislative package on cross-border distribution of investment funds was published in the Official Journal in July 201944. It tackles regulatory barriers, which represent a strong disincentive to cross-border fund distribution. While more work is needed to complete the single market, the package contains the following main improvements:(1) It makes it easier for EU alternative investment fund managers to test the appetite of potential professional investors in new markets (so-called ‘pre-marketing’). This will help them take more informed commercial decisions before entering a new market.(2) It clarifies customer service obligations for asset managers in their host Member State. This should ensure that investors have access to uniform, high-level customer service across the EU without requiring asset managers to be physically present.(3) It aligns procedures and conditions to exit national markets when asset managers decide to terminate the offering or placement of their funds ('de-notification procedure').(4) It increases transparency and introduces a single, online access point to information on national rules on marketing requirements and applicable44 Directive (EU) 2019/1160 of the European Parliament and of the Council of 20 June 2019 amending Directives 2009/65/EC and 2011/61/EU with regard to cross-border distribution of ***collective*** investment undertakings (Text with EEA relevance.) OJ L 188, 12.7.2019, p. 106-115,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L1160*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L1160), and Regulation (EU) 2019/1156 of the European Parliament and of the Council of 20 June 2019 on facilitating cross-border distribution of ***collective*** investment undertakings and amending Regulations (EU) No 345/2013, (EU) No 346/2013 and (EU) No 1286/2014 (Text with EEA relevance.) OJ L 188, 12.7.2019, p. 55-66,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1156.27supervisory*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1156.27supervisory) fees, which will help reduce the legal and administrative cost of cross-border activities of asset managers in the EU.The package entered into force on 31 July 2019 and will fully apply when it is turned into national laws by August 2021.4.2 The international role of the euroThe euro is the second most used currency globally. It is used for example for cross-border payments, as a reserve currency, for issuing international debt, and for granting or taking up international loans. The free flow of capital, both within and in and out of the euro area is a key prerequisite for strengthening the international role of the euro. In turn, its increased international role should lead to more capital movements across the euro area border.The Commission adopted the Communication ‘Towards a stronger international role of the euro’ in December 2018 to strengthen the integrity and stability of the euro system, and to provide opportunities to people and businesses across the world to use the euro. While it is ultimately up to market participants to choose which currencies they use on the international stage, the objective is to increase the attractiveness of the euro for global market participants and investors as well as make the euro area more autonomous. Progressing towards a system that relies less strongly on just one currency would add stability to, and be in the interest of, the global community. Strengthening the international role of the euro is part of the EU’s broader commitment to an open, multilateral and rules-based global economy.A number of EU policies encourage financial market developments that help increase the role of the euro. Completing the banking union, the CMU and the economic and monetary union are fundamental components of the policy to increase the euro's international role. The banking union and the CMU increase the stability and efficiency — and therefore the attractiveness of — the euro area and of the euro as a dependable means of conducting business. Building on the financial stability provided by an effectively functioning banking union, the CMU aims for deeper and more liquid markets. To this end, CMU initiatives intend to diversify sources of financing, eliminate barriers to cross-border investments and offer more investment opportunities.The Communication on the international role of the euro announced that the Commission intends to:(1) make further use of European market infrastructure to widen the use of the euro in derivatives contracts, i.e : financial instruments whose value depends on the value of underlying variables;(2) underpin confidence in the use of euro-area financial markets by ensuring the availability of trustworthy interest-rate benchmarks, which act as reference rates in many financial contracts; and(3) support a fully integrated instant payment system in the EU, to reduce the risks and the vulnerabilities of retail users of payment systems.28In addition, the Communication proposed to look at other policies that can increase the use of the euro in foreign exchange markets, energy contracting and transactions in certain strategic sectors (for example for certain commodities, such as oil and gas, raw materials, food commodities, and in the sector of transport manufacturing — aircraft, maritime transport and railways).In the first half of 2019, the Commission launched consultations in several key strategic sectors, such as foreign exchange markets, energy, commodities and transportation. It published the results of these consultations in its staff working document titled ‘Strengthening the International Role of the Euro — Results of the Consultations’45 on 12 June 2019, and highlighted the need for a coordinated strategy that involves the EU, Member States and market participants, and requires economic diplomacy.4.3 Payment services in the single market4.3.1 Retail paymentsWith the adoption of Directive 2007/64/EC on payment services in 2007, the EU created a comprehensive legal framework on retail payments. The Directive introduced the concept of payment institutions to bring more competition to a market that was previously dominated by credit institutions.Since then, the payment market has evolved significantly. Today, many innovative players are operating in the market. As a result, the market has become more competitive than ever before. Innovation has also led to new types of payment services, which were not regulated under Directive 2007/64/EC.In 2015, the Directive was revised and modernised to take account of these new technological developments and to introduce stronger security measures to make electronic payments safer and more secure. The revised Directive ((EU) 2015/2366) came into force at the beginning of 2018 and is accompanied by a range of delegated acts. The most important of these is Commission Delegated Regulation (EU) 2018/38946.This delegated act became applicable on 14 September 2019. Accordingly, banks and other account-servicing payment service providers have to apply stricter security measures to their payments. They must also have in place communication interfaces that will allow providers of new types of payment services to access — with the explicit consent of the account holder who makes use of these services — the ***data*** of that account holder. These developments will have a catalyst effect on innovation in the area of45   [*https://ec.europa.eu/info/files/strengthening-international-role-euro-sdw-2019\_en46*](https://ec.europa.eu/info/files/strengthening-international-role-euro-sdw-2019_en46) Commission Delegated Regulation (EU) 2018/389 of 27 November 2017 supplementing Directive (EU) 2015/2366 of the European Parliament and of the Council with regard to regulatory technical standards for strong customer authentication and common and secure open standards of communication (Text with EEA relevance. ),   [*https://eur-lex.europa.eu/legal-content/EN/TXT/*](https://eur-lex.europa.eu/legal-content/EN/TXT/) ?uri=CELEX%3A32018R0389.29payments and other financial services, leading to the development of new payment and account-related services, eventually driving the market towards open banking.4.3.2 Cross-border payments in euroRegulation (EC) No 924/2009 on cross-border payments requires that fees for cross-border payments in euro within the EU (i.e payments from one euro Member State to another) be the same as fees for domestic payments in euro (i.e payments within the same Member State). Non-euro area Member States, although covered by the Regulation, have not benefited from the effects of the Regulation. In non-euro area countries, domestic payments in euro are either very expensive or simply do not exist. Consequently, people and businesses in these non-euro area EU Member States pay high fees whenever a payment crosses the border of their country or when people travel and pay abroad. These high costs are an impediment to the completion of the single market and create two categories of payment service users in the EU.In March 2018, the Commission tabled a proposal seeking to extend the benefits of Regulation (EC) No 924/2009 to people and businesses in Member States outside the euro area and to put an end to the high costs of intra-EU cross-border transactions in euro made from non-euro area Member States. Further to the agreement between the European Parliament and Council, reached in December 2018, Regulation (EU) 2019/518 was published in the Official Journal of the EU on 29 March 2019. It ensures that as from 15 December 2019 individuals or companies transferring euros from these countries pay the same as they would for domestic transactions in the local currency.The amendments to Regulation (EC) No 924/2009 also establish additional transparency obligations for currency conversion practices in line with Articles 45 and 59 of Directive 2015/2366 on payment services in the single market. These amendments seek to help users to compare currency conversion service offers before initiating a payment transaction involving a currency conversion. Transparency requirements will mostly apply as from 19 April 2020 and will particularly benefit consumers who travel to Member States with a different currency than that of their home country.4.3.3 Single Euro Payments AreaRegulation (EU) No 260/2012 establishes technical and business requirements for credit transfers and direct debits in euro. The Regulation, known as the Single Euro Payments Area (SEPA) Regulation, adopted in 2012, has been another major step forward in the proper functioning of the single payments market. It has created an integrated market for electronic payments in euro, by migrating to EU-wide credit transfers and direct debits and introducing IBAN. This migration has led to significant savings as banks no longer encounter the high costs of running both ‘legacy’ and SEPA products in parallel. In addition, since 2012, payment services providers must ensure that where their accounts are reachable for domestic credit transfers and direct debits, those accounts are also reachable for cross-border credit transfers and direct debits. IBAN discrimination based on the location of the account is no longer permitted. Payers with an account in a country30other than that of the payee should be able to make a SEPA transfer from their account just like any other payer with an account in the country of the payee.At the end of 2017, the Commission issued the SEPA report on the application of the Regulation. The report concluded that the SEPA migration has been a success overall. However, the report identified a number of small challenges, including IBAN discrimination in a number of cases, including by utility companies and telecom providers. The report also highlighted that some Member States did not designate a competent authority capable of addressing non-compliance by payees, and even in those Member States that did, the authority was sometimes unable to enforce the SEPA Regulation, specifically in cases of IBAN discrimination. Since 2018, the Commission has focused its efforts on resolving these remaining obstacles to ensure that SEPA credit transfers and direct debits are accepted, irrespective of whether they are domestic or cross-border. In the follow-up of specific complaints, the Commission has launched EU-Pilots for several Member States to find out which steps are being taken to ensure that the payees concerned also respect the Regulation. In the case of Greece, Latvia47 and Poland, the Commission launched infringement cases to ensure that a competent authority is designated in these Member States to address the non-compliance of the Regulation by payees48.4.4 Direct taxation and free movement of capitalThe Commission’s agenda to tackle tax evasion and avoidance has achieved notable success. This work on fairer taxation removes distortions that many companies face due to the aggressive tax planning of their competitors. A coordinated EU approach also helps to prevent a mixture of national anti-abuse measures from creating new obstacles for businesses in the single market. Recent policy initiatives in the field of taxation are therefore essential for achieving more integrated capital markets in the EU.All of the initiatives announced in the 2015 action plan for fair and efficient corporate taxation in the EU49 have now been launched with the aim of ensuring that every company pays tax where it makes its profits. Several initiatives have already been adopted to strengthen the EU anti-abuse provisions (in particular the Anti-tax avoidance Directives50) and to boost tax transparency. Most recently, on 25 May 2018 the Member States adopted an amendment to the Directive on administrative cooperation in direct47 Latvia has made amendments to the Law on Payment Services and Electronic Money in this respect that came into force on 12 November 2019.48 See also section 3.2 for more information on infringements related to free movement of capital.49 Communication from the Commission to the European Parliament and the Council on 'A fair and efficient corporate tax system in the European Union: 5 key areas for action', COM(2015) 302,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0302.50*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0302.50) Council Directive (EU) 2016/1164 of 12 July 2016 laying down rules against tax avoidance practices that directly affect the functioning of the internal market,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016L1164.31taxation51*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016L1164.31taxation51) to make intermediaries (e.g advisers, consultants, lawyers and accountants) liable to report to their competent authorities on cross-border arrangements that include at least one of the risk indicators (‘hallmarks’) laid down by law. The first exchanges of information between Member States on the arrangements take place from 1 July 2020.In October 2016, the Commission relaunched the Common Consolidated Corporate Tax Base by adopting two proposals that can be implemented in two stages52. Member States would as a first step implement the Common Corporate Tax Base (CCTB) and as a second step the Common Consolidated Corporate Tax Base (CCCTB). Both proposals are currently being negotiated in Council. The CCTB proposal includes provisions on an allowance for growth and investment (AGI), which aims to redress the current debt bias in taxation. The AGI will give companies similar tax benefits for equity as for debt, creating a more neutral and investment-friendly tax environment. Tackling this issue is one of the goals of the CMU, since the debt bias in taxation incentivises under-capitalisation, which can make companies more fragile and destabilise the economy.Considerable progress has been made in the area of administrative cooperation in direct taxation in the EU. In 2016, financial institutions initiated customer due diligence on their account holders in compliance with the national measures implementing Directive 2014/107/EU on the mandatory automatic exchange of information in the field of taxation. The purpose is to ***collect*** financial account-information to be exchanged in accordance with the OECD’s Standard for Automatic Exchange of Financial Account Information. The first automatic exchanges of information between tax administrations of the Member States took place in September 2017 and Austria joined the systematic exchanges in September 2018. This closer cooperation will allow tax administrations in the EU to ensure that taxpayers in each Member State comply with their national tax obligations for accounts held in other Member States. Improved tax compliance rules, in particular the self-certification procedures for tax residence included in the due diligence to be applied by financial institutions under the Directive, may help address the concerns of some Member States about applying withholding tax relief and refund procedures.The existing savings taxation agreements between the EU and five non-EU European countries53 (the Principality of Andorra, the Principality of Liechtenstein, the Principality of Monaco, the Republic of San Marino and the Swiss Confederation) have been updated to take into account the automatic exchange of financial account information based on the aforementioned OECD global standard. Two revised agreements (Liechtenstein and San Marino) entered into force on 1 January 2016 and the first automatic exchanges took51 Council Directive (EU) 2018/822 of 25 May 2018 amending Directive 2011/16/EU as regards mandatory automatic exchange of information in the field of taxation in relation to reportable cross-border arrangements,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L0822.52*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L0822.52) For more details, see:   [*http://europa.eu/rapid/press-release\_IP-16-3471\_en.htm*](http://europa.eu/rapid/press-release_IP-16-3471_en.htm) 53   [*https://ec.europa.eu/taxation\_customs/individuals/personal-taxation/taxation-savings-income/2004-ec-agreements\_en32place*](https://ec.europa.eu/taxation_customs/individuals/personal-taxation/taxation-savings-income/2004-ec-agreements_en32place) in September 2017. The three other revised agreements, including with the Swiss Confederation, entered into force on 1 January 2017 and the first exchanges took place in September 2018.Following a proposal by the Commission in October 2016, the Member States adopted a Directive on tax dispute resolution mechanisms54 in October 2017 that is applicable from 1 July 2019. This instrument lays down rules for resolving disputes more swiftly and efficiently between Member States that arise from the interpretation and application of tax treaties on the elimination of double taxation for businesses and individuals. The Directive creates an obligation to resolve the dispute within a set period of time and delivers an important innovation in that it offers guarantees for the rights of the taxpayer to trigger several stages of the dispute resolution procedure(s).Against the background of the CMU, the Commission is also taking action to encourage Member States to simplify withholding tax relief/refund procedures for compliant tax payers (see Section 4.1.2 for more details) and encourage best tax practices in promoting venture capital55 and business angel56 investment in start-ups and innovative companies. The 2017 study on tax incentives for venture capital and business angels57 found that taxation plays a role in supporting or hampering venture capital and business angel investment. The way in which tax incentives are designed could help lower the risk (upside and downside) of investments in SMEs and start-ups. The study observed 47 tax incentives designed to promote venture capital and business angel investment in the 36 countries sampled.Taxation is one of the policy areas monitored by the European Semester, the EU’s annual cycle of economic policy coordination. The main taxation priorities of the 2019 European Semester cycle were to stimulate productive investment, support employment, improve tax compliance and promote social fairness. In 2019, the Commission provided country-specific recommendations in the area of taxation to 17 Member States.4.5 Macroprudential measuresThe financial crisis highlighted the need for system-wide oversight and macroprudential measures. Macroprudential policy has been developed as a new EU policy area to limit systemic risk mainly by using prudential measures to address vulnerabilities that go beyond the scale of individual institutions.54 Council Directive (EU) 2017/1852.55 Venture capital is financing that investors provide to start-up companies and small businesses with long-term growth potential.56 A business angel is a private individual, often of high net worth and usually with business experience, who directly invests part of his or her personal assets in new and growing private businesses.57   [*https://ec.europa.eu/taxation\_customs/sites/taxation/files/final\_report\_2017\_taxud\_venture-capital\_business-angels.pdf33Capital*](https://ec.europa.eu/taxation_customs/sites/taxation/files/final_report_2017_taxud_venture-capital_business-angels.pdf33Capital) movements may be a source of risks that can be mitigated by macroprudential measures that limit, for instance, excessive credit growth in one Member State. Reciprocation measures aim to ensure that macroprudential measures taken in one country to address an overheating housing market will not be rendered ineffective by increased lending through foreign bank branches or cross-border lending into that country.The 2013 Capital Requirements Directive58 and Capital Requirements Regulation59 provide for a number of instruments for macroprudential use in the banking sector. Some instruments, like the countercyclical capital buffer (CCyB) and the buffer for global systemically important institutions (G-SIIs) are mandatory. Others, like the buffer for other systemically important institutions (O-SIIs), are not mandatory, although the identification of O-SIIs is mandatory. The EU macroprudential toolbox also encompasses other instruments whose application is discretionary. These include the systemic risk buffer (SyRB), measures under Articles 124 and 164 CRR, which can address vulnerabilities related to the real estate sector, and national measures under Article 458 CRR, which can only be used if no other measure in the EU macroprudential toolkit can adequately address emerging national systemic risks.Given that macroprudential risks may be very specific to a given country, the framework provides Member States with the necessary national flexibility to act. At the same time, it provides appropriate safeguards to ensure that the single market and the free flow of capital are not unduly affected. These safeguards come in the form of EU coordination or authorisation requirements prior to activating the selected measures. They also encompass a reciprocation framework (mutual recognition) to avoid cross-border leakages and circumvention of measures.In June 2019, amendments to the Capital Requirements Regulation and Directive (CRR/CRD IV) entered into force, as part of a broader overhaul of the EU’s prudential and resolution rules for banks (‘banking package’)60. These reforms include a number of58 Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC (OJ L 176, 27.6.2013, p. 338),   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013L0036.59*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32013L0036.59) Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 (OJ L 176, 27.6.2013, p. 1),   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0575.60*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0575.60) The banking package contains changes to the Capital Requirements Directive (Directive 2013/36/EU, OJ L 176, 27.6.2013, p. 338), the Capital Requirements Regulation (Regulation (EU) No 575/2013, OJ L 176, 27.6.2013, p. 1), the Bank Recovery and Resolution Directive (Directive 2014/59/EU, OJ L 173, 12.6.2014, p. 190) and the Single Resolution Mechanism Regulation (Regulation (EU) No 806/2014, OJ L 225, 30.7.2014, p. 1). It was published in the Official Journal on 7 June 2019 (OJ L 150 7.6.2019) and entered into force 20 days after publication,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L:2019:150:FULL&from=EN.34targeted*](https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=OJ:L:2019:150:FULL&from=EN.34targeted) improvements to the existing macroprudential provisions that will become applicable in December 2020, i.e 18 months after the date of entry into force61.Several Member States have supplemented the EU laws on the macroprudential toolset for the banking sector with national macroprudential laws. Most of these national laws are for mortgage transactions, such as caps on the loan-to-value ratio, loan-to-income ratio, debt-to-income ratio, debt-service-to-income ratio and maturity limits.Figure 10: Macroprudential measures of economic significance activated in 2019 by EEA Member StatesSource: ESRB. European Commission calculations (up to October 2019).Note: The figure only takes into account notified measures that are of economic significance. Measures of a more procedural or administrative nature, such as setting the countercyclical capital buffer rate at 0%, are not considered. Other measures that have to be notified periodically, like the yearly identification of O-SIIs and the CCyB buffer rate, are not reported if they merely serve to confirm the measures already notified. Reciprocation measures are also not regarded as being measures of economic significance.Macroprudential measures notified by Member States mainly address three types of risks: aggregate credit growth, the systemic importance of financial institutions and the risks stemming from the real estate sector. Figure 10 provides an overview of the number of measures of economic significance per Member State, notified so far in 2019. These measures have been of a tightening nature.First, the activation of countercyclical capital buffers (CCyB) is noteworthy. To date, nine Member States have set a non-zero CCyB rate. Eight of these Member States have61 The upcoming changes to the macroprudential instruments in EU banking legislation are presented in ‘Upcoming changes to the macroprudential provisions in CRR/CRD4’, Special Feature B, in ESRB (2019), A Review of Macroprudential Policy in the EU in 2018, April 2019.35set a non-zero CCyB rate or have increased an already positive CCyB rate in the course of 2019 (cut-off date October 2019). Five of these Member States have also announced further increases in CCyB rates. Furthermore, in 2019, three Member States announced the setting of a non-zero CCyB rate. Figure 11 summarises the activation of the CCyB.Figure 11: Activation of the countercyclical capital buffer in 2019 by EEA Member StateSource: ESRB. European Commission calculations (up to October 2019).Note: Bulgaria has a 0.5% CCyB since October 2019, which is scheduled to increase to 1% from July 2020. Czechia has a 1.5% CCyB since July 2019, which is scheduled to increase to 1.75% from January 2020 and to 2% from July 2020. Denmark has a 1% CCyB since September 2019, which is scheduled to increase to 1.5% from June 2020 and to 2% from December 2020. France has a 0.25% CCyB since July 2019, which is scheduled to increase to 0.5% from April 2020. Ireland has a 1% CCyB since July 2019. Lithuania has a 1% CCyB since June 2019. Slovakia has a 1.5% CCyB since August 2019, which is scheduled to increase to 2% from August 2020. Sweden has a 2.5% CCyB since September 2019. The UK has a 1% CCyB since November 2018. Belgium has announced an increase of the CCyB from 0% to 0.5% from July 2020. Germany has announced an increase of the CCyB from 0% to 0.25% from July 2020. Luxembourg has announced an increase of the CCyB from 0% to 0.25% from January 2020. Sweden has had a 2% CCyB since March 2017, which is scheduled to increase to 2.5 % from September 2019. In the EEA, Iceland has had a CCyB of 1.75% since May 2019, which is scheduled to increase to 2% from February 2020, and Norway has had a CCyB of 2 % since December 2017, which is scheduled to increase to 2.5% from December 2019.Second, around 200 G-SIIs and O-SIIs have been identified in the EU. The additional capital buffer requirements for such institutions vary from 0% to 2% (subject to phasing-in). Decisions taken in 2019 have broadly confirmed the results of the previous years in terms of banks identified as G-SIIs and O-SIIs and in terms of calibration of the buffer requirements.Third, by October 2019 23 Member States had activated measures to address vulnerabilities stemming from the real estate sector (cut-off date October 2019). Compared to 2018, one more Member State introduced borrower-based measures based on national law, raising the number of countries with such measures from 18 to 19. In 2019, two Member States adopted new or additional borrower-based measures or36tightened measures already in place. Borrower-based measures appear to be relatively effective. In practice, borrower-based measures reduce vulnerabilities on the balance sheets of both banks and households, even if they mainly apply to new mortgage loans. Capital-based measures seem to have had a more indirect, limited effect on cyclical adjustments and the cost of loans. Nonetheless, vulnerabilities in the real estate sector remain a key concern in several EU Member States. In September 2019, the European Systemic Risk Board (ESRB) addressed warnings and recommendations on medium-term residential real estate vulnerabilities to 11 Member States62. The key vulnerabilities highlighted by the ESRB assessment relate to: (i) high or rising household indebtedness and the ability of households to repay their mortgage debt; (ii) the growth of mortgage lending and the loosening of lending standards; and (iii) the valuation or price dynamics of residential real estate.In addition, systemic risk buffers are currently used in 14 Member States for a wide range of purposes. In 2019, two Member States (Croatia and Hungary) recalibrated their already activated systemic risk buffers, and one Member State (the United Kingdom) activated a systemic risk buffer for the first time. One Member State (Estonia) also notified a planned national measure under Article 458 CRR in 2019, while another one (Finland) notified the intention to prolong by 1 year a national measure already activated under Article 458 CRR in 2017. In each case, after giving due consideration to European Banking Authority (EBA) and ESRB opinions, the Commission refrained from proposing to the Council an implementing act rejecting the draft national measures.Overall, the macroprudential toolset is designed to balance the need to address risks, at national level, with that of preserving the single market. A number of safeguards exist to avoid unintended consequences. However, the Commission, the ESRB and the EBA continuously monitor the use of macroprudential measures and their compatibility with the free movement of capital.4.6 Anti-money laundering and countering the financing of terrorismDuring the last year, work has continued to strengthen the EU's anti-money laundering framework. This consisted of initiatives to strengthen the supervisory aspects as well as cooperation with law enforcement authorities. The Commission also adopted several reports on the Member States' implementation of the anti-money laundering framework.4.6.1 Increasing law enforcement authorities' access to financial informationThe Directive (EU) 2019/115363, published on 11 July 2019, aims to improve the use of financial information by giving law enforcement authorities direct access to information62   [*https://www.esrb.europa.eu/news/pr/date/2019/html/esrb.pr190923~75f4b1856d.en.html63*](https://www.esrb.europa.eu/news/pr/date/2019/html/esrb.pr190923~75f4b1856d.en.html63) Directive (EU) 2019/1153 of the European Parliament and of the Council of 20 June 2019 laying down rules facilitating the use of financial and other information for the prevention, detection, investigation37about the identity of bank-account holders contained in national centralised bank registries. It also gives law enforcement authorities the possibility to access certain information from national financial intelligence units (FIUs) — including ***data*** on financial transactions — and improves the information exchange between FIUs and their access to law enforcement information that is necessary to perform their tasks. These measures will speed up criminal investigations and enable authorities to combat cross-border crime more effectively.4.6.2 Supervision and regulatory technical standards (RTS)4.6.2.1 European supervisory authorities reviewOn 12 September 2018, the European Commission amended its proposal to review the European supervisory authorities’ Regulations in order to reinforce the Authorities' mandate in matters relating to preventing and combating money laundering and terrorist financing64. The text of the amending Regulation has been agreed by the co-legislator and was adopted on 18 December 201965.This act will give a leading and coordinating role to the EBA in order to centralise resources currently scattered across the three European supervisory authorities (ESAs), thus establishing a robust support structure. The EBA will also be able to ask competent authorities to investigate possible breaches of the relevant rules and to oversee national procedures in this area. Under specific, circumscribed circumstances, it will be able to address decisions on money laundering matters directly to individual financial sector operators and engage in binding mediation between national competent authorities on such matters. .or prosecution of certain criminal offences, and repealing Council Decision 2000/642/JHA,   [*https://eur-lex.europa.eu/eli/dir/2019/1153/oj.64*](https://eur-lex.europa.eu/eli/dir/2019/1153/oj.64) COM(2018) 646 final:   [*https://ec.europa.eu/commission/sites/beta-political/files/soteu2018-supervisory*](https://ec.europa.eu/commission/sites/beta-political/files/soteu2018-supervisory) -authorities-regulation-646\_en.pdf 65 Regulation (EU) 2019/2175 of the European Parliament and of the Council of 18 December 2019 amending Regulation (EU) No 1093/2010 establishing a European Supervisory Authority (European Banking Authority), Regulation (EU) No 1094/2010 establishing a European Supervisory Authority (European Insurance and Occupational Pensions Authority), Regulation (EU) No 1095/2010 establishing a European Supervisory Authority (European Securities and Markets Authority), Regulation (EU) No 600/2014 on markets in financial instruments, Regulation (EU) 2016/1011 on indices used as benchmarks in financial instruments and financial contracts or to measure the performance of investment funds, and Regulation (EU) 2015/847 on information accompanying transfers of funds (Text with EEA relevance) (Text with EEA relevance), OJ L 334, 27.12.2019, p. 1–145,   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\_.2019.334.01.0001.01*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2019.334.01.0001.01) ENG&toc=OJ:L:2019:334:TOC.384.6.2.2 Regulatory technical standardsAs part of its legal obligation under the fourth Anti-Money Laundering Directive, the Commission has adopted Delegated Regulations on the following regulatory technical standards that have been developed by the ESAs:• Regulatory technical standards for the minimum action and the type of additional measures credit and financial institutions must take to mitigate money laundering and terrorist financing risk in certain non-EU countries, adopted on 31 January 201966.• Regulatory technical standards on the criteria for appointing central contact points for electronic money issuers and payment service providers and with rules on their functions, adopted on 7 May 201867.4.6.3 Adoption of an anti-money laundering packageOn 24 July 2019, the European Commission adopted a Communication to the European Parliament and the Council titled ‘towards better implementation of the EU’s anti-money laundering and countering the financing of terrorism framework’68. It was accompanied by four reports69: (1) the Commission’s biannual supranational risk assessment of money laundering and terrorist financing risks facing the EU's internal market; (2) an assessment of recent alleged money laundering cases involving EU credit institutions; (3) a report on cooperation between FIUs; and (4) a report on the interconnection of Member States' national centralised automated mechanisms on bank accounts.66 Commission Delegated Regulation (EU) 2019/758 of 31 January 2019 supplementing Directive (EU) 2015/849 of the European Parliament and of the Council with regard to regulatory technical standards for the minimum action and the type of additional measures credit and financial institutions must take to mitigate money laundering and terrorist financing risk in certain non-EU countries (Text with EEA relevance):   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0758.67*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32019R0758.67) Commission Delegated Regulation (EU) 2018/1108 of 7 May 2018 supplementing Directive (EU) 2015/849 of the European Parliament and of the Council with regulatory technical standards on the criteria for the appointment of central contact points for electronic money issuers and payment service providers and with rules on their functions (Text with EEA relevance):   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L\_.2018.203.01.0002.01.ENG&toc=OJ:L:2018:203:TOC.68*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.203.01.0002.01.ENG&toc=OJ:L:2018:203:TOC.68) COM(2019) 360 final, Communication from the Commission to the European Parliament towards better implementation of the EU’s anti-money laundering and countering the financing of terrorism framework:   [*https://ec.europa.eu/info/files/communication-commission-european-parliament-towards-better-implementation-eus-anti-money-laundering-and-countering-financing-terrorism-framework\_en.69*](https://ec.europa.eu/info/files/communication-commission-european-parliament-towards-better-implementation-eus-anti-money-laundering-and-countering-financing-terrorism-framework_en.69) Report on the assessment of the risk of money laundering and terrorist financing affecting the internal market and relating to cross-border activities (COM(2019) 370 final and Annex of 24.7.2019); report on the interconnection of national centralised automated mechanisms (central registries or central electronic ***data*** retrieval systems) of the Member States on bank accounts (COM(2019) 372 final of 24.7.2019); report on the assessment of recent alleged money laundering cases involving EU credit institutions (COM(2019) 373 final of 24.7.2019); report assessing the framework for cooperation between Financial Intelligence Units (COM(2019) 371 final of 24.7.2019).39The reports show that there are major divergences in the application of the framework. Continued action is therefore needed to ensure legislation on anti-money laundering and countering the financing of terrorism is fully, consistently and effectively implemented, notably by key competent authorities such as supervisors and FIUs. The Commission will continue to monitor the implementation of the updated legal framework and of the recommendations in its supranational risk assessment.The report on the interconnection of national centralised bank registries concludes that the interconnection is technical feasible and that, given that a future EU-wide interconnection of the bank registries would speed up access to financial information and cross-border cooperation, the Commission intends to further consult with relevant stakeholders, governments, as well as FIUs, law enforcement authorities and asset recovery offices as potential end-users of a possible interconnection system. For an interconnection to be achieved a legislative proposal would be required.The reports also identify structural shortcomings that have not yet been addressed.Finally, the reports recommend that the Commission consider further harmonising the rulebook on anti-money laundering and countering the financing of terrorism. One option would be transforming the Anti-Money Laundering Directive into a Regulation, conferring specific anti-money laundering supervisory tasks to an EU body, and having a stronger mechanism to coordinate and support cross-border cooperation and analysis by FIUs.4.6.4 EU list on high-risk non-EU countriesUnder Directive (EU) 2015/849, the Commission is required to adopt a delegated act setting out the list of high-risk non-EU countries that have strategic deficiencies in their anti-money laundering/countering the financing of terrorism (AML/CFT) regimes.The Commission adopted a first Delegated Regulation on 14 July 2016 listing 11 jurisdictions in line with the assessment also made by the Financial Action Task Force (FATF) — the international standard setter in the field. The Commission successively amended this list in order to reflect the latest available information.Using its scrutiny powers, the European Parliament rejected some of those delegated acts that updated the EU list — requesting that the Commission make a more autonomous assessment that does not exclusively rely on FATF lists. The Commission confirmed on 29 June 2017 that it would work towards a more autonomous assessment methodology to identify jurisdictions that have strategic deficiencies in tackling ML/TF. This approach was confirmed by the legislator when adopting the fifth Anti-Money Laundering Directive (May 2018) which provides for a wider set of criteria for autonomous assessments.On 22 June 2018, the methodology for identifying high-risk non-EU countries was issued, supporting an objective, fair and transparent listing process70. The methodology70   [*https://ec.europa.eu/info/files/methodology-high-risk-third-countries\_en40provides*](https://ec.europa.eu/info/files/methodology-high-risk-third-countries_en40provides) that the Commission will consider any non-EU country identified by the FATF as having strategic deficiencies as high-risk. This baseline will also be complemented by an autonomous EU assessment based on the criteria set in the Anti-Money Laundering Directive.On 13 February 2019, the Commission adopted a new delegated act based on the new methodology71, listing 23 ‘high-risk third countries’ in the area of money laundering and terrorist financing.On 7 March 2019, the Council unanimously decided to reject this delegated act on procedural grounds as ‘not established in a transparent and resilient process that actively incentivises affected countries to take decisive action while also respecting their right to be heard’. On 14 March 2019, the European Parliament adopted a resolution commending the work done by the Commission, regretting the Council rejection and encouraging the Commission to come up with a new delegated act as soon as possible72.The Commission Services are now working on a refined methodology that strengthens the engagement with non-EU countries.In any case, the inclusion of a country on the list of high-risk non-EU countries does not trigger economic or diplomatic sanctions, but, rather, requires ‘obliged entities’ such as banks, casinos and real estate agencies to apply enhanced due diligence measures on transactions involving these countries, and to make sure that the EU financial system is equipped to prevent money laundering and terrorist financing risks coming from these non-EU countries.4.6.5 Application of the Regulation on information accompanying transfers of fundsOn 19 June 2019, the European Commission adopted its mandatory report on the implementation of Regulation (EU) 2015/8471 on information accompanying transfers of funds73, which imposes a set of obligations on payment service providers with regard to the information on payers and payees that has to accompany transfers of funds.The Commission found Member States' implementation of the sanctions part of the Regulation to be of an overall satisfactory quality. However, the report identified some shortcomings and underlined the need to eliminate all legal loopholes.71   [*https://ec.europa.eu/info/files/commission-delegated-regulation-c-2019-1326-supplementing-directive-eu-2015-849-european-parliament-and-council-identifying-high-risk-third-countries-strategic-deficiencies\_en72*](https://ec.europa.eu/info/files/commission-delegated-regulation-c-2019-1326-supplementing-directive-eu-2015-849-european-parliament-and-council-identifying-high-risk-third-countries-strategic-deficiencies_en72) P8\_TA(2019)0216:   [*https://www.europarl.europa.eu/doceo/document/B-8-2019-0176\_EN.html*](https://www.europarl.europa.eu/doceo/document/B-8-2019-0176_EN.html) 73 Regulation (EU) 2015/847 of the European Parliament and of the Council of 20 May 2015 on information accompanying transfers of funds and repealing Regulation (EC) No 1781/2006, OJ L 141, 5.6.2015, p. 1-18:   [*https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:282:FIN.41On*](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:282:FIN.41On) the application of the relevant provisions of the Regulation, no major deficiencies were identified. Modest sanctions and investigatory activities under the Regulation could be carried out if payment service providers comply with their legal obligations, but longer-term monitoring is needed to eliminate any potential weaknesses of the supervision framework.5 GLOBAL DEVELOPMENTS IN CAPITAL MOVEMENTS/PAYMENTS5.1 Free trade agreements and stand-alone investment agreementsFollowing the entry into force of the Lisbon Treaty, which gave the EU exclusive competence for FDI (Article 207 TFEU), the Commission engaged in an ambitious negotiation agenda that covers investment liberalisation and investment protection as well as investment dispute settlement in free trade agreements or stand-alone investment agreements.The investment protection provisions typically cover a number of standards of treatment to be afforded to investors of one party and their investments in the territory of another party. These include non-discrimination, fair and equitable treatment, prohibition of expropriation without compensation and free transfer of funds, and the possibility for dispute settlement between investors and states. However, some of these provisions have raised concerns in the past about how they might interfere with the right of states to regulate. Against this background, the Commission adopted a reform-based approach, which entails modern and innovative provisions to ensure a balance between investors’ rights and states’ right to regulate on legitimate public policy objectives. The Commission applies this approach in all its negotiations on investment protection provisions.In 2019, the negotiations intensified on the stand-alone investment agreement with China. Six rounds of negotiations took place in 2019, focusing mainly on commitments related to liberalisation and market access offers. In April 2019 at the 21st EU-China Summit, the two sides committed to achieve in the course of 2019 the decisive progress required — notably on the liberalisation commitments — for the conclusion of an ambitious EU-China Comprehensive Investment Agreement in 2020.The free trade agreement with Japan entered into force in February 2019. Discussions continue on investment protection and investment dispute settlement as part of a possible future investment protection agreement.The EU-Singapore free trade and investment protection agreements were signed in October 2018 and approved by the European Parliament in February 2019. The EU-Vietnam free trade and investment protection agreements were signed on 30 June 2019 and have been presented to the European Parliament for consent. Both investment protection agreements will also require ratification by the Member States in line with their respective internal procedures.The negotiations on a modernised trade part of the EU-Chile Association Agreement, which includes a chapter on investment liberalisation and protection, advanced in the42course of 2019 (three negotiating rounds took place in May, July and November 2019), and will continue in 2020.On 12 June 2019 a political agreement for an ambitious, balanced and comprehensive trade agreement with Mercosur was reached. The text is now subject to legal revision, and after translation into official EU languages will be submitted to Member States and the European Parliament for approval.The negotiations with Indonesia are ongoing. The latest round took place in Brussels in December 2019 and the next one should take place around March/April 2020 in Indonesia. With regard to the investment provisions being negotiated, both liberalisation and protection are covered.On 18 and 21 June 2018, the EU launched negotiations on free trade agreements with Australia and New Zealand respectively. Both negotiations cover investment liberalisation, including the free movement of capital and payments, but do not cover investment protection. In 2019, there have been three rounds of negotiations with New Zealand (February, May and December) and two with Australia (in March and October). The negotiations on the investment liberalisation chapter in the future free trade agreements (FTAs) with both countries are quite advanced and will continue in 2020.The negotiations of a Deep and Comprehensive Free Trade Area (DCFTA) with Tunisia cover investment liberalisation and investment protection. The latest negotiation round took place at the beginning of May 2019.5.2 Member State bilateral investment treaties with non-EU countriesAs a general rule, the agreements on investment protection negotiated at EU level with various non-EU countries replace the bilateral investment agreements concluded by Member States with the same countries. However, under Regulation (EU) No 1219/2012 establishing transitional arrangements for bilateral investment agreements between Member States and non-EU countries, the Commission can still authorise Member States to negotiate or conclude new bilateral investment agreements under certain conditions, namely there may be no EU level negotiation with the same country ongoing (or decided), and the agreement must be compatible with EU law and consistent with EU investment policy.The Commission takes its decision on the basis of a notification by the interested Member State after consulting the other Member States in a comitology procedure.5.3 Investment screeningThe EU has one of the world’s most open investment regimes, and collectively the Member States have the fewest restrictions on FDI in the world. This is expressly acknowledged in the OECD FDI Regulatory Restrictiveness Index, which measures statutory restrictions on foreign direct investment in 62 countries worldwide and how they have changed since 1997. However, in some cases foreign investors might seek to acquire strategic assets allowing them to access, for example, critical technologies, infrastructure or sensitive information, posing some risks to security or public order. In43response to such concerns, a number of Member States have introduced 'investment screening mechanisms', while at EU level the Regulation establishing a framework for screening of FDI into the EU was adopted, putting in place EU-wide cooperation on screening. While capital controls and capital flow management measures aim to prevent disorderly outflows from causing a financial and economic meltdown, investment screening mechanisms enable the public authorities to review and, if necessary, prevent inward investments on grounds of security or public order.5.3.1 Member States’ screening mechanismsAccording to the notifications by the Member States74, 15 of them have set up mechanisms to screen investment in order to safeguard public security or public policy interests (Denmark, Germany, Spain, France, Italy, Latvia, Lithuania, Hungary, the Netherlands, Austria, Poland, Portugal, Romania, Finland and the United Kingdom). Most of these mechanisms apply to both intra-EU/EEA and extra-EU/EEA investors, while others apply to extra-EU/EEA investors only. Some mechanisms identify sectors in which investments are subject to screening, while others are not limited to specific sectors or list sectors for illustrative purposes only. The screening mechanisms provide for thresholds (e.g acquisition of 25% of share capital/voting rights or control in a company) to identify the investments to be screened, which normally exclude portfolio investment. They can be triggered by voluntary or mandatory notifications and, under certain conditions, the public authority may initiate a review on its own initiative. Depending on this, the review may take place before the investment is completed (ex-ante) or after the completion of the investment (ex-post).In the reporting period, the following developments were observed in national investment screening frameworks:The Hungarian screening mechanism75 entered into force on 1 January 2019. The screening law introduces an obligation of prior notification and authorisation for acquisitions by non-EU/EEA investors of shareholding or control above certain thresholds in companies operating in the following sectors: manufacture of weapons and ammunition, dual-use goods, military activity, financial services, public utilities (electricity, natural gas and water), electronic communication, and information security of the state and municipalities.France amended its screening mechanism by Decree 2018-1057 of 29 November 2018 on foreign investments subject to prior approval76, which entered into force on 1 January 2019. The Decree expands the sectors covered by screening, enlarges the reasons for74 List of screening mechanisms notified by Member States, last update: 12 December 2019   [*https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc\_157946.pdf*](https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc_157946.pdf) 75 Act LVII of 2018 on controlling foreign investments violating Hungary’s security interests, unofficial translation available at:   [*https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc\_157938.pdf*](https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc_157938.pdf) 76 Available at:   [*https://www.legifrance.gouv.fr/eli/decret/2018/11/29/ECOT1816712D/OJ/texte.44refusing*](https://www.legifrance.gouv.fr/eli/decret/2018/11/29/ECOT1816712D/OJ/texte.44refusing) an authorisation to invest and expressly allows a target company to enquire in advance if the envisaged investment would be covered by the screening rules. In May 2019, France passed a law to support the growth and transformation of firms (known as the ‘loi PACTE’)77. The law introduces diverse measures to improve the business environment by further reducing barriers that limit the creation and growth of firms. Among other things, it revises the sanctioning regime of the screening mechanism and sets additional transparency requirements. The law also expands the golden shares regime in France (‘actions spécifiques’), essentially by making it possible for the state to issue golden shares independently from selling stakes, and extending the number of strategic companies for which the state can decide to introduce such shares.Italy has amended its investment screening framework by Decree Law No 22/2019 of 25 March 201978, which includes components and contracts related to 5G telecommunications in the scope of its screening mechanism.Following an infringement procedure for non-compliance with internal market freedoms, Croatia adopted on 20 February 201979 a new prior authorisation mechanism for the acquisition of shares in the energy company INA-Industrija nafte, d.d It allows the government to screen investments in the company above certain thresholds and to oppose the acquisition in case of ‘a serious threat to public safety and an exceptional risk of serious damage to public safety in a way that would jeopardise the secure, reliable and regular supply of energy and the protection of the safety of energy supply infrastructure’. The mechanism is accompanied by other measures that enable the government to monitor compliance with the stated objectives after the investment is made.Finally, Finland in March 2019 adopted a mechanism for mandatory prior approval of acquisitions of real estate by investors from non-EU/EEA countries. It has also adopted the law that provides the State with the pre-emptive right in real estate transactions in the immediate vicinity of strategic sites. Both laws entered into force on 1 January 202080.77 Loi No 2019-486 du 22 mai 2019 relative à la croissance et la transformation des entreprises, see Articles 152-154, available at:   [*https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=*](https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=) JORFTEXT000038496102&dateTexte=20190910.78 Decreto-Legge No 22/2019 of 25 March 2019, passed into law on 13 May 2019, available at:   [*https://www.gazzettaufficiale.it/atto/serie\_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2019-03-25&atto.codiceRedazionale=19G00032&elenco30giorni=true.79*](https://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2019-03-25&atto.codiceRedazionale=19G00032&elenco30giorni=true.79) Act amending the Act on privatisation of INA, published in the Croatian OJ on 1 March 2019:   [*https://narodne-novine.nn.hr/clanci/sluzbeni/2019\_03\_21\_437.html*](https://narodne-novine.nn.hr/clanci/sluzbeni/2019_03_21_437.html) 80 Law 470/2019, available at   [*https://www.finlex.fi/fi/laki/alkup/2019/20190470*](https://www.finlex.fi/fi/laki/alkup/2019/20190470), and Law 469/2019, available at:   [*https://www.finlex.fi/fi/laki/alkup/2019/20190469*](https://www.finlex.fi/fi/laki/alkup/2019/20190469). See also:   [*https://www.defmin.fi*](https://www.defmin.fi)/ en/topical/permission\_to\_non-eu\_and\_non-eea\_buyers\_to\_buy\_real\_estate.455.3.2 EU framework for screening of extra-EU investmentThe Regulation (EU) 2019/452 establishing a framework for screening of FDI into the EU was adopted on 19 March 2019. It was published in the Official Journal (OJ) on 21 March, and entered into force on 10 April 2019. It will be fully applicable as of 11 October 2020.The EU screening framework is designed to help all Member States and the Commission to identify and effectively mitigate possible risks that certain foreign investments may pose to security and public order, regardless of whether a Member State has a screening mechanism or not. The EU screening framework does not replace (or duplicate) screening mechanisms maintained currently by 15 EU Member States. It puts in place a cooperation mechanism, where Member States and the Commission would be able to exchange information on FDI likely to affect security or public order interests, and — when justified — to raise concerns (issue non-binding opinions) regarding such FDI. The Commission opinion will have a stronger impact, when projects or programmes of EU interest could be affected on security or public order grounds, as Member States will have to take utmost account of the Commission opinion, and justify if such opinion is not followed.The Regulation provides a non-exhaustive list of factors that may be considered when screening FDI. Factors include the impact of investments on: (i) critical infrastructure, e.g energy, transport, health, defence and financial; (ii) critical technologies, such as dual-use, artificial intelligence, robotics and cybersecurity; (iii) security of supply of critical inputs; (iv) access to sensitive information; and (v) freedom and pluralism of media. Factors that are specific to an investor may also be considered, e.g whether they are controlled by a foreign government, whether they have been involved in activities affecting security or public order, or whether there is a serious risk that they engage in illegal or criminal activities.5.4 Free movement of capital and the OECDIn May 2019, the OECD Council approved the review of the OECD Code of Liberalisation of Capital Movements. This Code commits its adherent countries to progressively liberalise cross-border capital flows81. The main objective of the review was to strengthen the Code by ensuring that it remains relevant in an environment that has substantially changed over the past decades. The Commission participated actively in the review and has introduced additional coordination among Member States to ensure that their positions are consistent, in particular on matters that are covered by a common legal framework in the EU.The reviewed Code ensures that adherent members can take measures necessary to preserve financial stability (‘macroprudential measures’) while preserving liberalisation standards. It clarifies that widely used macroprudential measures are not considered81   [*https://www.oecd.org/daf/inv/investment-policy/codes.htm46restrictions*](https://www.oecd.org/daf/inv/investment-policy/codes.htm46restrictions) (currency-based Basel III-type liquidity ratios such as the liquidity coverage ratio and the net stable funding ratio). It also provides flexibility for untested measures, acknowledging that the macroprudential toolkit is evolving.Other important outcomes of the review include:• Improvement of the assessment process of measures taken by adhering countries: clearer criteria for the conformity assessment of measures, stronger role of the OECD Secretariat in monitoring country measures, clearer deadlines for notification and prompt declassification of reports on assessment of measures;• Closer cooperation of other international organisations: consulting other international organisations, in particular the IMF for its expertise on balance of payment issues, is now explicitly allowed. This is of particular importance to address any compatibility issue that could arise with the IMF Institutional View82;• More effective decision-making: a country being under review may not block the conclusion of the assessment of country-specific measures.5.5 Economic and financial sanctions for non-EU countriesThe possibility of applying restrictive economic and financial measures is one of the general exceptions to the free movement of capital and payments in relation to non-EU countries. Pursuant to Article 215 of the TFEU, restrictive economic and financial measures may be taken against non-EU countries, or individuals, groups or non-state entities. Such measures are based on decisions adopted in pursuit of the objectives and within the legal framework of the common foreign and security policy83.The restrictions applied by the EU usually take the form of freezing the assets (funds and economic resources) of a specific person, entity or body, and sectorial measures, such as the ban on providing financial assistance for military activities, but many other measures are possible. The EU sanctions map84 provides detailed information on the current restrictive measures 85.In 2019 three new sanctions regimes were put in place. Under Council Regulation (EU) 2019/796 the Council can freeze the funds and economic resources of natural or legal persons, entities and bodies who are responsible for cyber-attacks and of those providing82 The IMF’s Institutional View on capital flows provides a macroeconomic framework for consistent policy advice on liberalising and managing capital flows, with the goal of helping countries harness the benefits of capital flows while managing the risks:   [*https://www.imf.org/external/np/*](https://www.imf.org/external/np/) g20/pdf/2018/073018.pdf 83 See Article 29 TEU on the approval of such a decision.84   [*www.sanctionsmap.eu85*](http://www.sanctionsmap.eu85) The EU Sanctions Map is an information tool. Note that the EU Official Journal is the official source of EU law and, in case of conflict, its content prevails over that of the EU Sanctions Map.47support to them. Two new geographic sanctions regimes concern Nicaragua86 and Turkey’s unauthorised drilling activities in the Eastern Mediterranean87. For the time being no persons, entities or bodies have been listed under these regimes.During the reporting period, most existing EU sanctions regimes were renewed for further six-month periods, including the regimes established in view of Russia’s actions destabilising the situation in Ukraine and North Korea’s nuclear proliferation activities. One sanctions regime was repealed during the same period88.The most prominent of the EU’s existing sanction regimes during the reporting period were those relating to Russia’s actions in Ukraine89. In addition to targeted individual restrictive measures like asset freezes against certain individuals and entities linked to the undermining of the territorial integrity of Ukraine, economic sanctions were first introduced on 31 July 2014. They include restrictions targeting Russian interests in the financial, oil and defence sectors. The EU’s restrictive financial measures aim to cut off strategic state-owned Russian companies from EU financing sources, thus imposing an indirect financial cost on the Russian state in order to induce a change in behaviour. In March 2015, the European Council linked the lifting of EU sanctions to the implementation of the Minsk peace agreements. The sanctions have been rolled over by a Council decision every half year since their introduction. On 27 June 2019, the Council prolonged the economic measures until 31 January 2020.The most far reaching EU sanctions regime in terms of the complexity of the financial and capital restrictions imposed is the one against North Korea on account of its nuclear proliferation activities90. The regime prohibits the transfer or clearing of funds to and from North Korea, as well as any transactions with banks domiciled in North Korea or the opening of branches and subsidiaries of North Korean banks in the EU and of EU banks in North Korea. It also requires that Member States step up monitoring of the86 Council Decision (CFSP) 2019/1720 and Council Regulation (EU) 2019/1716 of 14 October 2019 concerning restrictive measures in view of the situation in Nicaragua.87 Council Decision (CFSP) 2019/1894 and Council Regulation (EU) 2019/1890 of 11 November 2019 concerning restrictive measures in view of Turkey’s unauthorised drilling activities in the Eastern Mediterranean.88 Council Regulation (EU) 2019/985 of 17 June 2019 repealing Regulation (EU) 2018/1001 concerning restrictive measures in view of the situation in the Republic of Maldives.89 Council Decision (CFSP) 2014/145 and Council Regulation (EU) 269/2014 of 17 March 2014 concerning restrictive measures in respect of actions undermining or threatening the territorial integrity, sovereignty and independence of Ukraine, and Council Decision (CFSP) 2014/119 and Council Regulation (EU) 208/2014 of 5 March 2014 concerning restrictive measures directed against certain persons, entities and bodies in view of the situation in Ukraine.90 Council Decision (CFSP) 2016/849 of 27 May 2016 concerning restrictive measures against the Democratic People's Republic of Korea and repealing Decision 2013/183/CFSP, and Council Regulation (EU) 2017/1509 of 30 August 2017 concerning restrictive measures against the Democratic People's Republic of Korea and repealing Regulation (EC) No 329/2007.48activities of their financial institutions relating to North Korean banks, as well as detailed reporting by EU banks on such activities.Independent from the EU sanctions regimes, unilateral restrictive measures adopted by non-EU countries with extraterritorial impacts on EU operators have disruptive effects on the free movement of capital and payments within the EU.The European Union does not recognise the extra-territorial application of laws adopted by third countries and considers such effects to be contrary to international law. In this context, the purpose of the European Union’s Blocking Statute (Council Regulation (EC) No 2271/96) is to protect EU operators from the extra-territorial application of third country laws by nullifying the effect in the EU of any foreign court ruling based on the foreign laws listed in its Annex, and by allowing EU operators to recover in court damages caused by the extra-territorial application of the specified foreign laws.6 CONCLUSIONSSupporting the free movement of capital and facilitating cross-border capital flows ensure that the EU attracts much needed investments to sustain its economy and labour market. It also ensures a safe and stable financial system with proper risk sharing — a system that channels funds to the businesses and individuals that need them the most and can make the best use of them.In 2018, capital flows decreased. This included foreign direct investment (FDI), which is seen as one of the most stable and beneficial forms of investment. A closer look at the flows reveals that FDI transiting through the EU (originating from outside the EU and going outside the EU) might be responsible for a large part of this decline. This suggests that ‘genuine’ investment that benefits and remains in the EU is mostly stable.However, in the current context of slowing economic growth and global trade tensions, there is a pressing need for more closely integrated capital markets in the EU. Significant progress has been made on the Capital Markets Union (CMU), but it is time to reflect on how to extend it further. To this end, the High-level Forum on capital markets is consulting with market participants, civil society and academics with a view to proposing targeted policy recommendations for future CMU actions.The EU has set ambitious political priorities for the coming years, including being the first climate-neutral continent, being fit for the digital age and supporting our small and medium-sized enterprises, which are the backbone of the European economy. Meeting these objectives will require massive investment. Public finances will not be enough, so channelling private investment and mobilising cross-border investments is crucial. The remaining barriers to the free movement of capital clearly need to be brought down, and with the bilateral investment treaties between Member States coming to an end, it is crucial that investors continue to feel confident that their investments are effectively protected.The EU remains open to investment from non-EU countries and continues to negotiate free trade and investment agreements with its international partners to attract capital49flows. The EU also works together with international organisations such as the OECD to encourage others to become more open to capital movements, and to ensure that the international framework for free movement of capital is consistently applied. However, far from being a naïve free trader, the EU strives to protect its strategic interests. For example, to ensure scrutiny over purchases by foreign companies that target Europe’s strategic assets, the EU adopted in 2019 a framework for screening investments that will help identify and effectively mitigate possible risks of certain foreign investments.The EU will build on this framework and the other 2018-2019 CMU-related policies outlined in this report, to ensure that the EU meets the challenges of climate change and adapting to the digital age, and that people and businesses in the EU continue to reap the benefits of safe, open and efficient European financial markets.

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[***Council of the European Union: COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS An EU-wide assessment of National Energy and Climate Plans Driving forward the green transition and promoting economic recovery through integrated energy and climate planning PDF document ST 10874 2020 INIT18-09-2020***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:60YG-W0J1-JDG9-Y1XD-00000-00&context=1516831)

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10874/20 RH/nsTREE.2B ENCouncil of theEuropean UnionBrussels, 18 September 2020(OR. en)10874/20ENER 295CLIMA 191COMPET 409RECH 316AGRI 277ENV 521COVER NOTEFrom: Secretary-General of the European Commission, signed by Ms MartineDEPREZ, Directordate of receipt: 17 September 2020To: Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Councilof the European UnionNo. Cion doc.: COM(2020) 564 finalSubject: COMMUNICATION FROM THE COMMISSION TO THE EUROPEANPARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC ANDSOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS AnEU-wide assessment of National Energy and Climate Plans Drivingforward the green transition and promoting economic recoverythrough integrated energy and climate planningDelegations will find attached document COM(2020) 564 final.Encl.: COM(2020) 564 finalEN ENEUROPEANCOMMISSIONBrussels, 17.9.2020COM(2020) 564 finalCOMMUNICATION FROM THE COMMISSION TO THE EUROPEANPARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIALCOMMITTEE AND THE COMMITTEE OF THE REGIONSAn EU-wide assessment of National Energy and Climate PlansDriving forward the green transition and promoting economic recovery throughintegrated energy and climate planning11. THE ROLE OF INTEGRATED NATIONAL ENERGY AND CLIMATE PLANS IN DELIVERING THE 2030 TARGETS AND CONTRIBUTING TO RECOVERY AND RESILIENCEThis Communication presents the EU-wide assessment of the 27 National Energy and Climate Plans (from here onwards NECPs or the plans) submitted by Member States in accordance with the EU’s Governance regulation1, across all the dimensions of the Energy Union and in the light of the European Green Deal2 and post-COVID 19 recovery context.This assessment comes at the end of an extensive process of preparation and coordination at national level and constant dialogue between the Member States, the Commission and the other EU institutions. Member States have engaged since 2018 to prepare their NECPs, to be submitted by 31 December 2019. In June 2019, the Commission examined the draft plans3 and provided individual feedback to the Member States4, which took into account most of the recommendations. All Member States have now presented their final plans5 containing an integrated vision of the energy and climate transition for the next ten years. This has been an unprecedented process, as the plans have been subject to extensive consultation with stakeholders, civil society and citizens to ensure ownership and wide public support6. The Council also discussed the preparation of the plans in various occasions.The 27 plans give an overview of how Member States are approaching the first phase of their transition towards climate neutrality and where they want to go in the period 2021–2030 across five areas: decarbonisation, energy efficiency, energy security, internal energy market, research and innovation and competitiveness. Member States’ long term decarbonisation strategies will complement the plans7.The assessment shows how the full implementation of the plans would lead Europe to overachieve the current 2030 greenhouse gas emissions reduction target, establishing a springboard for the greater ambition proposed by the Commission in the Communication “Stepping up Europe’s 2030 climate ambition: Investing in a climate-neutral future for the benefit of our people” it is adopting in parallel, on the basis of an accompanying impact assessment.As the impact assessment shows, the plans also provide a solid base to aim in a realistic and responsible way to a higher greenhouse gas emissions reduction target for 2030 if additional action is taken at all levels to provide further momentum and to fill outstanding gaps and if the opportunities for a green recovery are fully taken up.1 Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action2 COM(2019) 640 final.3 COM(2019) 285 final.4 Commission Recommendations of 18 June 2019 on the draft integrated National Energy and Climate Plan of each Member State covering the period 2021-2030, C/2019/4401 to C/2019/44285 Ireland has asked to consider its intention to update its plan and the level of ambition in the near future.6 Several Member States organised local, regional, sectoral workshops to discuss the content of their final NECP with stakeholders (social partners, civil society, educational institutions, local institutions and environmental NGOs).7 Article 15 of the Governance Regulation: to be submitted by Member States by 1 January 2020.2The assessment takes into account the context of the post-COVID-19 recovery. NECPs are both a policy tool and an investment agenda that provide business and investors a forward-looking framework. They constitute a strong basis for Member States to design their green recovery and resilience strategies and deliver on broader European Green Deal objectives from a clean and circular economy to a zero pollution ambition. This Communication highlights how funding under the EU’s Recovery and Resilience Package can be used to support the investments and reforms identified in the national plans8, in particular by investing in energy efficiency, renovating buildings, deploying renewable energies, sustainable mobility, modernising electricity grids and boosting innovation in crucial technology areas such as renewable hydrogen and batteries.This Communication is a first step in a process that will involve other stages. The Commission will publish an in-depth assessment of each individual NECP in October together with the State of the Energy Union report, including country-specific guidance on how Member States can make further progress in implementing the plans. This will provide valuable input for Member States to draw on in preparing their national recovery and resilience plans and drive the investment agenda for green deal related projects that deliver jobs at the same time as a positive climate and environmental impact. It will also inform the Commission’s assessment of the recovery and resilience plans. Lastly, Member States need to ensure their Just Transition Plans (to be submitted in the context of the Just Transition Fund) are consistent with the NECPs.Throughout this process, the Commission will continue its dialogue with Member States with a view to supporting the full implementation of the plans, prepare their update due in 2023 and ensure they remain the compass to guide the national progress towards reaching ambitious energy and climate targets in 2030 and beyond. Coordination with Member States will also include the external aspects of the NECP’s and their implementation will be supported by energy and climate diplomacy.2. ASSESSMENT OF THE FINAL NECPS: WHAT HAVE THEY DELIVERED AND HOW CAN THEY SUPPORT RECOVERY AND RESILIENCE?2.1 Assessment of the renewable energy, energy efficiency and greenhouse gas reduction parts of the NECPs2.1.1 EU renewable energyThe assessment of NECPs shows that the share of renewable energy could reach, under existing and planned measures, a range of 33.1 to 33.7% in 2030 at Union level surpassing the target of at least 32% in 2030 and putting renewables at the forefront to achieve the objectives set out in the Communication on stepping up Europe’s 2030 climate ambition. 8 According to the IEA, a sustainable recovery plan could add 1.1 percentage points to global economic growth each year. The effect on employment would be significant, saving or creating roughly 9 million jobs a year over the next three years (IEA’s World Energy Outlook Special Report on Sustainable Recovery)3This would build on the back of continued relatively positive developments. The analysis of ***Eurostat*** figures for 2018 and projections at Member State level of the expected 2020 renewable energy share in final energy consumption show9 that the EU is projected to reach a renewables share of between 22.5% and 22.7% and that the vast majority of Member States are projected to meet their national binding targets. Early estimates suggest that renewable power generation capacity continued to grow by 6.2% in 2019, with a market growth of 33% compared to 2018. Furthermore, several analysts suggest that while negatively impacted by the COVID-19 crisis, the renewables industry and the associated investments are showing relatively strong resilience. The EU thus appears well on track to achieve the European target of 20% renewables share in final energy consumption by 2020. Nonetheless, several Member States, notably those which are projected to lag behind at this stage should consider additional measures, including in the form of cooperation mechanisms, to ensure that they achieve their 2020 national binding targets. The EU’s newly established renewable energy financing mechanism10 could in particular rapidly benefit larger scale offshore and innovative technologies. The flexible nature of the mechanism allows Member States to tap into the best potential for renewable energy generation across Europe and reduce the cost of support, helping Member States to achieve or even exceed their national target for 2020 and the EU’s 2030 target. The mechanism can also be combined with other EU instruments such as CEF or InvestEU to further streamline funding for new renewable energy projects.Nearly all final NECPs have confirmed or in some cases increased their renewable energy ambition compared to the draft plans. However, the aggregate figures mask differences between Member State contributions. Several plans fail to include sectoral trajectories that are in line with the Renewable Directive requirements, remaining below cost-efficient national potentials. By contrast, a few Member States have set very ambitious sectoral targets for renewables. Austria and Sweden with the objective of 100% renewable electricity by 2030 and 2040, respectively.The analysis for the Communication on stepping up Europe’s 2030 climate ambition shows that higher shares of renewables are fundamental to achieve higher greenhouse gas emissions reduction targets. As set out in the impact assessment, reducing greenhouse gas emissions by at least 55% would require a share of renewable energy in the EU of 38-40% by 2030. NECPs provide a vast number of matured projects of renewables that can also contribute to the economic recovery. Examples include the creation of 100.000 rooftops solar panel and small-scale storage programme in Austria; financial support to prosumers for installation of small-scale power plants in Lithuania, with an expected outcome of 696 MW of installed capacity as from 2024; investments to achieve 4 GW of offshore wind capacity in Denmark and 3.8 GW in Poland; the launch of six offshore wind tenders by 2023 aiming at 3.7 GW9 Uncertainty remains on 2020 energy demand impact by the pandemic and corresponding impacts on the society and the economy. Therefore, two distinct demand trends (low and high) are shown that appear likely as lower and upper boundaries.10 Renewable Energy Financing Mechanism C(2020)6123, operational as of January 20214capacity in France; and building solar farms and hydrogen infrastructure on former lignite mining sites in Greece and Portugal.NECPs and renewables: challenges and opportunities for the recovery and the European Green DealNECPs provide a clear signal from Member States that they back the rapid and cost-effective transition to a resilient carbon neutral economy, strongly based on renewables, which will help the private sector invest confidently. For example, at least 10 Member States have indicated their intention to phase out coal production of electricity in the coming years and the replacement of the decommissioned capacity mainly by renewable technologies. Clean mobility is also an example where a high number of Member States have set ambitious targets, in particular for electro mobility11 and advanced biofuels12. However, NECPs fall short of identifying the potential of offshore renewables that is available to them, and the related challenges. The Commission will help address this in a strategic manner in its upcoming Strategy for Offshore Renewable Energy by identifying key actions in the area of maritime planning, upscaling technologies, and a new approach to infrastructure planning.Frontloading investments in these solutions respecting the “do no harm” principle would align government spending and the financial stimulus for recovery and resilience with the increased ambition to reduce emissions by at least 55% by 2030 the EU’s ambition to transition to climate neutrality by 2050. Additional investments in renewables can also have a quick and positive impact on the recovery of the economy (as well as reduce energy bills and improve air quality in the case of non-combustible renewable). Each €1 million shifted from brown to green energy would create a net increase of five jobs13.Frontloading investments would also accelerate demand and competition, making Europe’s manufacturing base stronger along its value chain while showing worldwide industrial leadership and deliver better jobs. Investments in renewables create jobs. In the EU almost 1.5 million people were employed in the renewables sector in 2018, including the indirect jobs in the value chain. The solar photovoltaic sector is the most intensive job creator with 12 jobs for each million euro of investment. In contrast, the wind industry creates 3 jobs for each million euro of investment, but because of the expected growth over the period from 2020 to 2030 it will become the largest job creator in the renewables sector in the EU. At the EU level, IRENA estimated 2.7 million jobs in renewables by 2050, 1.7 in energy efficiency and 0.8 in system flexibility14.11 In its NECP, Germany has set a target of 7-10 million electric vehicles by 2030 and up to 1 million public accessible recharging points by 2030. Greece includes a target of 30 % of electric passenger cars by 2030 and Italy of 6 million electric vehicle by 2030.12 Estonia estimates a ten-fold increase of biomethane by 2030; Finland of advanced biofuels to 30% by 2030.13 Modelling estimates suggest that while €1 million spending in fossil fuels would create 2.7 full-time equivalent jobs, that same spending would create 7.5 FTE jobs in renewable energy or 7.7 FTE jobs in energy efficiency; Garrett-Peltier (2017), [*https://www.sciencedirect.com/science/article/pii/S026499931630709X?via%3Dihub14*](https://www.sciencedirect.com/science/article/pii/S026499931630709X?via%3Dihub14) IRENA (International Renewable Energy Agency) Global Renewables Outlook: Energy transformation 2050.5Similarly, IEA estimates that solar photovoltaic together with energy efficiency in buildings and industry create the most jobs per million euro of investment15.The European renewables industry is well positioned for global leadership. Its gross value added amounted to €80 billion in 2018 (growing at 6-8% annually). The EU is strong in developing the technologies necessary for renewables (e.g offshore renewables), including a rich ecosystem of SMEs. Renewables may also provide replacement employment in eligible Just Transition regions and generally in a decentralised manner also opportunities for remote areas and islands. Thanks to huge cost reductions, the cost-competitiveness gap of renewables is closing rapidly in the EU and mature renewables are now cost competitive and bring down energy prices for European consumers16.Member States are invited to fast track and make better use of the following measures, which are generally not included or sufficiently detailed in their NECPs17. Explore and maximise the use of waste heat/cold, ensure that citizens are entitled to become a renewable self-consumer (including in combination with storage systems), and be part of renewable energy communities, while promoting electrification based on renewables in transport that facilitate variable renewable energy generation projects. Furthermore, predictability on planned tenders including volumes and breakdown of new and repowered capacity for renewables, streamlining permitting (e.g single contact point), swift procedures for repowering and power purchase agreements have a positive impact on stimulating both large-scale and small-scale investments.Further grid rules and infrastructure adaptation will be necessary to cater for both increasing decentralised generation, large offshore renewable production and integration of hybrid projects combining renewables with storage, in particular renewable hydrogen. The potential for cross-border regional initiatives18 remains to be further tapped through better cooperation between Member States and use of EU funds, including funds under the temporary recovery instrument ‘Next Generation EU’, and building on regulatory advances19. This will further boost competitiveness and decarbonise demand side sectors such as buildings, industry, and transport, which traditionally relied on fossil fuels. The impact assessment accompanying the Communication on stepping up Europe’s 2030 climate ambition20 also shows that investments at local and national level are needed to create more physical links between energy carriers in an integrated energy system. For example, investments in modern, low-temperature district heating systems should be promoted (as they15 IEA (International Energy Agency), World Energy Outlook, Special Report Sustainable Recovery, June 2020; on average the three above mentioned measures create between 10-15 jobs for every million euros.16 The upcoming annual Prices and Cost report will provide further details17 The actions proposed in the Energy System Integration Strategy COM (2020) 299 final are complementary to the renewable energy regulatory framework18 Grouping of a number of Member States like south east Europe, Baltic, central Europe etc.19 Good examples of the regional cooperation are the North Seas Initiative and Baltic Sea Region that could be replicated to other regions across Europe.20 Communication on Stepping Europe’s 2030 Climate Ambition COM(2020) 5626can connect local demand with renewable and waste energy sources), as well as the wider electric and gas grid in order to optimise supply and demand across energy carriers.2.1.2 Energy efficiencyThe assessment of the final plans shows that the energy efficiency aggregated ambition would amount to a reduction of 29.7% for primary energy consumption and 29.4% for final energy consumption21, reaching 1176 Mtoe and 885 Mtoe respectively in 2030. This means that the ***collective*** ambition for 2030 has been increased compared to the conservative scenario from the draft plans22, thanks to several Member States increasing their planned efforts and clarifying points. However, there remains a gap compared to the Union’s 2030 target of at least 32.5%, which still stands at 2.8 percentage points for primary energy consumption and at 3.1 percentage points for final energy consumption.The COVID-19 crisis currently impacts on energy consumption, which might unexpectedly bring the EU very close to reaching the 2020 energy efficiency targets. However, this is not the result of structural changes nor adaptations and will not be long-lasting. Recovery from the COVID-19 crisis will lead to a rebound in energy consumption, which means that additional energy efficiency efforts and investments are needed to make energy efficiency gains structural23.The Energy Union has recognised a prominent role of energy efficiency and enshrined the guiding “Energy Efficiency First” principle into legislation24. Still, most final NECPs only set out limited details on the application of this principle despite the fact that energy efficiency plays a key role for the achievement of all targets, and notably the reduction of greenhouse gas emissions. Final plans include more details on electrification which is in line with the energy efficiency first principle. Co-benefits and possible trade-offs between energy efficiency measures and climate adaptation remain unrecognised and untapped.25 Member States need to consider cost-effective, technically, economically and environmentally sound energy efficiency measures as part of and as alternatives in planning, policy and investment decisions, and prior to making any future investment decisions on energy infrastructure.The Commission is preparing a dedicated guidance for the implementation of the Energy Efficiency First Principle for energy related policy planning and investment decisions across the economy. The Commission is already working towards implementing this principle in all its relevant energy policy proposals, such as the EU Strategy for Energy System Integration and the upcoming TEN-E revision.21 Compared to the projections of the 2007 Reference Scenario for 200722 The draft plans’ aggregated ambition ranged from 26.3%-30.2% for primary energy consumption and 26.5%-30.7 % for final energy consumption.23 Recent ***data*** BNEF shows that power consumption levels in several Member States is already back to normal.24 Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action25 Co-benefits include better insulation protecting against heatwaves (if coupled with adequate ventilation, while poorly executed energy efficiency measures that do not take into account vulnerability to climate hazards (such as flooding, hail, strong winds) are at risk of being damaged or destroyed.7Considering that additional action is in particular necessary in the built environment, it is welcome that NECPs include various energy efficiency measures in the building sector. In general, there is broad coverage in all NECPs (and in the national long term renovation strategies submitted so far) of supportive measures to building renovation. Some interesting approaches increase the level of stringency of ‘prescriptive’ measures, such as binding building renovation targets (e.g dwellings rented out having to meet a minimum performance class, tightening public procurement rules for buildings and legal limits on fossil fuel use for heating purposes, including bans). Several Member States have good examples to follow, including: Bulgaria has set an ambitious target to renovate over 5% of public buildings per year; Latvia intends to renovate 2 000 multi-apartment and 3 000 single family buildings by 2030; Romania has put in place specific financing schemes with an energy efficiency investment fund financed by private, national and EU funds; Cyprus has also co-financed programmes until 2020 to finance the renovation of 2 100 residential buildings and 164 SMEs.As the objectives, targets and contributions of the plans appear insufficient for the ***collective*** achievement of the EU’s energy efficiency objective for 2030, in line with Article 31 of the Governance Regulation the Commission shall propose measures and exercise its powers at Union level to ensure the achievement of the Union’s energy efficiency targets26. To that end, the Commission plans to review and possibly revise the Energy Efficiency Directive27 and if needed specific targeted provisions of the Energy Performance of Buildings Directive. It will also promote relevant Green Deal initiatives, notably the Renovation Wave and the Strategy for Energy Sector Integration, which will be key to promote further energy efficiency to bridge the gap. These would complement other actions targeting public procurement, energy audits, heating and cooling and recovery of waste heat (including from industrial sites and ***data*** centres28) energy services, administrative capacities, and skills. The integration of circular economy (i.e materials efficiency) would bring additional benefits to achieve climate and environmental objectives.Furthermore, the Commission is also preparing its Ecodesign and Energy Labelling Working Plan to identify priorities for the years ahead in terms of possible new or revised Ecodesign and Energy Labelling regulations whilst continuing to work with Member States to facilitate full and effective implementation and compliance.It is important to emphasise that the impact assessment accompanying the Communication on stepping up Europe’s 2030 climate ambition shows that the increased ambition for greenhouse gas emissions reductions by 2030 would also require higher energy efficiency ambition regardless of the scenario chosen. Final and primary energy consumption would have to decrease to around 39-41% and 36-37%, respectively, to achieve at least 55%greenhouse gas26 Article 31(3) of Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action27 [*https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12552-Review-of-Directive-2012-27-EU-on-energy-efficiency28*](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12552-Review-of-Directive-2012-27-EU-on-energy-efficiency28) The importance of the Primary Energy Factor in the facilitation of energy efficient decision between different energy carriers should be fully recognised.8emissions reductions. Thus, the challenge to increase energy efficiency efforts goes beyond the ambition gap of the final NECPs and additional measures need to match the ambition required by the Communication on stepping up Europe’s 2030 climate ambition.NECPs and energy efficiency: challenges and opportunities for recovery and European Green Deal objectivesEnergy efficiency and, in particular, building renovation and affordable housing are priorities for action and for investments to support the recovery through local jobs.Member States should explore the potential of speeding up building renovation in providing recovery stimulus where it is most needed: the local economies and SMEs (who account for 90% of the construction sector). Lowering energy bills, alleviating energy poverty, and, in the long-run, improving public health and comfortable living, can make society more resilient to potential future crisis. Worldwide, jobs in the energy efficiency sector are expected to total around 21 million by 205029. In particular, investment in social and affordable housing is a beneficial countercyclical economic measure that generates economic return in terms of employment during low economic conjuncture.Member States need to draw up and submit national long-term renovation strategies, broken down to action at regional and local levels30. As of end-August 2020, only 12 Member States31 had submitted their long-term strategies32. The Commission calls on all Member States who have not yet submitted their strategy to do so as a matter of urgency.The elements in the NECPs and in the limited number of these strategies submitted so far are an important building block for the policy vision to be set out in the Renovation Wave Initiative which will provide a political impetus to address cross-cutting challenges in the building sector. The initiative will build on three fundamental blocks: a solid regulatory framework, adequate financing and a strong governance framework based on long-term planning and stakeholder engagement. It will propose forward legislative and non-legislative instruments and enabling tools, including an important financing element, to ensure action at EU, national and local or regional levels.2.1.3 Greenhouse gas emissionsThe NECPs provide key information on how Member States aim to achieve their national emissions reduction targets set in the Effort Sharing Regulation (ESR)33. Currently, these targets range from 0 to -40% in 2030 compared to 2005 to achieve EU-wide minimum reductions in sectors not covered by the EU Emission Trading System (ETS)34 of 30%29 Global Renewables Outlook: Energy transformation 205030 Art. 11 of Governance Regulation on multilevel dialogue that aims to improve realism & buy-in by the levels of government implementing the strategies and plans.31 (NL, DK, FI, SE, AT, CY, FR, ES, CZ, LU, DE, EE). In Belgium, the regions of Brussels and Flanders32 The Energy Performance of Buildings Directive (EPBD) requires Member States to notify national long-term renovation strategies (LTRS) to the Commission by 10 March 2020.33 Regulation (EU) 2018/84234 The non-ETS sectors include effort sharing sectors such as, land transport, heating of buildings, ***agriculture***, waste and small industrial installations, and the Land Use Land Use Change and Forestry sector.9compared to 200535. Compared to their current ESR targets, Luxembourg, Slovakia, Slovenia and Sweden have set more ambitious national targets in the sectors not covered by the EU ETS. Also many other Member States project that the implementation of their policies and measures planned in the NECPs reduces emissions beyond their ESR binding targets36.An aggregation of the projected emission impacts of the national measures currently planned in the NECPs shows that by 2030 the EU would reduce emissions by 32% in sectors not covered by the ETS (excluding the land use, land use change and forestry (LULUCF) sector). This represents a progress of around 4 percentage points compared to the draft NECPs and is already a welcome first step towards achieving the increased ambition levels of the 2030 Communication on stepping up Europe’s 2030 climate ambition37.The assessment of the NECPs shows that for the economy-wide greenhouse gas emissions reductions, including those covered by the EU ETS, emissions reduce under existing and planned measures by 41% below 1990 levels, surpassing the EU 40% reduction target38. This is an improvement of about 1.5 percentage points compared to the draft EU NECPs. To achieve these emissions reductions, the NECPs lay out a mix of sectoral and cross-sectoral measures. Several Member States intend to make increased use of carbon pricing. For example, Germany has adopted a national emissions trading law which is gradually introduced. It covers fossil fuel CO2 emissions so far not included in the EU ETS, notably those of the transport and building sectors. Luxembourg plans to bring in a gradually increasing minimum carbon tax for all fossil fuels, which will be constantly adapted to the objectives of the Paris Agreement. Ireland envisages a strong carbon tax trajectory and increased its carbon tax by 30% in 2020, with all revenues ring-fenced to support climate action and protect the most vulnerable people in the country. Other Member States such as Belgium study the design of a carbon pricing mechanism for buildings and transport.In addition, all Member States can use credits from the LULUCF sector to help achieve their ESR targets. LULUCF is the only sector which is a net carbon sink, that is, which can sequester carbon from the atmosphere and store it in soils, biomass and harvested wood products. Member States can generate LULUCF credits if they report a larger carbon sink than the one which would have occurred if past management practices continued. If, on the contrary, the carbon sink is smaller than the business-as-usual counterfactual, then the corresponding emissions are considered debits and this sector creates net emissions; these would need to be compensated by using allocations from the effort sharing sectors39. Most Member States plan to ensure that their carbon sink will be large enough to avoid generating35 There is significant flexibility on how to achieve the national ESR targets, e.g transfers between Member States, limited use of EU ETS allowances for some Member States, or using a certain amount of additional emission removals in the land use and forestry sector.36 Croatia, Estonia, France, Greece, Hungary, Italy, Latvia, Lithuania, Portugal and Spain. In addition, while not providing emission projections reflecting their plans, Denmark and the Netherlands set national total greenhouse gas reduction targets in law which imply the need to meet if not surpass their non-ETS targets domestically.37 COM(2020) 56238 This is under the current 2030 target scope, including international aviation and excluding international navigation and the LULUCF sink.39 Regulation (EU) 2018/84110any debits, but very few of them give any indication in their NECPs of the extent to which they plan to generate and use LULUCF credits for ESR compliance. Several Member States indicate that their carbon sinks are decreasing due to ageing of forests, harvesting and increasing natural disturbances. Aggregating the projection information included in the NECPs reveals that around a third of the 2005 EU carbon sink could be lost by 2030. The LULUCF sector may even become a net emitter after 2030.Member States were required to list climate adaptation goals in their NECPs, where available and as applicable to achieve the Energy Union objectives. Although national adaptation strategies are available in all Member States and the changes in climate are affecting the entire EU, around a quarter of Member States have not listed such goals, and some limit themselves to describing the framework for adaptation policy making, without quoting the goals themselves40.NECPs and greenhouse gas emissions reductions: challenges and opportunities for recovery and European Green Deal objectivesThe planned sectoral national policies are often strongly focused on a broad set of measures addressing transport. In emission terms, this is the largest non-ETS sector. As it is also an economically important sector, planned measures are relevant for reducing emissions and for the recovery and should mutually support each other. Measures planned in the NECPs help, for example, to boost demand for clean zero and low emission vehicles that reduce CO2 and pollutant emissions in line with ambitious EU standards and ensure a clear pathway towards zero-emission mobility, in line with the priorities for fleet renewal as part of the overall economic recovery and resilience planning. This will be supported by an increased roll-out of recharging and refuelling infrastructure for zero and low emission vehicles and investments for green transition in the transport industry value chain (e.g batteries, hydrogen fuel cells). 20 NECPs included detailed measures to increasing the use of bicycles. Also the investment in public transport and promoting its use, as often planned, will help recovery. The upcoming strategy for sustainable and smart mobility will outline a comprehensive set of measures towards the decarbonisation of the transport sector.A lot of the measures to reduce ***agricultural*** emissions or increase the LULUCF sink enable synergies and significant opportunities for recovery and resilience. The main focus of NECP measures is on reducing emissions by optimising fertiliser use (through support to organic farming and precision farming) and addressing emissions from the livestock sector (grazing management, animal breeding/feeding and management). Anaerobic digestion measures reduce emissions, recover ***nutrients*** and diversify farm income with the production of energy. Nature-based solutions and the protection of natural areas are also mentioned. Some Member States plan measures to increase the LULUCF sink, for instance by providing subsidies for converting organic soils from arable land to protected natural areas, or for afforestation in40 Good examples for integrating climate change adaptation aspects coherently into different NECP dimensions and/or providing some detail on adaptation measures are Croatia, Ireland, Italy, Slovenia and Spain.11agricultural land41. Member States refer to the Common ***Agricultural*** Policy (CAP) and its rural development programmes as the main tool for supporting measures to reduce ***agricultural*** emissions and enhance sustainable forest management, as well as afforestation and forest resilience. The NECPs will be an important starting point in the preparation of the national strategic plans, especially for describing how to achieve the climate objectives of the CAP. The actions described in the NECPs are also relevant in the context of the Biodiversity Strategy, ‘farm to fork strategy and the forthcoming forestry strategy.Another sector with significant opportunities for recovery and resilience is industry. The regulatory and policy frameworks at EU level (e.g EU ETS, Innovation Fund, new industrial policy and the circular economy action plan) and at national level can help to accelerate and support modernisation and deep transformation of the energy-intensive industry ecosystem to climate-neutrality, including through the use of hydrogen and carbon capture utilisation and storage. Other important areas of work are to create lead markets for climate-neutral and circular products and to develop climate-neutral solutions and finance their uptake. In this context, it will be important to ensure that (national) subsidies do not unduly distort competition and trade among Member States.Measures promoting the circular economy with its potential for growth and jobs creation will also help further reduce waste emissions. The upcoming EU methane strategy will also support this. EU funding instruments available for renewable energy, energy efficiency and greenhouse gas reductions The costs for most renewables and the clean technologies needed to decarbonise energy-intensive industries are highly dependent on the cost of capital. The EU can play an important role in catalysing the development of private financing mechanisms that both attract capital and can be an effective means of reducing the cost of projects. Such mechanisms should also cater for small scale and technology specific needs so as to increase local participation and acceptance of the energy transition. This will be crucial for the deployment of renewables in the next decade at all levels. In this respect, early involvement of local authorities for continued public consultation and transparent planning is of utmost importance. Similarly boosting the Renovation Wave will require a huge amount of private capital. There is an array of instruments to help realise renewable, energy efficiency and other emissions reduction projects, which can, in certain instances, be complemented by private financing mechanisms. EU instruments available include the Connecting Europe Facility, Cohesion policy funds (including additional funding via REACT-EU), Just Transition Mechanism, InvestEU, Recovery and Resilience Facility, Innovation Fund, Modernisation Fund, Rural Development Fund, Horizon Europe, ELENA, Technical Support Instrument (TSI), and capacity building and market uptake measures under LIFE, Renewable energy EU Financing Mechanism, and the European Investment Bank.41 Belgium is considering shifting food production to the sea122.2 Promote investments and a just transition2.2.1 InvestmentsIn their NECPs, Member States presented an improved general overview of the expected investments needed to achieve the various objectives, targets and contributions. However, some of the plans lack details and do not allow to compare or add up the total investment needs for energy and climate objectives.Based on Commission calculations, to achieve the current EU 2030 climate and energy targets, annual investments related to energy production and use will need to increase in 2021-2030 by just over 1 percentage points of GDP on average, compared to the previous decade, that is, an increase of around €260 billion per year. For an increased greenhouse gas emissions reduction target of 55% this figure would increase to around €350 billion.Most Member States reported energy-related investment needs in the building, industrial, and transport sectors. Few reported expected investment needs in the ***agricultural*** sector, the third largest source of emissions in non-ETS sectors. While for some Member States, EU funds will make up significant portions of planned investments, the achievement of targets contained in the plans cannot be conditional on obtaining additional allocations from the EU budget.13Full implementation of the NECPs over the coming years will require to mobilise important amounts of new public and private investments. The response to COVID-19 provides the opportunity to spearhead some of the needed green investments and reforms through the national and EU recovery and resilience strategies, especially as these offer major job creation potential in areas such as energy and resource efficiency and renewable energies. Following the unprecedented drops during the COVID-19 crisis42, rising uncertainty about future oil demand due to changes in patterns of work, production and consumption highlights the risks of investments in stranded assets. In this regard, sustainable finance tools, such as the EU taxonomy will help to identify sustainable economic activities and guide capital flows to green investments43 44.In the field of energy and climate, the priority areas for reforms and investments include:- the renovation of the building stock and access to affordable housing;- decarbonisation of industry and renewable energy;- sustainable mobility;- energy system integration including infrastructure, batteries and renewable hydrogen.A wide variety of forms of support in the form of grants and financial instruments (loans, guarantees, equity) are available under the Multi-annual Financial Framework (MFF), the recovery and resilience package, including the Recovery and Resilience Facility, and from funds under specific legislative instruments such as the EU Emissions Trading System for prioritising these areas critical to the clean energy transition.The priority given to energy and climate investments is reflected in the Commission’s proposal for the 2021-2027 EU long-term budget. It sets a share of the Cohesion Fund and European Regional and Development Fund to be obligatorily earmarked on investments for a greener and low-carbon Europe. The final NECPs mark a milestone towards fulfilling the enabling conditions, i.e the conditions that have to be met by Member States in order to receive this funding.The NECPs put forward reforms and investment needs in these priority areas. Based on the plans, it is estimated that for building renovations alone, Member States identified the need to collectively invest around €130 billion per year. In social housing, it is estimated that €57 billion per year is needed45.42 Q1/2020 also saw a drop in coal and gas power generation (38 TWh and 3 TWh), the highest ever renewables share in the power mix in the EU (40% having risen by 38TWh), and reduced natural gas imports of €10 billion43 The development of the EU taxonomy for environmentally sustainable economic activities is one of the key actions of 2018 Action Plan for Financing Sustainable Growth. The sustainable finance toolbox will be further expanded through the upcoming Renewed Sustainable Finance Strategy to move the behaviour of financial actors, companies, and policy-makers further towards environmentally sustainable economic activities. This should prevent further investments into potentially expensive stranded assets that could block technology leaps and the needed innovation for reaching climate neutrality44 World Energy Investments 2020 – Analysis IEA [*https://www.iea.org/reports/world-energy-investment-202045*](https://www.iea.org/reports/world-energy-investment-202045) Report of the high-level task force on investing in social infrastructure in Europe 2018 [*https://ec.europa.eu/info/sites/info/files/economy-finance/dp074\_en.pdf14In*](https://ec.europa.eu/info/sites/info/files/economy-finance/dp074_en.pdf14In) view of the 2030 objectives and the envisaged energy system integration, the energy infrastructure (transmission and distribution networks, heating and cooling, transport, and energy storage) investment needs are estimated at the level of €59 billion per year46.By 2030, total investments needs in hydrogen electrolysers are estimated between €24-42 billion plus €220-340 billion to scale up and directly connect 80-120 GW of solar and wind energy production capacity. About €65 billion is needed for hydrogen transport, distribution and storage47.2.2.2 Just transitionThe NECPs also address the social and territorial implications that the clean energy transition can have. The transformation of extractive industries (hard coal, lignite, peat or oil shale) and carbon-intensive industries (cement, steel, aluminium, fertiliser or paper production) will pose a significant challenge to territories that are strongly reliant on such activities and will require to restructure and/or diversify the economy, maintain social cohesion, and, (re)train the affected workers and youth to prepare them for future jobs. Many NECPs include this transition in the coal sector and its social and economic impacts. The NECPs show that the transition has further accelerated due to global changes in prices of fossil fuels and falling costs of renewable energies. Europe is phasing out coal sooner than initially expected, which helps reduce greenhouse gas emissions and air pollution (the latter often being the main driver at local level for such a move, based on health and well-being concerns). This requires adequate measures to accompany regions and ensure no one is left behind.A total of 21 Member States are either already coal-free (Estonia, Latvia, Lithuania, Belgium, Malta, Luxembourg, Cyprus)48, or have committed to phasing-out coal (including lignite and peat), indicating specific dates in their NECPs (see above chart). Two Member States (Slovenia, Czechia) are still considering coal phase out while four (Poland, Romania, Bulgaria, Croatia) have not planned any phase out yet. In this context, the use of coal is projected to decrease by 70% by 2030 compared to 2015, and renewable electricity will represent 60% of electricity produced in the EU.A large majority of Member States still needs to develop clearer strategies and objectives through a cross-cutting approach to identify and measure the social, employment and skills consequences and other distributional impacts of the energy transition and give proper consideration on how to address these challenges.The Just Transition Mechanism, and the Just Transition Fund at its core, is specifically designed to address the social and economic impacts of the transition, focusing on the regions, industries and workers who will face the greatest challenges.46 In-depth analysis in support of the Commission Communication COM(2018) 77347 A hydrogen strategy for a climate-neutral Europe COM(2020)30148 Starting in 2020, the Coal Regions in Transition Initiative also addresses peat (FI, IE) and oil shale regions (EE). EE is still relying on oil shale.15The EU legislative proposal for the Just Transition Fund Regulation, requires that the plans for just transition (Territorial Just Transition Plans) be coherent with the objectives and investment needs identified in NECPs. The approval of Territorial Just Transition Plans by the Commission will unlock dedicated financing not only from the Just Transition Fund but also from the dedicated just transition scheme under InvestEU and the EIB public sector loan facility (the two other pillars of the Just Transition Mechanism).Overall, the NECPs did not provide a clear prioritisation of funding needs regarding just transition, nor investment needs for reskilling and upskilling and for support of labour market adjustments. A description of how the different sources of funding will complement each other are needed to promote a just and fair transition.Also related to a just transition, many NECPs address energy poverty. This is a major challenge, since close to 40 million Europeans were unable to afford keeping their home adequately warm in 2018. Most Member States have presented a detailed overview of energy poverty. Many also reported detailed indicators to analyse its impact on their territories. Several Member States use the primary indicators developed by the European Energy Poverty Observatory. NECPs also address affordability often, notably in the context of the energy and climate transition. This is the case, for instance, in Austria, Belgium, France, the Netherlands or Denmark.16Based on the information in their NECPs, most Member States are only preparing to take a more systematic approach to address energy poverty, despite the clear focus set out in the Clean Energy Package.To help Member States take more determined and targeted action against energy poverty, the Commission will adopt guidance on the definition and on indicators of energy poverty this autumn. This will facilitate sharing of good practices and build on the work of the EU Energy Poverty Observatory.NECPs and just/fair transition: challenges and opportunities for recovery and European Green Deal objectivesBased on the EU wide assessment summarised above, and in the context of the Just Transition Mechanism, it would appear that Member States need to work further to develop specific actions for a clean and fair energy transition in the most affected regions, including mobilising private investment, and synergies with other funding sources and mechanisms for regional cooperation. In that respect, pillar II (InvestEU scheme) and pillar III (EIB public loan facility) of the Just Transition Mechanism will offer new ways of financing the transition, in particular by leveraging public and private investments. Member States are encouraged to finalise their Territorial and Just Transition plans so they can become eligible to the different pillars of the Just Transition Mechanism.Coal regions in transition is an EU initiative to help address challenges and opportunities in those areas49. The Commission supports regional and local level involvement in ‘just transition’ related initiatives, which are a driving force for Coal Regions in Transition. The Commission assists regions in building cross-regional consortia, identifying transition-related projects and matching projects with funding opportunities, including under EU funding programmes50 51.All stakeholders need to continue cooperating and providing support to regions in a tailored manner, including through implementing the Just Transition Mechanism and Fund. The Commission will continue working with Member States and affected territories to ensure a just transition, leaving no affected region and their people behind. The Just Transition Platform (add reference to the website), launched in June 2020, will support authorities and stakeholders working on just transition, by providing tailored technical assistance, not least to develop and then implement the transition plans for both coal regions and carbon intensive regions.49 All coal, peat and oil shale regions (DE, PL, CZ, BG, RO, ES, EL, IE, HU, SK) are supported via EU funds (Cohesion policy, LIFE, H2020). Support also comes in the form of technical assistance (Structural Reform Support Programme, the EIB-Commission support through Jaspers, ENER’s START programme and contract with the World Bank).50 The Initiative is an open forum for stakeholder dialogue with national, regional and local authorities, wider society, industry, trade unions, NGOs, academia, experts in energy transition, and the European Commission.51 E.g joint work by Commission and Polish partners in Poland’s coal country team set up under the initiative led to €100 million of ERDF and Cohesion Funds being reprogrammed in Silesia to support local ‘just transition’ projects. This highlights the need to anticipate consequences of the transition and adapt policies and objectives in a concerted manner. Most Member States currently planning the phase out of coal or other solid fossil fuels (peat, oil shale) would benefit from providing more specific information on the way to proceed with the transition until 2030 and beyond.17The Commission will also continue promoting dialogue and cooperation with and among local authorities through the Covenant of Mayors (already covering 320 million EU citizens in over 10 000 municipalities), the Clean Energy for EU Island Initiative (56 islands in 25 Member States)52, and the establishment of a new Climate Pact. Public-private partnerships53 for social housing can complement public-sector measures to combat energy poverty at local level.2.3 Energy security, internal energy market, R&I and competitiveness2.3.1 Energy securityThe COVID-19 crisis has shown the importance of a resilient energy system with appropriate business continuity plans. It has tested the resilience of critical energy infrastructures and highlighted their vulnerability to shortages in the supply of strategic components and technologies, as well as the importance of preserving strategic supply chains. It has also highlighted the interlinkages between different sectors and the need to protect against cyberattacks since the energy system is increasingly digitalised and decentralised54. A number of NECPs also acknowledge energy efficiency and domestic renewables as key factors contributing to their energy security (Malta, Luxembourg, France, Lithuania and Portugal). Even though most Member States flag their energy sector as vulnerable to climate change in their national adaptation strategy or even in the decarbonisation chapter, only five Member States have proposed corresponding measures under the chapter on energy security.In terms of external energy security, the EU remains dependent on imports for half of its primary energy consumption, but has diversified its supply routes, notably for natural gas. Regional cooperation is crucial in this respect. In their NECPs, seven Member States (Bulgaria, Italy, Estonia, Germany, Poland, Croatia, and Ireland) are considering or planning further LNG capacities to ensure supply security or increase competition on the gas markets.Member States with nuclear energy as part of their energy mix, presented their nuclear plans in their NECPs. The Commission will continue to secure the application of the highest safety standards for nuclear technologies, supporting the regulatory processes and cooperation between concerned Member States. Concerned Member States should maintain adequate capacities in all the parts of the nuclear supply chain and ensure security of fuel supply to lead to safer facilities for people and the environment, and focus on building up skills and industrial strategic capabilities for decommissioning and nuclear waste reprocessing.52 26 islands receive support for the development of their Clean Energy Transition Agenda (6 'pilots' and 20 'pioneers'), 13 more islands have signed the Island pledge in 2019 towards full decarbonisation; 16 additional islands receive support on specific technical aspects for projects being prepared.53 Such as the Papillon project (city-NGO-industry) in Belgium54 The Commission Staff Working Document Energy Security: good practices to address pandemic risks, contains a list of risks and challenges in the short-term and long term, as well as a series of 20 good practices to address risks in the energy sector that are associated with a pandemic. [*https://ec.europa.eu/energy/topics/energy-security/energy-supply-and-pandemic\_en18NECPs*](https://ec.europa.eu/energy/topics/energy-security/energy-supply-and-pandemic_en18NECPs) and energy security: challenges and opportunities for recovery and European Green Deal objectivesOn energy security, the pandemic highlighted the need to focus more on the resilience of clean technology supply chains. Developing strategic supply chains of industrial capabilities in clean technologies55 should be a focus of recovery and resilience plans56. Member States need to identify policies and measures from NECPs to improve preparedness and enhance resilience in this respect. This also requires cross-border cooperation and EU action, including beyond EU’s borders supported by an assertive energy diplomacy.Member States need to ensure that their energy systems are capable of meeting the challenges posed by both extreme events (storms, droughts, floods, heatwaves) and slow-onset pressure (e.g water scarcity, sea-level rise, permafrost thawing), not only within the EU, but also outside its borders in terms of energy imports. The EU is providing funding (Horizon 2020 call and future Horizon Europe funding) to reduce reliance on commodity modules by developing next generation solar photovoltaic manufacturing through innovative technologies for modules that bring together the whole value chain. As part of the new Security Union Strategy57, which addresses both critical infrastructure and cybersecurity, the Commission proposed actions to tackle the specific risks faced by critical energy infrastructures in an integrated energy system and infrastructure. A Network Code on cybersecurity in electricity will be developed with sector-specific rules to increase the resilience and cybersecurity aspects of cross-border electricity flows. This includes rules on common minimum requirements, planning, monitoring, reporting and crisis management.2.3.2 Internal Energy MarketA fully integrated and well-functioning internal energy market provides price signals to guide investment in green energy and technologies, secures energy supplies and enables the least-cost path to climate neutrality through smart technologies. The NECPs assessment highlights several shortcomings in the energy market (flexibility through smart grids, storage and limited demand-side response). These have a negative impact on costs for consumers and industry, hamper a successful recovery, and the transition towards climate neutrality.In this context, the NECPs are a tool to help ensure that the objectives the electricity and gas internal market legislation are achieved, and the right policy and financial framework is in place to meet the challenge of climate neutrality at least cost while safeguarding energy security. The NECPs also provide an opportunity to strengthen the role of consumers as active participants and beneficiaries of the green transition.Though most Member States recognise the importance of the new electricity market design, only some have a holistic approach to necessary changes in forward-looking objectives. In an55 Including photovoltaic, batteries, renewable hydrogen, wind and ocean energy, grid and electronic components56 Complementing the EU’s Action Plan on Critical Raw Materials, and upcoming European Raw Materials Alliance including energy. 57 EU Security Union Strategy COM(2020)605 final19integrated and cost-reflective energy system, efficient markets should provide transparent price signals for consumers to both contribute to and benefit from the transition. Many plans also lack key information on competition and market liquidity.A considerable number of NECPs refer to smart meter deployment with a specific and measurable target as enabling consumers to actively participate in the market. However, few set specific objectives and clear timelines, making it difficult to monitor progress towards the targets.Fossil fuel subsidies remain a major impediment to a cost-efficient energy and climate transition and to a functioning internal market. The final plans show a slight improvement in the reporting of energy and fossil fuel subsidy amounts and measures to phase them out. Providing the necessary details overall would be important for an assessment of the extent to which fossil fuel subsidies in place are hampering climate objectives58. Only three countries (Italy, Denmark, and Portugal) have performed a comprehensive stocktake of fossil fuel subsidies and few Member States intend to phase them out or have formulated specific policies.Electricity interconnections together with local grids are a key enabler for decarbonisation, market integration, security of supply and competition. Most Member States have included interconnectivity targets or projections of interconnectivity level by 2030 in their final plans. On electricity, most Member States have already achieved and even far exceeded the EU interconnectivity target of 15% as set for 2030. The role of Projects of Common Interest (PCIs) in meeting this target is key59. The Commission will continue to assist the remaining Member States in increasing their interconnection capacity and ensure that existing interconnection capacity is fully used to maximise the benefits of the internal energy market in line with EU law60. Member States have indicated the investment needs relating to the internal energy market in their NECPs. On interconnections, Germany indicated that it needs €55 billion to upgrade its existing electricity transmission system and to build new onshore transmission infrastructure by 2030. A further €21 billion is needed for offshore electricity transmission infrastructure to allow for the installation of 17-20 GW offshore wind by 2030. Spain also planned to strengthen and expand transmission and distribution lines, including between islands, and interconnections with neighbouring countries, in particular France. On investments related to energy system integration and flexibility, Estonia indicated 500MW of pumped hydro storage by 2028, and Greece plans to implement ‘smart’ policies for islands58 Although Member States have addressed the recommendation describe and list energy subsidies in their NECPs, the quality of the information ranges from general descriptions to comprehensive and quantified lists of subsidies. 19 Member States have included information on fossil fuel subsidies. 12 Member States have indicated (the intention to) work on setting plans to phase out fossil fuel subsidies. Only six Member States have included a timeline to phase out some of the existing fossil fuel subsidies.59 Since the Energy Infrastructure Regulation (TEN-E) came into force in 2013, nearly 40 gas and electricity PCIs have been implemented and some further 79 Projects of Common Interest (PCIs) are expected by 2022. To this end, an amount equal to EUR 3.8 billion has been invested from the Connecting Europe Facility (CEF).60 Article 16.8 of the Regulation (EU) 2019/943 on the Internal Market for Electricity20that cannot be interconnected in a cost-effective way, for instance by setting up innovative hybrid renewable power generation with storage systems.NECPs and internal energy market: challenges and opportunities for recovery and European Green Deal objectivesThe focus on ensuring that markets remain liquid and competitive is key to delivering energy and climate goals as well as steering recovery investments to avoid distorted market signals. A more structured and coherent approach is needed to identify and promote sources of flexibility and address any barriers to market participation by new players and enable open and competitive markets for the transition. This should be fully reflected by Member States when implementing their NECPs.Though Member States follow different paths to sector integration, the recently adopted EU Strategy for Energy System Integration can constitute a reference point for Member States on more flexible energy systems and provide the next steps in adapting energy markets to climate neutrality needs.The Commission will also promote greater demand side flexibility through a Network Code61, revision of the State Aid guidelines, and consumer information.Member States need to fulfil their obligation to report on energy subsidies, in particular for fossil fuel subsidies, and measures to phase them out. In view of the international commitments to phase out fossil fuel subsidies in the G20 and the UN, as well as EU’s own policy commitments, the Commission will address this matter in the State of the Energy Union report 2020 and issue further guidelines to Member States to promote a shift away from fossil fuel subsidies. This will help Member States to address the incoherence between 2030 objectives and green recovery and resilience on the one hand, and the use of scarce financial resources to encourage fossil fuels consumption and prevent the needed technological shifts on the other. The Commission will pay particular attention to improving reporting on fossil fuel subsidies and progress towards phasing them, particularly as part of the integrated national energy and climate progress reports. In the context of the legislative reviews of the Energy Taxation Directive, as well as State Aid Guidelines, the Commission will consider the need to take further measures to ensure coherence among EU policies and address the EU Green Deal’s ambition to end fossil fuel subsidies.Concerning infrastructure, most plans identified as key actions the completion of PCI projects, strengthening of internal grids and the deployment of innovative technologies such as smart grids and new generation electricity grids62, including the revision of network codes for renewable energies. European grids must adapt to the changing energy system of more decentralised, digital real-time, and two way energy across sectors. To this aim the Commission will review the TEN-E and TEN-T Regulations and the Alternative Fuels61 To unlock the potential of electric vehicles, heat pumps and other electricity consumption to contribute to the flexibility of the energy system (starting end-2021).62 New generation electricity grids make efficient use of new communication technology (e.g digital platforms) to exploit the energy infrastructure in an innovative way (e.g flexible networks), by its users (generators, consumers and prosumers).21Infrastructure Directive, the scope and governance of the Ten Year Network Development Plans, and accelerate investment in smart, highly-efficient, renewables-based electricity, district heating and cooling, and in CO2 infrastructure.2.3.3 Research, innovation and competitivenessThere final NECPs fail to pay sufficient attention to R&I needs for delivering on climate and energy objectives. There is an overall decrease in national budgets devoted to R&I in clean energy technologies and a severe lack of national objectives and funding targets that show concrete and relevant pathways to 2030 and 2050. Most of the plans also outline only funding of existing non-energy specific programmes that run for fewer than five years.The cooperation between the Member States and the Commission through the Strategic Energy Technology Plan (SET-Plan) received full support in the vast majority of the NECPs as a basis for energy R&I planning and alignment. Some Member States specified areas of particular interest, but most did not specify how national funds and/or activities are allocated under the work packages (implementation plans) in which they are involved and how the SET Plan and their national energy and climate objectives are linked.Batteries will play an equally prominent role for the EU’s transport decarbonisation and power sector to keep system costs low (by providing emissions free balancing and flexibility and reducing grid expansion needs). Batteries are covered by NECPs in this respect for their necessary roles in stationary and mobility applications. NECPs cover partially the related needs for further R&I and the development of industrial manufacturing capabilities. The European Battery Alliance63, launched by the Commission three years ago, has helped to provide the necessary impetus among industrial stakeholders to invest in battery production in the EU. Member States, industry and other key stakeholders have responded massively and rapidly, including through Important Projects of Common European Interest (IPCEI). Over 500 actors are now part of the alliance that has attracted €100 billion of combined investments announced along the EU value chain. There are over 20 battery factories under development (at different maturity stages) with numerous projects across the whole value chain, including extraction and refining raw materials, battery materials, and recycling. The first resulting 11 EU factories that are being built should start producing by 2022-2023 and deliver 270GWh batteries per year by 2030. Industry estimates this results in value added of €250 billion annually from 2025 onwards, creating 4 to 5 million jobs, whilst overall transport electrification including road and rail in the EU could bring additional 600,000 jobs by 2030.Before the end of 2020, the Commission will adopt a new fit-for-future regulatory framework for batteries, which will aim to ensure that all batteries placed on the EU market (regardless of their origin) meet the highest standards regarding performance, durability, safety, responsible sourcing of raw materials and minimal environmental impact, including low carbon footprint63 To develop a strong, innovative, sustainable and competitive battery value chain in the EU, supporting transport electrification in response to the strong demand for electric vehicles, securing access to batteries strategic raw materials and increasing resilience and autonomy, capturing the skills and boosting manufacturing capacities.22over their life cycle. The new regulation should be complemented by high quality and timely standards to be developed by CEN/CENELEC.Some Member States give specific attention to long-term technologies such as carbon capture and use and storage (CCUS) which could contribute to decarbonise certain hard-to-abate sectors by 2030 and hydrogen, while incremental innovation in more near-term technologies such as energy efficiency, wind and solar receives less attention.The approach to competitiveness varies between NECPs. Some followed a narrow definition looking at patents and researchers, or even just at power prices. Other plans cover technology deployment aspects and thus take a broader competitiveness approach to national suppliers of clean technologies, including the value chains to develop such solutions. However, most plans lack quantitative indicators and are therefore not measurable.NECPs and R&I and competitiveness: challenges and opportunities for recovery and European Green Deal objectives A new strategic approach to clean energy R&I and competitiveness is needed to rebuild the European economy and accelerate the innovation and market uptake of new technologies and innovation for climate neutrality. Both EU and national R&I policies as well as funding and national industrial strategies need to be better aligned with energy and climate objectives and be made operational through NECPs. A range of funding instruments are available to help Member States do more in this area, such as Horizon Europe, the Innovation and Modernisation Funds and Invest EU. In September 2020, the Green Deal call will also support economic recovery by providing €1 billion of R&I funding (with €250-300 million for key energy priorities). The Innovation Fund launched a first call in July 2020, providing €1 billion to large-scale projects for clean and innovative technologies. A new call dedicated to small-scale projects (with a capital expenditure of less than €7.5 million) is being prepared and will be launched by the end of 2020.The Commission will revise the SET-Plan in 2021. This will support the EU’s green recovery and address the R&I needs of Member States, who also need to develop clear and ambitious national objectives and funding targets for R&I. The EU will also work with the private sector to increase their level of R&I spending and related deployment in clean energy technologies. Hydrogen strategy Most NECPs acknowledge64 the role of hydrogen in the energy transition. Half of the plans mention concrete hydrogen-related objectives for the domestic generation of renewable or low-carbon hydrogen, for end-use in industry and hard-to-electrify transport sectors (such as Luxembourg which aims to make steel more sustainable through renewable hydrogen use).64 France, Germany, Austria, The Netherlands for instance have concrete plans in their NECPs, while others such as Portugal are developing fast concrete strategies.23The Commission, Member States and industry will work together in the Clean Hydrogen Alliance on implementing the recently published EU Hydrogen Strategy. The goal is to develop an investment agenda with a pipeline of viable projects and further develop clean hydrogen supply chains and downstream technologies. Energy diplomacy and coordinated action beyond EU borders, particularly with the countries in the Neighbourhood, will be necessary for the successful implementation of the Hydrogen Strategy. Numerous projects are underway. Denmark and Germany building at Bornholm a 3-5 GW offshore wind energy production, including an electrolysis facility to fuel trucks, busses, ships and aircraft. Spain is planning since the submission of its NECPs the construction of a 100 MW PV plant, 20 MWh ion lithium battery storage system and hydrogen production system through electrolysis in Puertollano.Together with the State of the Energy Union Report, the Commission will present the first Competitiveness Progress Report in autumn 2020. This will analyse how competitive the clean technologies and solutions are and propose a common approach to assessing competitiveness and quantifying efforts. The underlying Clean Energy Transition - Technologies and Innovations Report will present a more detailed evidence-based analysis of the current and future status of clean technologies and solutions to help create a stronger link between R&I activities, clean technologies, and energy and climate objectives (at national and EU level).2.4 Regional cooperation and environmental aspects in the NECPs2.4.1 Increased cooperation between Member States and multi-level dialogueThe plans indicate that, though Member States understood well and described the need for regional cooperation, with some making use of existing regional fora in drawing up the plans, the full potential of regional cooperation has yet to be seized. Few Member States describe specific measures to optimise access to and use of regional facilities or how to plan better renewable energy deployment and energy efficiency measures in cooperation with other Member States.Building on the NECPs, Member States should make better practical use of regional cooperation. This should include using existing fora to address common issues affecting energy transition priorities, especially energy efficiency, transport, smart grids and renewables (such as planning, skills shortages for renewable energies, energy efficiency and buildings) thus enhancing the energy transition regionally. Examples of this happening already are the four existing groups: the Pentalateral and CESEC, the Northern Seas initiative, and the Baltic countries (for example Estonia and Latvia are planning a joint auction for offshore wind).24Regional planning of auctions, such as for offshore wind, would help build a steady pipeline of projects and underscore foresight and recovery contribution of this sector65.Member States should accelerate flagship projects with a regional dimension such as offshore wind and fast charging networks along TEN-T corridors. To do this they should use the recovery funds, CEF and regional aid funds, and the EU renewable energy financing mechanism, making full use of regional forums. Member states could also collaborate on the pilot testing of breakthrough energy efficiency or energy generation technologies, with a view to identifying the most efficient and cost-effective technologies and triggering their industrial production. The pooling of architectural heritage renovation projects could also trigger the large scale production of specific technologies such as solar shingles or photovoltaic glass, and render those a cost-effective option for the renovation of historic buildings.2.4.2 NECPs and environmental policiesAir pollution is a risk factor for certain illnesses, such as respiratory and cardiovascular diseases66. These are the diseases that put people at a higher risk from COVID-19.The Governance Regulation requires67 Member States to report on the impacts of industrial, ***agricultural***, transport and energy policies and measures on air pollution, linked to environmental legislation68. Despite some efforts made, there continues to be insufficient reporting of the projected impacts of the planned policies and measures on the emissions of air pollutants by Member States in their final plans. Only 13 Member States provided a sufficient level of detail and/or improved analysis of the air impacts compared to the draft plans. The final plans provide insufficient analysis of potential trade-offs between air and climate/energy objectives (mostly related to increasing amounts of bioenergy). It is welcome, though, that some Member States analysed impacts of planned measures on all air pollutants regulated under the National Emissions Reduction Commitment Directive69, with even sometimes a useful split by source sector, which helps define mitigating measures more efficiently.The assessment of the potential impacts of expanding bioenergy planned in several plans on carbon sinks, biodiversity, water, and air pollution is insufficient. They lack details on how to supply the required sustainable biomass, by feedstock and origin and trajectories for forest biomass, and how they are aligned with measures to maintain and increase the carbon sink.65 Slovenia has promoted regional cooperation in setting up smart grids and introduced innovative technologies in the wider region together with Croatia, using the Connecting Europe Facility.66 WHO estimates globally annual 7 million premature deaths due to air pollution and over 400,000 premature deaths in the EU according to the European Environmental Agency67 The Energy Union Governance Regulation stipulates that this obligation applies “where relevant”, which is the case in all sectors where air pollutants and GHG emissions originate from the same source (transport, energy, ***agriculture***, industry, domestic heating etc.).68 NEC Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants.69 EU 2016/228425NECPs and environmental policies: challenges and opportunities for recovery and European Green Deal objectivesAll Member States should strengthen the link between National Air Pollution Control Programmes (NAPCPs) and NECPs, also in terms of implementation at local level70. This will improve the process of identifying synergies and avoiding or mitigating trade-offs, while promoting synergetic measures (e.g clean transport, increased share of non-combustible renewables).In most NECPs, further work is needed to integrate and quantify greenhouse gas emissions reductions associated to circular economy policies, and assess the synergies and trade-offs of specific policies with biodiversity (e.g role of ecosystem services for mitigation and adaptation, but also risks in terms of biodiversity loss). The analysis of such interactions could be expanded to other environmental domains, such as water and soil pollution, resource-efficiency and the water-energy nexus in line with the “do no harm” principle espoused in the European Green Deal. When assessing the potential to develop bioenergy, Member States should also evaluate the efficiency of bioenergy compared to other sources of renewable energy, including in terms of land-use and carbon sinks, air quality and other environmental impacts. As set out in the Biodiversity Strategy, the EU will prioritise solutions such as ocean energy, offshore wind (that supports fish stock regeneration), solar-panel farms that provide biodiversity-friendly soil cover, and sustainable bioenergy.3. CONCLUSIONSThis assessment shows that the first implementation of the new integrated planning framework set out in the Governance Regulation has been very positive. All Member States have submitted final plans of good quality, albeit sometimes with some delay. The plans follow a comparable structure and cover integrated national objectives and policies for all the dimensions of the Energy Union. The plans were also the outcome of wide consultation and participation at national and subnational level, building a strong sense of ownership of the energy and climate transition objectives. This work represents a major effort by Member States and lays the foundation for stepping up the ambition to deliver climate neutrality in line with the European Green Deal, the proposed European Climate Law and the Communication on stepping up Europe’s 2030 climate ambition.The aggregate assessment at EU level has identified the following key takeaways and trends. The final plans are substantially more ambitious than the 2018 draft plans, on key dimensions such as greenhouse gas emissions reduction or renewables targets. This is in line with the Commission’s June 2019 recommendations on the draft plans.70 At municipality level, air quality drives behaviours towards energy transition and decarbonisation as the benefits are felt quickly. EU finances several bottom up initiatives covering circular economy and air pollution.26First, the assessment shows that Member States are accelerating their energy and climate transition driven by the EU wide objective of climate neutrality. Greenhouse gas emissions reductions surpass the current EU target of -40% by 2030 compared to 1990 levels. Under existing and planned measures they would decrease by 41% in the current EU target scope, excluding the LULUCF sink. The energy mix is projected to change even faster than expected by many only recently. The plans indicate that almost all Member States are phasing out from coal or have set a phase-out date. The use of coal is projected to decrease by 70% compared to 2015, with renewable electricity set to reach 60% of electricity produced by 2030.Second, the assessment shows that the share of renewable energy could reach under existing and planned measures a range of 33.1-33.7% by 2030 at Union level, going well beyond the current 2030 target of at least 32% share of renewable energy. Further investment and reforms in renewable energies identified in NECPs, have the potential to push this share further up.Third, with regard to energy efficiency, an ambition gap for 2030 remains. Albeit reduced compared to that of the draft plans, the gap still stands at 2.8 percentage points for primary energy consumption and 3.1 percentage points for final energy consumption, compared to the target to increase energy efficiency by at least 32.5% by 2030. While there is a growing attention to the issue, as shown by the final plans, and measures already planned at the European level, there are still significant efforts to be made to close the gap. In this context, the Commission will take action, in particular through the Renovation Wave initiative and the review and possible revision of the Energy Efficiency Directive, and guidance for the Energy Efficiency First Principle.Furthermore, plans dot not always detail with sufficient precision actions and measures in important dimensions such as identifying investment needs, mobilising funding, research and innovation and competitiveness, regional cooperation, land use land use change and forestry, just transition and energy poverty. Lastly, Member States need to step up efforts to phase out fossil fuel subsidies. Recommendations from the Commission in these respects where not fully taken into account.The shortcomings and remaining gaps emerging from this EU wide assessment will have to be addressed through a ***collective*** effort both by Member States and at EU-level. Member States will have to implement their NECPs, taking into account the new financing opportunities under the MFF and the Recovery and Resilience Facility. Investments should primarily be centred on renovating buildings, sustainable mobility, decarbonising industry and ***agriculture***, renewable energies, including renewable hydrogen, and associated technologies and solutions for energy system integration. Enhanced attention should also go to climate adaptation and carbon sinks. Mature projects should be frontloaded as much as possible. The Recovery and Resilience Facility should be used in conjunction with other existing funds, notably InvestEU to crowd in private financing and scale up public financing.In the context of the fifth report of the State of the Energy Union to be adopted in October, the Commission will publish staff working documents for each Member State containing individual assessments of each final NECP and of the way these addressed the related 2019 Commission recommendations. They will also provide some guidance for the implementation27of the plans, and on actions that will help exploit the full potential of the plans in the context of a green recovery.The Commission will assist Member States in implementing the plans through bilateral and regional engagement, the exchange of best practices, as well as through the different tools at its disposal, such as the Structural Reform Support Programme and its proposed successor the Technical Support Instrument, which offer tailor-made technical support to Member States to improve the capacity to design, develop and implement reforms, the InvestEU and the instruments proposed under Next Generation EU. Furthermore, the Commission will promote technical exchanges with Member States on the implementation of the NECPs, making the link with national recovery and resilience plans.Action at national level will be reinforced and complemented by further policy measures at EU level, to close the remaining gap and increase the ambition level, as set out in the parallel Communication on stepping up Europe’s 2030 climate ambition. The full implementation of the Clean Energy Package, including a rapid adoption of any outstanding measures, provides a solid foundation for this work.Finally, this first exercise shows that a well-designed governance framework matters for delivering a common effort at European level. Building on the existing framework centred around the NECPs, this will nonetheless require adaptations to evolving needs and policy priorities under the Green Deal and the recovery and resilience plans. In its review by mid-2021 of the energy and climate legislation to reflect the increased greenhouse gas emissions reduction ambition for 2030, the Commission will also review the Governance Regulation and ensure that it remains fit for purpose.The NECPs are not a one off exercise, but an iterative process. The annual reporting of greenhouse gas emissions inventories and projections, as well as the national bi-annual implementation reports, will be important tools for monitoring progress. Based on these elements Member States will update and revise their NECPs in 2023 (drafts) and 2024 (final)71. This will provide the opportunity to build on lessons learned from the first years of implementation and adapt plans to the changed climate and energy targets and economic circumstances, reflecting the agenda for green investment developed at national level in the context of the Recovery and Resilience Plans.71 For these updates, Member States should use, whenever available and as soon as they become available, European ***statistics***

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[***Who will win the electric vehicle race? The role of place-based assets and policy***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:6BNK-C111-DY41-73R9-00000-00&context=1516831)

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**ABSTRACT**

Regional economies are shaped by their economic histories and existing endowments. This paper explores the question: how do a region’s economic history and institutional endowments affect its success and trajectory in an emerging industry? Our case, electric vehicle development and production, is an industry which combines more traditional skilled manufacturing with knowledge-driven innovation activities. We present deep qualitative case studies of two regions, focusing on one firm in each. The case of Tesla in the San Francisco Bay Area examines an electric vehicle firm in a region with a strong tech innovation system, while the case of Maserati in Emilia-Romagna, Italy, examines a firm that builds on a regional history of automotive manufacturing. Across cases, we compare regional skill endowments, institutional coordination, and place-based policymaking. We conclude that, as an emerging industry under a new economic paradigm, electric vehicle manufacturing by Tesla and Maserati represents two different conceptions of the industry and consequently two different location strategies. Yet these two strategies remain rooted in regional contexts, owing both their success to successful exploitations of these, and their struggles to their failure to compensate for regional gaps. This presents a clear opportunity for place-based industrial strategy to evolve and intervene.

**FULL TEXT**

**Introduction**

Regional economies are shaped by their institutional endowments and economic histories, and this extends from the regional to the firm level in mutually reinforcing ways. A region’s economic success in a certain cluster depends on its ability to generate, attract, and host firms in a certain sector; likewise, a firm’s success in a region is influenced by the institutions that are present. A region’s economic history shapes the institutions that emerge as well as those that persist.

This is especially the case for regions and firms that rely on innovative activity for their economic success. An extensive literature on regional innovation connects firms’ success to regional institutional contexts. Although there is a rich and sometimes diverging set of theoretical explanations for why regional contexts matter to innovation, conclusions center the importance of knowledge sharing to innovation, and the importance of proximity and institutional facilitators to knowledge sharing (Baptista, 2000; Bell, 2005; Bell and Albu, 1999; Moulaert and Sekia, 2003). The advent of advanced manufacturing, including the incorporation of smart technology, has reinforced the role of regional contexts. Given the challenges of industrial reorganization, advanced manufacturing has disproportionately concentrated in a few regions (Andreoni, 2018; Birkel and Hartmann, 2019; Ciffolilli and Muscio, 2018; Tassey, 2014; Tiraboschi and Seghezzi, 2016).

The powerful influence of regional context creates particular challenges for designing place-based industrial policy at the regional level, the topic of this paper. Attempts to intervene at the regional level—defined based on boundaries of political and administrative control—in economic development policy are growing, and the notion of openly targeting sectors or technologies is coming back into political vogue in both the United States and Europe (Andreoni et al., 2019; Block, 2008; Chang and Andreoni, 2020; Di Tommaso, 2020; Di Tommaso and Schweitzer, 2013; Di Tommaso et al., 2019, 2020a, 2020b; Stiglitz et al., 2013). As increasing disparities among regions threaten political, social, and economic stability, countries see place-based policies as critical to lift up regional economies (Iammarino et al., 2019; Rodríguez-Pose, 2018). Yet it is unclear how effective place-based approaches will be for emerging industries.

Thus, we ask: How much, and in what ways, do a region’s institutional endowments and economic history affect its success in a new industry? How can place-based industrial policy intervene to support the growth of new and emerging industries? We approach these questions by examining electric vehicle (EV) development and production, an emerging industry that combines traditional skilled manufacturing with knowledge-driven innovation activities. Drawing on the methodological approach of studying regional economies through the study of prototypical firms, we compare two contrasting cases of firms focusing primarily on luxury EV production (Markusen, 1994). The case of Tesla Motors is a relatively new and highly innovative EV firm, founded and based in the San Francisco Bay Area, a region with a strong technology-oriented regional innovation system but little auto manufacturing. The case of Maserati, an established auto manufacturer based in the Northern Italy region of Emilia-Romagna, provides an example of a traditional auto firm expanding to EVs in a region with a deep history of auto manufacturing and mechanics, but relatively little innovation capacity in electronics and ITs. The regions differ in both economic history and policy context: Tesla emerged largely in the absence of formal industrial policy (excepting tax credits), while Maserati benefits from Emilia-Romagna’s institutional thickness, generated in part by industrial policy.

We use mixed methods to examine these questions. To describe regional economic competitiveness, we analyze ***data*** on firms, occupations, trade flows, and productivity (with variations across the two cases due to ***data*** availability). ***Data*** on EV manufacturers’ locations came from trade publications and firm websites. Description of the firms comes from archival research, including academic articles and popular press, and interviews. In the Bay Area, we conducted five semi-structured interviews with private and public sector informants familiar with Tesla, its home city of Fremont, and Silicon Valley. For the Emilia-Romagna case, we built upon literature and direct ***data*** from automotive companies, and conducted semi-structured interviews with public sector informants from Attractiveness Research Territory, the Emilia-Romagna Joint Stock Consortium.

We begin with a discussion of literature on evolutionary economic development, regional innovation systems, and the role of labor supply in industries’ location decisions. We present an overview of the global automobile industry and how its location patterns reflect this literature’s findings. Our two cases are presented individually, with a discussion of each region’s economic history and endowments, the firm’s history and strategic approach, and the firm’s interaction with their region. We conclude with comparative analysis of the two, focusing on how regional economic histories, the regional skill endowment, and institutional coordination have shaped these firms’ strategic approaches, successes and failures, and their implications for the development of place-based industrial policy.

**Path dependence and the automobile industry**

**Economic history, path dependence, and evolutionary economic development**

The concept of path dependence describes how certain events can lead to specific pathways of development through self-reinforcement (David, 1985), and can be applied to regional planning and economic geography (Amin and Thrift, 1995). For example, a region’s historical specialization in a certain industry may lead to public and private investments in infrastructure around that industry, and the development and persistence of political, economic, and social institutions appropriate to that industry and its workers (Hassink, 2005; Martin, 2009). These investments and institutions thus reinforce the region’s existing path.

A new development path might evolve out of an existing one; as an example, Boschma and Wenting (2007) find that a thriving bicycle industry in early 1900s Coventry, UK “laid the foundations” for an eventual concentration and success of the automotive industry in the region. But development paths can also disincentivize or prevent a region from reorienting its economic development along a different path, “locking in” particular approaches. Path dependence can thus be interpreted as a place-dependent process (Martin and Sunley, 2006).

**Regional innovation systems and regional embeddedness**

The economic benefits to firms of agglomeration have been recognized since Marshall’s observations of localization scale economies in the 1920s, in which he noted that firm co-location in the same industry generated shared positive externalities (Marshall, 1930; Van der Panne, 2004). Regional innovation literature argues that firms in highly innovative industries derive particular benefits from co-locating with other innovative firms and institutions (Cooke et al., 1998; Malmberg and Maskell, 1997). In addition to Marshallian externalities like shared labor pools and knowledge exchange, innovative firms benefit immensely from physical proximity at the regional level because it specifically facilitates the exchange of tacit or non-codifiable knowledge and information (versus explicit knowledge), which is increasingly essential to innovation in knowledge-intensive industries and is a source of competitive advantage in global markets (Asheim and Gertler, 2005; Becattini, 1991; Maskell and Malmberg, 1999; Storper, 1995).

Regional innovation systems literature theorizes that formal and informal institutions, including scientific, political, industrial, and intermediary organizations, make up a dynamic environment at the regional level which significantly influences the innovative success of firms and regions (Cooke et al., 1998; Dei Ottati, 1994; Lundvall, 1988). Regional innovation systems emphasize the embeddedness of these institutions—private finance, universities, laboratories, and vocational-training competencies that have close local ties are all identified as indicators of strong regional innovation systems. The importance of embeddedness also extends to firms themselves, which must integrate themselves within their regional innovative system in order to capture the locational advantages (Kramer and Revilla-Diez, 2012; Mattes, 2013). The extent of a firm’s integration into its regional innovation system has significant effects upon that firm’s innovative success.

**Labor and space**

With the ascendance of knowledge-based industries, there is increasing focus around the world on the need to train and retain a skilled workforce, even in manufacturing. This focus on human capital in information and communications technology (ICT) has altered the spatial division of labor described by Massey (1984), in which peripheral regions become production zones for industries that are controlled almost entirely from central regions. If human capital is now more important in production work, then location strategies of firms and corresponding regional development will evolve to reflect this, and the spatial division of labor will change.

**The automotive industry and its location patterns**

The automotive industry has roots in both Europe and the US, with significant inroads made by Japanese automakers into global markets in the 1970s (Holweg and Oliver, 2015). During the 1970s and 1980s, automobile manufacturers began consolidating and decentralizing operations, concentrating their research and development (R&D) activities in central locations, and moving manufacturing and production to peripheral regions with lower labor costs (Bordenave and Lung, 1996; Lechner and Dowling, 2003; Schoenberger, 1987). Foreign producers simultaneously opened production plants overseas to reduce transportation costs for the final product (Klier and McMillen, 2006).

In the US, the automobile industry has historically concentrated in the greater Detroit, Michigan region, aided by local agglomeration economies (Klepper, 2007). Headquarters and R&D have remained there, though production functions have been moved overseas or to peripheral regions of the US. Between the late 1970s and the mid-2000s, Michigan lost over a third of auto industry employment, while southern states’ auto industry employment tripled. Foreign-owned auto firms, particularly Japanese firms, also began opening assembly and production operations in the US South (Klier and McMillen, 2006).

In Europe, the auto industry has traditionally concentrated in certain regions of Germany, the UK, France, and Italy, often referred to as the “Blue Banana,” both for innovation and production. However, the European auto industry experienced a similar transformation at the end of the 20th century due to the saturation of local markets and resulting stagnation, and the emergence of new countries as both production sites and new markets (Berta and Ciravegna, 2006; Lung, 2000; Volpato and Zirpoli, 2011). Auto production consequently decreased in the Blue Banana as original equipment manufacturers shifted their production to Spain and Eastern Europe in search of cost advantages (Bordenave and Lung, 1996; Humphrey and Memedovic, 2003; Pavlínek, 2012). In Italy, traditional manufacturing regions such as Piedmont (Fiat) and the southern areas have generally seen declines. Emilia-Romagna, which specialized in luxury and sports cars and developed a local supplier pool, resisted this shift.

In the past two decades, these shifts have been complicated by the growth of new markets and the emergence of new producers in Asia, with China and India in particular joining Japan as new sources of supply and demand.

The decline of manufacturing in the US and parts of Europe has been the dominant narrative, as the economic paradigm has shifted from Fordist/mass production organization to one based on ICT and automation. However, this has been a decline in terms of employment, rather than in productivity. While the number of jobs in manufacturing has dropped in the U.S. and Western Europe, the productivity of the manufacturing sector has increased (Kowalski, 2014). The types of jobs and the skills demanded in manufacturing have changed to reflect this technological and organizational shift, with literature identifying and investigating “advanced manufacturing,” or manufacturing in which computer and automation technology, flexibility, and integration with services play a significant role (Muro et al., 2015; NSTC, 2012; Tassey, 2014). This evolution blurs the lines between some forms of manufacturing and other industries. For example, Schulze et al. (2015) argue that the technologies used in mobility industries and consumer electronics industries are increasingly convergent. Such changes in the skill content of production would then shift spatial divisions of labor that traditionally separated production functions from research and control functions (Massey, 1984).

Furthermore, it is increasingly theorized that the current economic paradigm, characterized by a shift from manufacturing to services and the increased prominence of ICT, is giving way to a new one. In the new paradigm, the development and implementation of networked technologies that learn, communicate, and self-monitor defines economic growth and organization, and manufacturing processes continue to shift in form. Although these definitions are not interchangeable, the literature, theory and policy on “Industry 4.0,” the industrial “Internet of Things,” and “smart factories” all pertain to new or anticipated changes in how, where, to what extent, and with what characteristics manufacturing will take place. However, in contrast to the proliferation of studies on the integration of innovation and production in industries like life sciences and nanotechnology, attempts to empirically study these changes to manufacturing and their implications for spatial, social, and economic policy are only just emerging (Ciffolilli and Muscio, 2018).

**Place-based industrial policy**

Interest in place-based industrial policy stems in part from the regional economic divergence of the early 21st century (Rodríguez-Pose, 2018). As an example, the European Union’s emphasis on “smart specialization” strategies in RIS3 incentivizes regions to specialize in industries in which they can, in theory, develop a unique and distinctive advantage that builds on their existing strengths and capabilities (Crespo et al., 2017). Smart specialization assumes that path dependence plays an important role and that regional context matters immensely to both firms’ outcomes and policy effectiveness (Barbieri et al., 2019; Boschma, 2015; McCann and Ortega-Argilés, 2015; Monga, 2013). Despite the lack of comparable industrial policy in the U.S., the EV industry has benefited extensively from federal and state tax credits incentivizing consumers to buy new vehicles. Though these are not explicitly place-based, they do have specific impacts on the places where EV production is concentrated.

Despite the interest in regional place-based policies, there remains a lack of research and theory that can inform how, why, and what interventions will succeed (Bailey et al., 2015; Barbieri et al., 2020; Barca et al., 2012; Di Tommaso et al., 2017, 2020a; Foray et al., 2011). This is particularly the case for emerging industries that reflect the continued transformation of the economy.

**The EV industry as a case**

The EV industry has emerged only recently, growing from 50,000 total plug-in light EVs sold globally in 2011 to 2 million sold in 2018 (IEA, 2019; US OEE: United States Office of Energy Efficiency and Renewable Energy, 2016). EV development and manufacturing have been undertaken both by new firms focusing primarily upon EVs, such as Tesla, and large automotive firms looking to pivot in the face of rising concerns about global climate change and growing market interest in electric options, such as Chevrolet, Fiat-Chrysler, or BMW.

Auto manufacturers providing EVs are headquartered in North America, Europe, and Asia. Location choices for these firms largely follow the patterns of the traditional auto manufacturing industry. As seen in Figures 1 to 3, R&D activities are located near firm headquarters or in central regions with significant endowments of skilled labor, and production facilities tend to be located in more peripheral areas, though firms make efforts to open production plants in different continental markets.

**Figure 1.**

EV manufacturers in North America. EV: electric vehicle.

**Figure 2.**

EV manufacturers in Europe. EV: electric vehicle.

**Figure 3.**

EV manufacturers in Asia. EV: electric vehicle.

**Figure 4.**

Map of Silicon Valley (R. Schten).

**Figure 5.**

Tesla locations with job postings, 2018. Source: ***Data*** scraped from [*www.tesla.com/careers*](http://www.tesla.com/careers) on 9 October 2018.

The following case studies examine two regions: the San Francisco Bay Area in the US, and Emilia-Romagna in Italy. Both regions host manufacturing activities for EV producers, but differ significantly in their institutional and skill endowments, and in the nature of their regional innovation systems.

**Tesla and the San Francisco Bay Area**

**The economic history of the San Francisco Bay Area**

The San Francisco Bay Area has long been a global leader in the development of innovative technology, particularly in high-tech sectors. From the 1970s to the early 2000s, most of the region’s high-tech innovation was concentrated in the two counties of “Silicon Valley” (San Mateo and Santa Clara), although activity has since spilled over into Alameda County and San Francisco County (Figure 4). The Bay Area is one of, if not the, most characteristic examples of a regional innovation system, with knowledge generating and knowledge exploiting institutions linked to one another and to national and global systems (Cooke, 2001).

Federal investments in defense in Santa Clara County during and following the Second World War helped spur the transformation of Silicon Valley from a predominately ***agricultural*** region to a hub for technology. Stanford University received extensive federal R&D funding for projects like ARPANET and for education and research in engineering and computer science. Local firms expanded significantly due to wartime and postwar defense contracts (Mazzucato, 2015; Saxenian, 1996). Capitalizing on local institutions like the Stanford Research Institute and the Stanford Industrial Park, an open culture of business development between university and private entities emerged (O’Mara, 2005).

By the early 1970s, two major shifts were reshaping the region’s economy: the shift to semiconductor manufacturing as the major industry in the Valley, and the shift from federal defense contracting to consumer electronics development and production (Collaborative Economics, 2001). Following increased international cost competition for manufacturing, Silicon Valley’s manufacturing sector diversified into other products like printers, business services, disc drives, PCs, and customized chips, reorganized into a flexible production system (Saxenian, 1996). The personal computer revolution then laid the groundwork for the IT and internet revolution of the 1990s, fueled by venture capital (Castells, 1997; Saxenian, 1996). Despite the dot-com bust in 2001, firms like Apple and Google matured into giant corporations, while a new generation of software development, artificial intelligence, and other startups emerged in the 2010s.

Location quotients for industry and occupations at the two-digit and three-digit NAICS code level (Tables 1 to 3) show a relative concentration of high-tech employment in the Bay Area, consisting here of the San Francisco–Oakland–Hayward and the San Jose–Santa Clara metropolitan statistical areas. While the region hosts a competitive concentration of high-tech occupations, it is weaker in concentration of production workers, with the exception of electrical, electronic, and electro-mechanical assemblers, suggesting that a shift to knowledge-based manufacturing is taking hold.

**Table 1.**

Bay area industrial location quotients 2018.

|  | **Bay area location quotient** |
| --- | --- |
| Technology and engineering industries |  |
| ***Data*** processing, hosting,   and related services | 3.90 |
| Other information services | 0.12 |
| Professional, scientific,   and technical services | 1.93 |
| Manufacturing industriesa |  |
| Fabricated metal products | 0.39 |
| Machinery | 0.48 |
| Computer and   electronic product | 1.59 |
| Electrical equipment,   appliances and components | 0.56 |

Source: Bureau of Labor ***Statistics*** QCEW and OES 2018. Comparison Region: United States.

aTransportation Equipment Manufacturing is a category at the three-digit NAICS level, but ***data*** for part of the Bay Area are suppressed.

**Table 2.**

Bay area occupational location quotients 2018, major occupational categories.

|  | **Bay area location quotient** |
| --- | --- |
| Computer and mathematical occupations | 2.68 |
| Architecture and engineering occupations | 1.71 |
| Production occupations | 0.68 |

Source: Bureau of Labor ***Statistics*** QCEW and OES 2018. Comparison Region: United States.

**Table 3.**

Bay area occupational location quotients 2018, detailed occupational categories.

|  | **Bay area location quotient** |
| --- | --- |
| Technology and engineering occupations |  |
| Computer and information research scientists | 5.06 |
| Computer systems analysts | 1.89 |
| Computer programmers | 1.82 |
| Software developers, systems software | 4.58 |
| Computer network architects | 2.04 |
| Computer network support specialists | 1.26 |
| Computer hardware engineers | 8.12 |
| Electrical engineers | 2.09 |
| Electronics engineers, except computer | 2.73 |
| Industrial engineers | 1.10 |
| Mechanical engineers | 1.06 |
| Production occupations |  |
| First-line supervisors of production and operating work | 0.55 |
| Electrical, electronic, and electromechanical assemblers | 2.11 |
| Structural metal fabricators and fitters | 0.39 |
| Fiberglass laminators and fabricators | 0.41 |
| Assemblers and fabricators, all other, including team assemblers | 0.89 |
| Computer-controlled machine tool operators, metal and plastic | 1.07 |
| Cutting, punching and press machine setters, operators, and tenders, metal and plastic | 0.41 |
| Machinists | 0.70 |
| Molding, coremaking, and casting machine setters, operators, and tenders | 0.25 |
| Tool and die makers | 0.21 |
| Welders, cutters, solderers, and brazers | 0.37 |
| Welding, soldering, and brazing machine setters, operators, and tenders | 0.54 |

Source: Bureau of Labor ***Statistics*** QCEW and OES 2018. Comparison Region: United States.

**Table 4.**

Skill requirements from Tesla job postings in manufacturing department, Fremont, CA.

| **Required or requested skills** | **Number** | **Percent** |
| --- | --- | --- |
| Formal education | 50 | 56.8 |
| Bachelor’s degree or higher | 32 | 36.4 |
| Specific programming/technical software skillsa | 41 | 46.6 |
| Robotics programming skills | 17 | 19.3 |

Source: ***Data*** scraped from [*www.tesla.com/careers*](http://www.tesla.com/careers) on 9 October 2018.

aThe majority of jobs requested MS Office skills; these were not included.

**Institutional coordination in the bay area**

The Silicon Valley model has diverged from high-tech regions in other parts of the US and other countries, which are organizing place-based industrial policies to support the emergence of entrepreneurial ecosystems anchored by local institutions. Despite Silicon Valley’s roots in government and university collaborations with the private sector, there are few formal initiatives to shape cross-fertilization between researchers and industry. Instead, a specialized business ecosystem, consisting of a plethora of firms—lawyers, accountants, management consultants, etc.—providing support services to entrepreneurs, has emerged organically and is heavily subsidized by local venture capital. For example, in the past three years, Silicon Valley firms received $139 billion in venture funding, 40–50% of the US total each year (PricewaterhouseCoopers, 2020).

Driving the success of the model in Silicon Valley is human capital, consisting of education and work experience as well as tacit knowledge (Gertler, 1995, 2003). Exchange of tacit knowledge in the Bay Area is facilitated by worker mobility and immigrant entrepreneurship (Saxenian, 1996, 2005). Over one-fourth of Bay Area residents are foreign-born, compared with 14% of U.S. residents (Johnson and Sanchez, 2019).

**Place-based (industrial) policy in the bay area**

Despite the region’s many assets for entrepreneurship, it faces challenges related to land use and infrastructure, especially housing shortages, transportation bottlenecks, rising income inequality, and unequal access to social services and education for residents. Though the State of California offers business support programs, including tax credits for equipment purchases and workforce retraining, these are generally not targeted by either industry or region. Absent an explicit industrial policy at the federal and state level, several regional organizations, including the Bay Area Council, and the Silicon Valley Leadership Group, dominate the regional economic development dialogue (Storper et al., 2015). Given the region’s livability crisis, these actors have largely shifted their focus to planning issues. Thus, to the extent that there is a place-based industrial policy in the region, it focuses on residential quality of life rather than creating and retaining jobs.

**Tesla**

Tesla was founded in Palo Alto in 2003 by four entrepreneurs and a software developer (Voigt et al., 2017). At the time, the other commercially available EVs were produced by established auto manufacturing firms who also produced conventional and hybrid vehicles. Tesla was awarded an early stage loan from the US Department of Energy in 2010 under the Advanced Technology Vehicles Manufacturing program, which the firm repaid nine years ahead of schedule (Tesla, Inc., 2013b; US DOE: United States Department of Energy Loan Programs Office, 2013). Tesla also benefited from a California state tax credit of $15 million in 2016 (Baker, 2016).

Although established as an EV production firm, Tesla’s strategy differs from other manufacturers of EVs, targeting the niche market of luxury sports cars. The firm envisioned first creating a demand for “high-performance electric vehicles,” then subsequently producing a mass market line (Hettich and Müller-Stewens, 2014). Tesla has consequently attempted to compete on technology and design rather than on price, and hasn’t pursued the economies of scale that make auto manufacturing profitable for traditional firms. Tesla invested significantly in R&D and in specific technologies, first through partnerships with existing firms and then in-house (Hettich and Müller-Stewens, 2014). Human capital is essential to this strategy, with intellectual property and talent constituting a significant part of the firm’s value (Voigt et al., 2017).

Tesla is arguably a prototypical example of the emerging economic paradigm, reflecting characteristics of “Industry 4.0” or the industrial IoT in its production and maintenance processes (Cheng et al., 2016; Valentin, 2019). A recall issued by the company in 2014 was implemented entirely remotely, with consumers receiving updates to faulty software on their vehicles without physically bringing them to a dealership (Brisbourne, 2014; Rayes and Salam, 2017).

Whether Tesla is a “tech company” or an “auto company” has been widely debated, both by mainstream and tech media, and by academics in business and management fields. The former argue that Tesla’s similarities or dissimilarities in executive compensation strategies, valuation, product types, etc. determine the distinction (Aziza, 2019; DeBord, 2019; Smith, 2020). The latter argue over the significance of Tesla’s ability to overcome barriers of entry to the automobile industry, becoming the first new U.S. auto company to do an initial public offering on the New York Stock Exchange since the 1950s (Perkins and Murmann, 2018). Some interpret Tesla’s success as evidence that large tech firms like Google and Apple can easily enter the EV market; others argue that Tesla’s success is neither easily reproducible nor indicative of a fundamental shift in the industrial organization of auto manufacturing.

Tesla’s characteristics, and whether they reflect an orientation as a tech company or an auto company, have significance for industrial policy, regional planning, and economic geography. In planning for an emergent EV industry, how should regions respond? What institutions, labor, and infrastructure will be needed, and how can existing regions adapt their endowments to meet these needs? What spatial patterns of investment might arise and how will they affect local markets for land use and labor?

Tesla has employees at multiple locations on three continents (Figure 5). Both the firm’s headquarters and the largest manufacturing plant are located in the Bay Area, in Palo Alto and Fremont, respectively. Tesla also owns and operates a solar cell factory in Buffalo, NY; a battery factory in Nevada; and two other locations that assemble cars for specific domestic markets: Tilburg, Netherlands, and Shanghai, China, opened in late 2019. The company has announced plans to open a fourth plant that will manufacture batteries, vehicle components, and assemble vehicles in Berlin, Germany (Metzner, 2019; Tesla, Inc., 2013).

**Tesla in California**

In 2010, Tesla purchased an auto manufacturing plant in Fremont, CA for $42 million, recently vacated by the joint Toyota–GM project of New United Motor Manufacturing, Inc. (NUMMI) (Tesla engineer, personal interview, 27 February 2019). Under GM’s ownership, the plant was plagued by labor disputes and low productivity. The subsequent takeover by NUMMI in 1984 resolved these problems. As a manufacturing firm in a higher-cost region with a unionized workforce and high productivity, NUMMI was widely recognized as a success story of a more innovative, flexible approach during the ongoing disintegration of manufacturing industries in the U.S. Following the 2008 recession, however, Toyota closed the NUMMI plant, moving its vehicle production to lower-cost North American regions.

Tesla’s production approach varied significantly from Toyota’s. When Toyota took over NUMMI, they retained workers, invested in training, and permitted continued union representation. Despite a weak attempt at intervention by the State of California, Tesla rehired only a small portion of former NUMMI workers, successfully and intentionally avoided union representation, and offers lower wages for similar positions (Kowalski, 2014). Much of its workforce comes from the megaregion, living in temporary housing or even RVs (Tesla engineer, personal interview, 27 February 2019).

Tesla describes its operation as vertically integrated: even the car seats are manufactured in-house for quality control (Tesla engineer, personal interview, 27 February 2019). Its plant houses the largest hydraulic press in the world. At the same time, it has largely recreated NUMMI’s specialized pool of suppliers. Though Fremont feared the loss of supplier firms linked to NUMMI, the automotive cluster rebounded a few years after Tesla arrived, providing more jobs than before (Chapple et al., 2017).

Assembly line automation at the Tesla Factory is key to the firm’s strategy. The Fremont plant is noted for the number, size, and capacity of the robots involved in its automated manufacturing process, with robots always on hand to repair those that have broken down (Perkins and Murmann, 2018; Tesla engineer, personal interview). These robots were heavily relied upon when Tesla attempted to dramatically scale-up production of the Model 3 in 2017 and 2018 (Kottenstette, 2019). Struggles in this process, mostly attributed to failures in the automation technology, caused Tesla to miss its production targets in 2018 and 2019 (Boudette, 2019).

Tesla’s recruitment strategies reflect an emphasis on knowledge-based and formal/semi-formal technical and programming skills. A scraping of the Tesla website’s job postings in October of 2018 found that over half of the 88 manufacturing department job openings at the Fremont factory requested a specific level of formal education. Over a third requested a bachelor’s degree, seven specified an associate’s degree or higher, and six a high school diploma. Of those that didn’t specify formal education, 19 requested specific software or robotics programming skills (Table 4).

**Tesla’s strategy in the regional context**

Tesla’s successes and failures relate closely to place-based assets in the San Francisco Bay Area. First, much of Tesla’s success is attributed to their technological product. Their battery and powertrain technologies were estimated in 2019 to be “years” ahead of their competitors. Tesla’s incorporation of advanced, networked software, including driver-assistance technologies, contributes significantly to the firm’s success and indicates possible fundamental shifts in the auto industry. Tesla’s ability to compete on a technological basis, particularly as an unusually vertically integrated auto firm, reflects its dependence on intellectual property and human capital. Both are place-based assets entrenched in the Bay Area’s long-time role as an innovative, tech-focused region.

In addition, Tesla’s ability to raise financing during its early years was essential to its survival and success as a startup, and contributed to its position as the second highest-valued car company in the world (Stringham et al., 2015). As noted previously, the vibrant venture capital scene is a widely acknowledged component of the Bay Area’s success as a regional innovation system.

Tesla’s failures are similarly linked to the region. Tesla has been widely criticized for failing to produce its vehicles at anything approximating a mass-market level, failing to meet industry norms for auto production until 2019 (MacDuffie, 2018). A recent “turnaround” in the last half of 2019 led to rising stock prices, but Tesla has continued to suffer from safety issues related to batteries that reflect poorly on the firm’s production quality (Alba, 2019). The Fremont factory has also received significantly more fines for occupational health and safety violations than any other U.S. factory (Adelson and Hull, 2019; Ohnsman, 2019).

Tesla’s recent selection of Berlin, Germany, as the location for their fourth plant, reflects a location choice oriented toward technology development rather than production skills endowments. Europe’s auto manufacturing regions are located elsewhere: in southern Germany, northern Italy, and the UK. Production strategies based on peripheralizing manufacturing in low-cost regions while concentrating R&D elsewhere would suggest lower-cost production sites in Spain, Portugal, or Eastern European countries. Berlin, however, is receiving media coverage deeming it an emerging technology hub, with a possible emphasis on mobility technology (Petzinger, 2019).

**Maserati in Emilia-Romagna, Italy**

**Economic history of Emilia-Romagna**

Emilia-Romagna, located in central northern Italy, has followed a path distinct from other highly industrialized Italian regions, emerging as a relatively knowledge-intensive manufacturing region in the past two decades. Emilia-Romagna’s industrial specialization evolved out of military exploitation of its strategic location and ***agricultural*** resources, and following the process of mechanization of its large traditional ***agricultural*** sector (Montanari et al., 2004; Zamagni, 1993). In both World Wars, the region served as a hub for military transport, logistics, mechanics, and food processing. Following the Second World War, Emilia-Romagna gradually reconstructed itself on the basis of this deep expertise, becoming a center for traditional industries including the processing and packaging of food and pharmaceuticals, machinery manufacturing, and motor industries.

In the 1970s, the transition to post-Fordist modes of production caused an economic crisis for Italy’s most industrialized regions. In other regions, including Emilia-Romagna, a new approach to industrialization emerged, which became widely known as the “Third Italy” (Bagnasco, 1977; Becattini, 1987, 2004; Brusco, 1982; Fuà and Zacchia, 1983). The Third Italy regions were characterized by communities of diverse actors connected by dense social networks, including small and medium enterprises, local institutions, associations, and skilled workers and entrepreneurs. Through flexible specialization and adaptive innovation, these regions were able to respond to the demands of the post-Fordist system (Amin, 1999; Boschma and Lambooy, 2002; Helliwell and Putnam, 1995; Piore and Sabel, 1984). In the 1980s and 1990s, Emilia-Romagna’s economy continued to develop based on this model of industrial organization, which was rooted in the productive history of the region and facilitated by government and civic institutions.

Even as manufacturing regions in Italy have evolved from flexible specialization to a knowledge-based economic paradigm, Emilia-Romagna has retained more manufacturing than its peers. The service sector has grown, and manufacturing has shrunk, but this shift has been slower than in other Italian regions. Manufacturing is relatively concentrated among a few industries, particularly in machinery (21% of manufacturing employment) and in metallurgy and vehicle production (18%), but has diversified at the sub-industrial level (Andreoni, 2018). The regional economy has also become increasingly organized around value chains, linking diverse production, activities, and firms in Emilia-Romagna (Rinaldi, 2005).

Although Emilia-Romagna has retained a significant manufacturing base, knowledge and technology have become more important components within it. Employment in mid- and high-tech manufacturing has increased from 8.7 to 10.2% of all manufacturing employment in the past 10 years. Private investment in R&D per capita in Emilia-Romagna was over twice the Italian average, and above average for regions in EU28 member states (Figure 6).

**Figure 6.**

Growth in knowledge and technology content of regional manufacturing. Source: ***Eurostat***.

**Figure 7.**

Automotive firm density by town, Emilia-Romagna, 2017. Source: AIDA-Bureau Van Djik database.

The automobile industry contributes approximately 10% of the total value added generated by the Emilia-Romagna manufacturing sector. It is geographically concentrated in three of Emilia-Romagna’s provinces: Modena, Bologna, and Reggio nell’Emilia, though automotive firms are present across the region.

**Institutional coordination in Emilia-Romagna**

In the last century Emilia-Romagna has hosted a community of firms, people, and institutions specialized in mechanics and motors, which continues to shape the local manufacturing economy (Figure 7). The density and cohesion of this community constitutes a territorial asset and an attracting factor for external actors. Ferrari, Lamborghini, and Maserati are some of the best-known brands, heading up a long list of small and medium firms that make up the “Emilia-Romagna Motor Valley.”

Formal institutions and policies have played an essential role in the region’s transition to knowledge-based advanced manufacturing. Since 2002, when the innovation law was established, regional institutions have built and strengthened networks of existing actors and connected tangible and intangible assets already rooted in regional manufacturing. Emilia-Romagna is home to four public universities providing advanced and a network of technical colleges and post-secondary diploma technical training institutions (Istituti tecnici superiori (ITS)) providing specialized training. Seven public–private foundations offer two-year courses in specific competencies linked to local economic strengths, including mechatronics, logistics, and sustainable mobility.1

Regional institutions and policies also support networking, collaboration, and knowledge exchange, and provide funding and services. The backbone of the regional innovation system is the High-Technology Network, a group of 96 public and private innovation centers and laboratories, which emerged informally in the 2000s and was later connected by public initiatives into an organized framework including incubators, digital innovation hubs, and enterprise clusters.

Location quotients for the region confirm that manufacturing industries, especially machinery manufacturing, play a significant role in Emilia-Romagna (Table 5). Knowledge-oriented industries are somewhat concentrated in the region, though to a lesser extent.

**Table 5.**

Emilia Romagna industrial location quotient 2017.

|  | **Emilia-Romagna location quotient** |
| --- | --- |
| Technology and engineering industries |  |
| ***Data*** processing, hosting, and related services | 0.65 |
| Other information services | 1.08 |
| Scientific research and development | 1.22 |
| Professional, scientific, and technical services | 1.12 |
| Manufacturing industries |  |
| Fabricated metal products | 1.25 |
| Computer, electronic products and optical products | 1.52 |
| Electronic components and boards | 1.28 |
| Computers and peripheral equipment | 2.84 |
| Communication equipment | 1.53 |
| Instruments and appliances for measuring, testing and navigation | 1.41 |
| Electrical equipment, appliances and components | 1.08 |
| Machinery | 2.39 |
| Transport equipment | 0.93 |
| Passenger vehicles | 1.10 |

Source: I-STAT ***data***.

**Place-based policy in Emilia-Romagna**

The Emilia-Romagna region released a smart specialization strategy in 2012, specifying areas in which the region’s competitive and innovative potential could be augmented through intervention (Regione Emilia-Romagna, 2012). The automotive industry was identified as a specialization area and three strategies were developed to support it. Corresponding policies and initiatives were undertaken to implement each strategy, creating an integrated, dense architecture of institutional, policy, and financial support.

In the first strategy, regional institutions in Emilia-Romagna work to strengthen technological and human capital in the region, providing targeted training through ITS in technology related to mobility, including software applications, automation, and new energy sources. The region also established a university program dedicated to automotive engineering and design, the Motor-vehicle University of Emilia-Romagna (MUNER), which links regional universities and nine large firms representing luxury, sport, and high-range engines brands.2 Emilia-Romagna also developed a formal innovation platform for tech and knowledge transfer from 26 of the High Technology Network’s research laboratories to producers in the sector.

The second strategy strengthens ***collective*** action among firms. Regional policymaking supported and financed the development of formal associations representing different clusters, including one on mechanics (MECH-ER).3 The MECH-ER cluster, which involves 48 firms, 32 research centers, 6 private innovation centers, and 3 training centers, gathers and integrates actors belonging to different value chains. One of these, MoVES, *Motori e Veicoli efficienti, sostenibili e intelligenti*, is focused on improving environmental sustainability, energy efficiency, connectivity, and automation of vehicles, and aims to formalize scientific collaborations among and between firms and research institutions. Another association, the Emilia-Romagna Sustainable Electric Mobility association (E-Rmes), gathers 24 firms and 3 research institutions involved in the design and production of automotive components, particularly electric powertrain integration (Ausiello, 2016).

The final regional strategy aims to attract resources to the region by providing financial support to firms that improve innovative, technological, and employment outcomes at the regional level. Suppliers have been increasingly involved in MUNER, contributing to human capital formation. In addition, some foreign actors that have increased their presence in the region are willing to co-develop EV technology with smaller brands to share the cost of development and exploit the advantages of scale economies in such forms of investments.4

Emilia-Romagna’s automotive industry strategies have interpreted smart specialization policies as an investment in territorially based resources, building off of existing capacities and potential to improve the region’s competitive position in an international economy. The region has increasingly attracted foreign automakers from countries that are emerging as global automotive producers. For example, a Chinese joint venture was recently established between the state-owned enterprise FAW and the regional engineering firm Silk EV.

Emilia-Romagna’s auto industry has close trade linkages with other European regions and is a net exporter in each sub-industry of automotive production (Table 6). Production is highly integrated with Germany in particular, which is both the largest trading part for the Emilia-Romagna auto industry and the main country of origin for foreign firms producing passenger vehicles in the region (Pollio, 2018). Full vehicles produced in Emilia-Romagna are exported to a wider range of areas, with the U.S. accounting for the largest share.

**Table 6.**

Emilia Romagna’s international trade flows, 2017.

|  | **Imports** | **Exports** |  |  |
| --- | --- | --- | --- | --- |
| **Category** | **Trade in millions €** | **Percent of total regional imports** | **Trade in millions €** | **Percent of total regional exports** |
| Total | 3988.9 | 11.31 | 5766.48 | 9.63 |
| Full vehicles | 2894.55 | 8.21 | 3970.97 | 6.63 |
| Body | 92.09 | 0.26 | 95.90 | 0.16 |
| Parts and accessories | 1002.26 | 2.84 | 1699.71 | 2.84 |

Source: ISTAT ***data***.

**Table 7.**

Emilia-Romagna auto industry, firm-level ***data***, 2017.

|  | **Number of firms** | **Revenues (thousands €)** | **Number of employees** |  |  |
| --- | --- | --- | --- | --- | --- |
| **Total** | **Average** | **Total** | **Average** |  |  |
| Automakers | 20 | 8,225,922 | 411,296 | 7147 | 357 |
| Luxury | 5 | 7,876,192 | 1,575,238 | 6423 | 1285 |
| Part makers | 111 | 866,364 | 7805 | 3652 | 33 |
| Electric and electronic appliances | 15 | 88,624 | 5908 | 358 | 24 |
| Others | 96 | 777,740 | 8101 | 3294 | 34 |
| Bodies, trailers and semi-trailers makers | 36 | 126,274 | 3508 | 753 | 21 |

Source: AIDA-Bureau Van Djik ***data***.

Luxury vehicle production plays a significant role in Emilia-Romagna’s regional automotive manufacturing industry (Table 7). Firm-level ***data*** show that, while only a handful of auto firms are specialized in luxury and sport vehicles, they are responsible for more than 96% of the total revenues and about 90% of employment in the regional auto industry (Pollio, 2018).

Foreign firms also have a strong presence within the production context and are essential actors in the regional value chain. Like luxury firms, they represent a small total number of firms (17 out of 157) but a disproportionate part of revenue (87% of total) and value-added generated by the auto industry (92% of total) in Emilia-Romagna. Many suppliers and luxury automakers are under foreign ownership (for example, Lamborghini is owned by the German Audi-Volkswagen).

**Maserati in Emilia-Romagna**

Maserati is a key part of Emilia-Romagna’s unique development as an automotive production and innovation region. The firm was founded in 1914 in the city of Bologna, Emilia-Romagna, and the first Maserati was manufactured there in 1926. Maserati initially specialized in racing autos, through which the firm improved its technological capacity and gained international brand recognition. Its first non-racing road car was produced after the end of the Second World War. The firm has changed ownership and management several times during the past century, controlled by the founders Maserati brothers (1914–1939), the Orsi family (1939–1968), Citroen (1968–1974), Italian state-owned enterprise GEPI (1975–1993), Fiat/Ferrari (1993–2010), and now Fiat-Chrysler.5

**Maserati’s strategy in the Emilia-Romagna context**

Despite ownership changes, Maserati’s factory in Modena, Emilia-Romagna has been there since 1939, and its headquarters and R&D are also located there. Industry press indicates that the Modena plant is being upgraded to produce Maserati’s first EV, the Alfieri, in 2020 or 2021, and that the firm will partner with Ferrari to produce the powertrains (Kautonen, 2019). The Fiat-Chrysler group has invested significantly in Maserati, targeting EVs and luxury markets. Relative to the other two exporting brands in the region, Maserati has significantly increased the number and percentage of its cars sold abroad in the past five years, drawing on the region’s strong foreign linkages (ANFIA, 2020).

Maserati’s labor demands are shifting to reflect the technological advancement of their program. Their 2019 job listings reflected expanding R&D needs, with demand for workers with engineering degrees and software skills (Table 8). Maserati is active in the Emilia-Romagna auto manufacturing cluster as a partner of the MUNER project.

**Table 8.**

Labor demand by Maserati, 2019.

| **Functions** | **Job openings** |
| --- | --- |
| After sales | 3 |
| Finance | 3 |
| Human resources | 1 |
| Information technology | 1 |
| Manufacturing | 3 |
| Marketing | 3 |
| R&D—Powertrain | 5 |
| R&D—Vehicle | 15 |
| Sales | 1 |
| Total | 33 |

Source: [*www.careers.maserati.it/*](http://www.careers.maserati.it/). ***Data*** accessed February 2020.

**The future of EV manufacturing in Silicon Valley and Emilia-Romagna: Critical reflections on place-based industrial policy**

Effective place-based policy promoting innovative economic development is in demand. Tailoring regional place-based strategies to emerging industries presents a particular challenge, as intervention is demanded even when it isn’t yet clear what kinds of externalities will benefit emerging industries, what kinds of spatial location patterns these industries will adopt, or how the industry could be expected to continue to evolve. The two cases of Tesla and Maserati provide an opportunity to examine these questions via the emerging EV production industry, which involves elements of traditional auto manufacturing and of high-tech innovation and advanced manufacturing. The cases demonstrate a potential role for place-based industrial policy in supporting emerging industries, but also suggest that the interventions needed will vary widely depending on context.

Both Tesla and Maserati draw on their regions’ extensive economic histories and endowments and the industrial paths that they created. Tesla, a firm that emerged from a high-tech regional innovation system, draws heavily on its local high-tech workforce. In an emerging industry that combines elements of both innovative high technology and traditional auto manufacturing, Tesla’s technology has remained at the forefront of the EV industry and enabled it to compete effectively with traditional auto manufacturers. Maserati also draws advantage from Emilia-Romagna’s long-established history as a manufacturing-oriented region. The firm has access to a trained production workforce, production infrastructure, and networks of suppliers with expertise in luxury automobile markets.

Both Tesla and Maserati also benefit from institutional coordination of their regions. Tesla has been able to draw on the Bay Area’s deep venture capital to successfully finance its unorthodox attempt to break into the automobile production sector. It benefited not only from infrastructure and suppliers inherited from the NUMMI plant, but also the broader Silicon Valley ecosystem of tech startups. Maserati has profited from a dense network of regional institutions supporting innovation, and has been able to partner with established auto manufacturers, including global players, that are part of the regional “community of people and firms” (Becattini, 2015).

The embeddedness of the two firms in their home regions seems to support place-based industrial policy; place-based industrial policy appears to benefit Maserati already. The Emilia-Romagna local government has designed, implemented, and funded policy intended to cultivate knowledge-intensive innovation, production, and skill development. This policy builds off of the existing regional strength in automobile manufacturing, and works to develop cross-sector partnerships and diversify beyond traditional production areas. Such policy intervention should help Maserati compensate for potential regional technology shortcomings, while it benefits from regional production expertise, infrastructure, and partnerships.

Conversely, Tesla has developed and implemented cutting-edge technology throughout its existence without the benefit of place-based policy intervention. Although tax credits supported production in the Fremont plant and stimulated EV consumption, there is no industrial policy supporting local knowledge-intensive innovation and skill development. Thus far, the firm’s acquisition of NUMMI has enabled production. However, Tesla’s output remains unreliable due to bottlenecks in the production process and labor performance instability. Despite continual expansion, Tesla is rarely able to meet its production goals. Tesla may also struggle to find and retain production employees and expand production infrastructure in the Bay Area if regional land prices and cost of living continue to rise. Without place-based interventions to help stabilize the workforce, Tesla will likely take advantage of its expansion to other knowledge-intensive regions, like Berlin, to shift production outside of the Bay Area.

Unlike Tesla, Maserati has not yet put its EV on the market, although its partnership and knowledge base are in place. Yet its future is also tenuous, in part because regional policies have focused largely on the risky strategy of attracting foreign capital to the region, as well as relying on foreign actors to support the region’s skill-building. Its EU ranking as a moderate innovator raises questions about its long-term competitiveness vis-à-vis other competitors in Europe (European Commission, 2018).

Literature on regional innovation systems emphasizes the value of environments that encourage informal networking and knowledge exchange, including across sectors, and the importance of embeddedness for firms seeking the advantages of this environment. However, these case studies emphasize that policies intended to support or grow innovation systems will vary based on the types of industries these regions seek to germinate, and the needs of the firms that are embedded in the regional system. Place-based policies appropriate for EVs would need to identify both the specific needs of this emerging industry and the shortcomings of the region in question. In Tesla’s case, this means ensuring that workers can move to and remain in the area. In Maserati’s case, interventions would need to continue to increase local knowledge competencies and access to capital. These are two distinct approaches to place, suggesting that the construction of industrial policy must be locally specific, even for the same industry.

Emerging industries may diverge from existing patterns of the spatial division of labor seen in more established industries. For example, production and research may not be as clearly delineated from one another in more advanced manufacturing contexts. Skill needs are also transformed, requiring a smaller, more agile, and high-skilled workforce. In some cases, knowledge-intensive regions may gain new production activities (viz. Tesla building a new plant in Berlin); yet at the same time, regions with multiple traditional strengths like Emilia-Romagna may also benefit. Existing development paths may support new players in emerging industries, but may also hamstring them, sometimes simultaneously. This is illustrated in Tesla and Maserati’s successes in capitalizing on regional strengths while struggling to make up for regional shortcomings. Thus, whether adopted by a region acting alone or an entire country or federation like the EU, a place-based industrial policy will need to give regions the flexibility to design their own unique approaches.

**Notes**

1See [*www.itsemiliaromagna.it/*](http://www.itsemiliaromagna.it/).; 2See [*www.fesr.regione.emilia-romagna.it/erdf*](http://www.fesr.regione.emilia-romagna.it/erdf)/ and [*www.motorvehicleuniversity.com/*](http://www.motorvehicleuniversity.com/).; 3See [*www.mech.clust-er.it/en/*](http://www.mech.clust-er.it/en/).; 4On this see, for example, the declaration of Volkswagen at [*www.autonews.com/automakers-suppliers/vw-group-talks-peers-share-electric-expertise*](http://www.autonews.com/automakers-suppliers/vw-group-talks-peers-share-electric-expertise) (accessed 10 June 2020).; 5After the merger, parts of Maserati production were moved to FCA plants in Piedmont.

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[***Soar Catchment Abstraction Management Strategy***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:60V3-GT31-F0YC-N23N-00000-00&context=1516831)

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**Body**

London: The Environment Agency, UK Government has issued the following news release:

SoarAbstraction Licensing StrategyA strategy to manage water resources sustainablyAugust 2020LIT 26462 of 28We are the Environment Agency. We protect and improve the environment.We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.We can’t do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.Published by:Environment Agency Horizon House, Deanery Road, Bristol BS1 5AH[*www.gov.uk/environment-agency*](http://www.gov.uk/environment-agency)© Environment Agency 2018All rights reserved. This document may be reproduced with prior permission of the Environment Agency.Further copies of this report are available from our publications catalogue: [*http://www.gov.uk/government/publications*](http://www.gov.uk/government/publications) or our National Customer Contact Centre: 03708 506 506Email: [*enquiries@environment-agency.gov*](mailto:enquiries@environment-agency.gov) ContentsContents .............................................................................................................................31. About the licensing strategy.........................................................................................41.1 Water abstraction licensing principles and process ...................................................41.2 Abstraction considerations.........................................................................................51.3 Abstraction restrictions ..............................................................................................51.4 An overview of the Soar catchment ...........................................................................62. 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How we manage abstraction in the Soar ALS area...................................................163.1 Assessment points (surface water)..........................................................................163.2 Managing Groundwater ...........................................................................................183.3 Artificial and Heavily modified water bodies (HMWBs) ............................................193.4 Protected areas .......................................................................................................204. Managing existing licences ........................................................................................224.1 Water rights trading .................................................................................................224.2 Taking action on unsustainable abstraction.............................................................234.3 Regulating previously exempt abstraction ...............................................................235. List of abbreviations....................................................................................................256. Glossary .......................................................................................................................274 of 281. About the licensing strategyThis strategy sets out our approach to managing new and existing water abstraction and impoundment licensing within the Soar catchment in the Humber river basin district. It provides information about where water is available for further abstraction and how reliable a new abstraction licence may be. The following sub-sections provide further information about our licensing approach as well as an introduction to the Soar Abstraction Licensing Strategy (ALS) area.We apply this approach to the water body in which the abstraction is located. Water bodies are sub-catchment surface water units or groundwater units on which we carry out assessments and map results. It also applies to all downstream surface water bodies that may be affected by any reduction in abstraction-related flow, or adjacent groundwater bodies affected by any reduction in groundwater level.Please see Managing Water Abstraction for the technical explanation, legal and policy requirements behind ALS.Please see abstraction pages on gov.uk for advice on who needs an abstraction or impoundment licence, and how to apply.1.1 Water abstraction licensing principles and processOur licensing approach ensures that River Basin Management Plan (RBMP) objectives for water resources activities are met and we avoid deterioration within this catchment in line with the Water Framework Directive (WFD). WFD seeks environmental objectives of protecting and enhancing the water environment and ensuring the sustainable use of water resources for economic and social development. The ALS sets out how we will manage the water resources of a catchment and contribute to implementing the WFD.The document Managing Water Abstraction outlines the over-arching principles that we follow in managing our water resources. How we apply these principles in the Soar ALS area is outlined in this section. If you want to abstract water it outlines where water is available for further abstraction and the principles we follow in assessing your application for a licence.Abstraction licence application processAnyone wanting to take more than 20 m3/day (4,400 gallons) water from a source of supply (i.e river, stream, lake, well, groundwater, etc.) must have an abstraction licence. In dealing with abstraction applications we may require the application to be advertised and may require supporting environmental information. When considering the application we check that the quantities applied for and the purpose of the abstraction are reasonable, that there is sufficient water available to support it and that the potential impacts on the environment and other water users are acceptable. Depending on the outcome of our investigations we will issue a licence either as applied for, or with conditions that restrict the abstraction to protect the environment or rights of other users. In certain cases we may have to refuse the application. Any applicant who is not happy with our decision has the right to appeal against it.Applying for impoundment5 of 28Applications for impoundments will be dealt with on a case-by-case basis. An impoundment is a dam, weir or other constructions in an inland waterway that obstructs or impedes flow and/or raises water levels.Applying for hydropowerWater abstraction for hydropower schemes is non-consumptive, with almost all water used returned to the watercourse. Maximum abstraction volumes are determined in line with the Environment Agency's Hydropower Good Practice Guidelines and based on the assessment of environmental risk for each scheme (please see Hydroelectric power schemes: application for further information in regard to applying for abstraction for hydropower).1.2 Abstraction considerationsEach application is determined on its own meritsWhilst this document may say that water is available for further abstraction, this does not guarantee that all applications will be successful. We will determine each application upon its own merits and any local impacts. This may mean we are either unable to grant a licence as applied for, or even at all.Water resources reliabilityIt is important to understand that when we issue a licence we do not guarantee the supply of water at all times. We have to protect the environment and rights of other abstractors. To do this we may add constraints to licences. Licence holders need to understand the implications of this as it affects the reliability of supply. For example, in drier years it is more likely that conditions will come into effect and abstraction is more likely to be stopped.Abstractions are managed to protect the environmentWe assess the impacts of new applications for water to make sure that complying with the WFD the resultant river flows will maintain a good ecology or if the ecology is not good, will not deteriorate the ecology of our rivers further. If the water body is of high hydrological regime, we need to make sure that the river flows will maintain the near pristine condition of the water body.We will also take action if necessary to limit the increase in current abstraction when we think this will lead to deterioration of the ecology or the near pristine condition of our high hydrological regime water bodies. This is to ensure compliance with the WFD.1.3 Abstraction restrictionsWhen issuing a licence we have to protect the environment and rights of other abstractors. To do this we may add conditions to licences. These could be limitations on the time of year when abstraction can take place and the period of time a licence is valid, as explained below.6 of 28Hands off flow (HoF) and hands off level (HoL) conditionsTo protect the environment and the right of other abstractors we may issue a licence with conditions referred to as ‘hands off flow’ (HoF) and / or 'hands off level' (HoL) to respectively protect surface water and groundwater resources. These specify that if the flow in the river or groundwater level drops below that which is required to protect the environment, abstraction must stop. As a result, when we grant a licence, it does not mean that we guarantee a supply of water. Therefore, in dry years, restrictions are likely to apply more often, which will affect the reliability of supply.See section 3.1 for details relating to licence restrictions within the Soar catchment.Time limited licencesIn recognition of changing pressures on water resources all new licences and variations to existing licences (other than downward variations or minor variations having no environmental impact) will have a time limit imposed. This allows for the periodic review and changes to abstraction licences where circumstances have changed since the licence was granted.All new licences within an ALS area have a common end date (CED) so they can be reviewed at the same time. The normal duration of a licence is usually 12 years. When an application is made within six years of the CED, we will generally apply the subsequent CED to any licence granted. This is to avoid issuing shorter and shorter duration licences as the CED approaches. However, where we are uncertain about the long term impacts of an abstraction we will grant a short term licence during which time potential impacts are monitored. We have the discretion to apply short or long time limits to a licence and this will be done on a case by case basis, following discussion between the applicant and ourselves. Additional information about the replacement of time limited licences is available in Managing Water Abstraction.See section 2.5 for such conditions in the Soar catchment.This strategy was finalised in March 2020 and it supersedes the strategy issued in February 2013.1.4 An overview of the Soar catchmentThe Soar catchment is a significant tributary of the River Trent. The catchment of the River Soar covers an area of approximately 1,380 km2, covering much of the county of Leicestershire, together with small areas of south Nottinghamshire and north east Warwickshire. Located near the centre of the catchment, the principle urban area is the City of Leicester, with a population of approximately 330,000 (source: Office for National ***Statistics***, 2011 Census). Other significant towns include Wigston, Melton Mowbray, Loughborough and Kegworth (Map1).Sources of water across the Soar catchmentFrom its source, south east of Hinckley, the River Soar follows a northerly course towards its confluence with the River Trent near Ratcliffe on Soar, south west of Nottingham. There are a number of important tributaries, including the rivers Sence and Wreake and7 of 28the Rothley, Black and Kingston brooks. The Charnwood Reservoir Group, located in the north west of the catchment, includes Cropston, Swithland, Thornton, Blackbrook and Nanpantan reservoirs. With the exception of Nanpantan, these water-bodies are impounding reservoirs, with legal agreements requiring compensation discharges to be made from Thornton Reservoir to the Rothley Brook and from Blackbrook Reservoir to the Black Brook, maintaining flow downstream of the dams.There are limited sources of groundwater (aquifers) across the Soar catchment. The Environment Agency classifies aquifers as principal, secondary and unproductive strata. Secondary aquifers hold less significant water resources. The geology of the Soar CAMS area is dominated by impermeable clays and marls with limited areas of permeable rocks that provide exploitable groundwater resources. In the north west of the catchment there are some limited outcrops of Sherwood Sandstone, classified as a ‘principal’ aquifer. Although not viewed as ‘strategic’ or regionally significant, these can provide locally important groundwater sources, as does the pre-Cambrian strata of this area of the catchment. More widespread through the river corridors of the catchment are alluvial sand and gravel deposits, although the extent and depth of these superficial deposits can be limited.The River Soar is predominantly a lowland watercourse, rising in the south west of the catchment. The rivers Sence, Eye, Wreake and Kingston Brook all drain typically rolling wolds countryside. However, Charnwood, in the west of the catchment, rises to 250 metres above sea level, with an upland heathland environment contrasting against the gentle rolling open farmland of the surrounding clay areas of the Leicestershire wolds. The pre-Cambrian, solid geology of the upland area generated a favourable location for the construction of the reservoirs during the nineteenth century for public water supply to Leicester. The Rothley, Quorn and Black brooks drain this area.There are few water resource pressures within the Soar catchment as the vast majority of public water supply is imported from neighbouring catchments. There are a number of public water supply reservoirs in the west of the catchment. Many of these reservoirs have been designated SSSIs by Natural England. There is very little strategically important groundwater licences.8 of 28Map 1. The catchment of the River Soar including the network of major rivers and the location of major cities across it.9 of 282. Water resource availability of the Soar ALS area2.1 Resource assessmentResource assessment is at the heart of abstraction management. To manage water effectively we need to understand how much and where it is available, and how much the environment and existing abstractors need. We have a monitoring network to measure river flows and groundwater levels. We use these ***data*** along with our knowledge of human influences and environmental needs to establish a baseline of water availability for each water body that builds into a picture for the catchment. The main components of this assessment that help us to understand the availability of water resources are:• The Environmental Flow Indicator (EFI); a resource allocation for the environment defined as a proportion of natural flow• The Fully Licensed (FL) scenario; the situation if all abstraction licences were being used to full capacity• The Recent Actual (RA) scenario; the amount of water which has actually been abstracted on average over the previous six yearsRiver flows change naturally throughout the year, so we want to protect flow variability in our rivers from low to high flow conditions. We use flow ***statistics*** to help to do this. Flow ***statistics*** are expressed as the percentage of time that flow is exceeded. Resource availability is calculated at four different flows, Q95 (the flow of a river which is exceeded on average for 95% of the time i.e low flow,), Q70, Q50 and Q30 (higher flow). This information gives a more realistic picture of what the current resource availability is within a given water body.2.1.1 Water resource availability colours and implications for licensingIn order to communicate water resources availability across catchments, we usually use a colour code system. Table 1 defines the colour codes used for presenting resource availability (of surface water) with the licensing implication associated to each colour. However, not all of them necessarily apply to any individual catchment.Table 1. Surface water resource availability colours and associated implications for abstraction licensing.Surface water resource availability colourImplication for abstraction licensingHigh hydrological regimeThere is more water than required to meet the needs of the environment. However, due to the need to maintain the near pristine nature of the water body, further abstraction is severely restricted.10 of 28Surface water resource availability colourImplication for abstraction licensingWater available for licensingThere is more water than required to meet the needs of the environment.New licences can be considered depending on local and downstream impacts.Restricted water available for licensingFull Licensed flows fall below the Environmental Flow Indicators (EFIs).If all licensed water is abstracted there will not be enough water left for the needs of the environment. No new consumptive licences would be granted. It is likely we will be taking action to reduce full licensed risks. Water may be available if you can ‘buy’ (known as licence trading) the entitlement to abstract water from an existing licence holder.Water not available for licensingRecent actual flows are below the EFI.This scenario highlights water bodies where flows are below the indicative flow requirement to help support a healthy ecology in our rivers. We call this 'Good Ecological Status' (GES) or 'Good Ecological Potential' (GEP) where a water body is heavily modified for reasons other than water resources.Note: we are currently taking action in water bodies that are not supporting GES or GEP. We will not grant further licences. Water may be available if you can buy (known as licence trading) the amount equivalent to recently abstracted from an existing licence holder.Heavily Modified Water Bodies (HMWBs) (and/or discharge rich water bodiesThese water bodies have a modified flow that is influenced by reservoir compensation releases or they have flows that are augmented. These are often known as ‘regulated rivers’. They may be managed through an operating agreement, often held by a water company. The availability of water is dependent on these operating agreements. More detail if applicable can be found in section 3.1 Surface Water.There may be water available for abstraction in discharge rich catchments, you need to contact the Environment Agency to find out more.2.1.2 Groundwater resource availability colours and implications for licensingFor groundwater availability there are only three colour codes. Table 2 presents these colours with the licensing implication associated to each colour.Table 2. Groundwater resource availability colours and associated implications for abstraction licensing.11 of 28GWMU resource availability colourImplication for abstraction licensingWater available for licensingGroundwater unit balance shows groundwater available for licensing. New licences can be considered depending on impacts on other abstractors and providing there will be no significant impact on surface water flows, dependent wetlands, groundwater levels or cause saline intrusions.Restricted water available for licensingGroundwater unit balance shows more water is licensed than the amount available, but that recent actual abstractions are lower than the amount available OR that there are known local impacts likely to occur on dependent wetlands, groundwater levels or cause saline intrusions but with management options in place.In restricted groundwater units no new consumptive licences will be granted. It may also be appropriate to investigate the possibilities for reducing fully licensed risks. Water may be available if you can ‘buy’ (known as licence trading) the entitlement to abstract water from an existing licence holder.In other units there may be restrictions in some areas e.g in relation to saline intrusion.Water not available for licensingGroundwater unit balance shows more water has been abstracted based on recent amounts than the amount available.We will not grant further consumptive licences. It will be appropriate to take action to reduce fully licensed risks. Water may be available if you can 'buy' the entitlement to abstract water from an existing licence holder (known as licence trading).2.2 Resource availabilityThe water resource availability, calculated at four different flows, Q95 (low flow), Q70, Q50, and Q30 (higher flow) for this ALS is presented in Map 2 with the definition of availability colours and associated licensing implication explained in Section 2.1.1 For further licensing information about surface water, please refer to Section 3.1 12 of 28Map 2. Water resource availability colours at different flow rate for the Soar ALS area.13 of 282.3 Groundwater resource availabilityGroundwater availability is guided by the surface water resource availability unless we have better information on principal aquifers or we are aware of local issues we need to protect. Map 2 shows the water resource availability colours for surface water in the Soar ALS area.Under the Water Framework Directive aquifers are designated as named groundwater bodies (GWBs). We may divide GWBs into groundwater management units (GWMUs). In the case of Principal aquifers we use the information and assessments on these units to determine water availability and licence restrictions. In certain areas, resource concerns over groundwater mean that the standard water resource availability colours have been overridden.There are no large areas of principal aquifer in the Soar catchment, hence GWMUs are not required. Map 3 presents the typology and extent of the aquifers across the catchment. Within the neighbour catchment Lower Trent and Erewash, the Diseworth GWMU (Sherwood Sandstone) is quantified as having water available for licensing. Geographically, this extends into the Soar catchment, but has wholly been assessed as part of the Lower Trent and Erewash ALS.There is potential water availability from other geological formations within the Soar catchment. The vast majority of bedrock outcrop relates to the Mercia Mudstone group. These are predominantly clay based and provide very inconsistent resources. However, locally important sources may be available subject to environmental assessment and considered on an individual case basis.Proposals for abstraction from the Superficial Deposits will also be considered, but where the groundwater resources are found to be in continuity with the surface water course, these will be subject to a hands off flow (HoF).Further information about resource availability from groundwater can be found in Section 3.2 2.4 Resource reliabilityIf you want to apply for a licence, it is worth considering the reliability of your abstraction. By assessing the quantity of water available at different flows it is possible to see when there is a surplus or deficit of water and the associated reliability of an abstraction. This is an indication only; actual reliability of a licence will be discussed when you apply.Map 4 gives an indication of the resource availability for consumptive abstraction in Soar ALS area expressed as a percentage of time.14 of 28Map 3. Typology and extent of the aquifers across the Soar catchment.15 of 28Map 4. Water resource reliability of the Soar ALS expressed as percentage of time available.16 of 282.5 Other considerations for availability and reliabilityAs explained in the Introduction section, we may have to add constraints to licences such as ‘hands off flow’ (HoF) conditions to protect the environment and the rights of other abstractors. HoF values applicable to watercourses across the Soar catchment are stated in Table 3.In addition, new licences within an ALS are usually given a Common End Date (CED), which allows them to be reviewed at the same time. The next CED for this ALS is 31st March 2037.2.6 ImpoundmentsApplications for impoundments will be dealt with on a case by case basis. More information may be found on our water management web pages on gov.uk 3. How we manage abstraction in the Soar ALS area3.1 Assessment points (surface water)We assess surface water flows at Assessment points (APs), which are significant points on a river, often where two major rivers join or at a gauging station. APs cover multiple surface water bodies. Where groundwater abstractions directly impact on surface water flows, the impact is measured at the surface water AP.Table 3 gives an indication of how much water is available for further abstraction and the associated restrictions we may have to apply to new and varied abstraction licences from the main river. Tributaries to the main river may be subject to different restrictions and quantities and will be assessed locally on a case by case basis.Each HoF is linked to an AP and is dependent on the resource availability at that AP. In some cases additional restrictions may apply to licences where there is a more critical resource availability downstream to protect the ecological requirements of the river. This is detailed in the last column of Table 3 if applicable.All abstraction licence applications are subject to an assessment to take account of any local and downstream issues and may be subject to further restrictions.In cases where there is water available at all flows we may apply a Minimum Residual Flow (MRF) to protect very low flows. We will decide this on a case by case basis.Reading from top to bottom in Table 3 are the APs in the Soar ALS area. Reading across the columns you can see the potential HoF that may be applied to a licence, the number of days water may be available under this restriction and the approximate volume of water in Ml/d (Mega litres per day) that may be available.Across the Trent catchment the water resource management strategies are driven by the need to protect flows at the fluvial end point of the River Trent at North Muskham gauging station. The need to protect flows entering the tidal River Trent and navigation requirements in the fluvial River Trent has concluded that in order to provide this protection, a HoF of 2650 Ml/d at North Muskham (equivalent flow at Q90) is needed to be maintained.17 of 28Therefore, throughout the Soar catchment all HoFs have been set at local gauging stations but at flows which are equivalent to or higher than 2,650 Ml/d at North Muskham gauging station. In the Soar catchment, the need to protect flows entering the River Trent has meant we have applied an equivalent HoF of 340 Ml/d (flow at Q90) as measured at Kegworth gauging station to all APs to ensure adequate protection is given to the HoF set at North Muskham. As a result, in the Soar catchment 17 Ml/d is available which has been assigned to the whole of the catchment. This, however, does not guarantee that this quantity is available at any one particular assessment point throughout the catchment and schemes will be assessed on a case by case basis.Groundwater licences which are not from principal aquifers described in Section 2.3 will be individually assessed. Where they are linked to surface water, the surface water restrictions described below may be applied.Parts of the Soar catchment are discharge rich so the strategy outlined below depends on the resource situation remaining as it is currently. Any changes to major abstractions from or discharges to the catchment may result in a change in this licensing strategy or to the volumes of water available.In addition, we may ask applicants to provide additional information about any likely environmental impact of the proposed abstraction. This will be assessed on a case by case basis.We have also an obligation to protect all Habitats Directive sites and implement the needs of the Eels Regulations 2009, as amended in 2011. Conditions may be added to new licences and variations to ensure the protection of fish, other aquatic wildlife and protected sites.3.1.1 Our licensing strategy across the Soar ALS areaIn addition to the above considerations, below is our strategy referred to in Table 3 when processing new abstraction applications or renewing the existing licences depending on water availability status of each AP catchment and in which AP catchment the location of abstraction lies.(1) For existing licences, the renewal of licences will be considered subject to the following criteria and local considerations:-environmental sustainability is not in question-there is a continued justification of need for the water-the water is used efficientlyWe will also take into account any objections received to renewal of the licence.(2) Availability of water in the catchment and at each AP is overall subject to a HoF of 340 Ml/d and the following conditions:-No new unconstrained abstraction will be granted-Groundwater licences will be considered for small abstractions on a case by case basis depending on the scale and impact on surface water-There is a time limit of 31st March 203718 of 28Table 3 Summary of licensing approach for the APs of Soar ALS area.APNameWater Resource AvailabilityHoF Restriction (Ml/d) and critical APNo. of days per annum abstraction may be availableApprox. volume available at restriction (Ml/d)Is there a gauging station at this AP?1UpperRiver Soar – LittlethorpeConditional availability (1&2 above)340.0 (Q90) AP8On average 32917Yes2River SenceConditional availability (1&2 above)340.0 (Q90) AP8On average 329Yes3River EyeConditional availability (1&2 above)340.0 (Q90) AP8On average 329No4River Wreake\*Conditional availability (1&2 above &\*)340.0 (Q90) AP8On average 329Yes5Rothley BrookConditional availability (1&2 above)340.0 (Q90) AP8On average 329Yes6MiddleRiver Soar –Pillings Lock(Barrow on Soar)\*\*Conditional availability (1&2 above &\*\*)340.0 (Q90) AP8On average 329Yes7Kingston BrookConditional availability (see 1&2)340.0 (Q90) AP8On average 329No8LowerRiver Soar –KegworthConditional availability (see 1&2)340.0 (Q90) AP8On average 329Yes\* The exception to this is the Welby Brook (WFD waterbody GB104028047570). This tributary catchment has issues with low flow and has been closed on a precautionary basis.\*\* The exception to this is the Quorn Brook (WFD waterbody GB104028047060). This tributary catchment has issues with water regulation and low flow and has been closed on a precautionary basis.3.2 Managing Groundwater19 of 28As explained in Section 2.3, for Principal aquifers we may divide the area into groundwater management units (GWMUs), which are sub-divisions of the groundwater bodies. In these cases we use the information and assessments on these units to determine water availability and licence restrictions.Where groundwater abstractions directly impact on surface water flows, including reduction of base flow, the impact is measured at the surface water AP. In these cases, restrictions may be applied to licences, such as Hands off Level (HoL) or Hands off Flow (HoF) conditions. The HoL is a groundwater level below which an abstractor is required to reduce or stop abstraction. The HoF is applied when flows fall below a certain rate in a connected watercourse. Other restrictions may apply where availability is limited or to protect the environment, for example to prevent saline intrusion.Licence restrictions on groundwater abstractions in the Soar ALS areaAs mentioned in Section 2.3 there are no large areas of principal aquifer in the Soar catchment, hence GWMUs are not required. However, there might be local resources available which are subject to environmental assessment and will be considered on an individual case basis. Proposals for abstraction from these resources where the groundwater are found to be in continuity with the surface water course, will be subject to a hands of flow. Table 4 details groundwater availability status within Soar ALS area and the restrictions that might be applied to abstractions likely to impact on groundwater dependent environments.Table 4: Licence restrictions on groundwater abstractions in the Soar ALS area.Groundwater BodyWater Resource StatusApproximate Volume of water available (Ml/d)Licence RestrictionSoar Secondary Combined (Mercia Mudstone Group)Water Available for licensing-Further abstractions from superficial deposits are available. A HOF of 340 Ml/d will be applied to applications found to be in continuity with a surface watercourseSuperficial DepositsWater Available for licensing-Further abstractions from superficial deposits are available. A HOF of 340 Ml/d will be applied to applications found to be in continuity with a surface watercourse3.3 Artificial and Heavily modified water bodies (HMWBs)Artificial water bodies describe water bodies that are entirely man-made for example canals. They also include lakes where no significant water body existed previously (gravel pits) or impounded rivers or lakes with an artificial catchment (reservoirs). A heavily20 of 28modified water body is an existing body of water that has had its original appearance significantly changed to suit a specific purpose. For example, a river water body that has undergone extensive re-alignment for navigation, or a flood defended coastline.Artificial water bodies and HMWBs are considered together and in the same way. These water bodies can be classified for many reasons, but for water resources purposes they are classified if they may contain a lake and/or reservoir that influence the downstream flow regime of the river or groundwater level. The downstream ‘flow modified’ water bodies are also classified as heavily modified. They are designated for water resource purposes if the flow regime has been altered by flow regulation/augmentation. The availability of water in water resource designated HMWBs will depend on the compensation release and/or operating agreements that impact on these water bodies.Within the Soar ALS area, there are a number of waterbodies that are designated Artificial or HMWBs. Blackbrook catchment is designated a HMWB that itself include Blackbrook reservoir. There are also Cropston and Swithland reservoirs within Quorn Brook catchment that are artificial waterbodies. Together, these three reservoirs are known as the Charnwood reservoirs and they provide storage for drinking water and are all designated artificial waterbodies. As they are impoundments, they obstruct the watercourses and thus alter the flow regime downstream of these impoundments. This affects the water availability within these catchments. Please refer to section 3.1 above for further details. The Quorn Brook catchment has been closed to further consumptive abstraction as the waterbody is failing to meet certain elements of the WFD.3.4 Protected areasUK law provides a very high level of protection to two types of designated sites due to their special environment. These are:• Special Areas of Conservation (SAC), which contribute to biodiversity by maintaining and restoring habitats and species;• Special Protection Area (SPA), which provides protection to birds and their nests, eggs and habitatsRamsar sites and Sites of Special Scientific Interest (SSSI) also carry a high level of environmental importance.Across Soar ALS area there are three SSSIs: Blackbrook Reservoir SSSI, Buddon Wood and Swithland Reservoir SSSI, and Bradgate Park and Cropston Reservoir SSSI. All reservoirs were originally built and are still managed for public water supply. All three reservoirs have been notified for their marginal and inundation plant communities. The inundation plant communities are characteristic of ***nutrient*** poor lake waters and high winter / low summer water levels. The interest feature has been assessed as being in unfavourable condition due to the water quality and water level management. Blackbrook and Cropston reservoir SSSIs are stocked with brown trout but also supports crayfish Austropotambius pallipes. It is isolated from populations of the non-native American crayfish Pacifastacus leniusculus, the carrier of a fungal spore which has devastated populations of the native crayfish.21 of 28Map 5: Designated sites across the Soar ALS area.22 of 284. Managing existing licences4.1 Water rights tradingWe want to make it easier to trade water rights. A water rights trade is where a person sells all or part of their water right, as defined by their abstraction licence(s), to another person on a permanent or temporary basis. In the majority of cases a trade will involve a change in abstraction location and/or use which we will need to approve through the issue or variation of abstraction licences.In licensing trades, as with new abstraction licences, we need to make sure that we do not cause any deterioration in water body status both within the water body / bodies where the trade will take place and to downstream water bodies.Guide to the potential trading in water bodies of Soar ALSTable 5 provides a guide to the potential for trading in water bodies of Soar ALS water resource availability colour, as shown on Map 2.To find out more about licence trading please go to our water management web pages on gov.ukTable 5 Licence trading information associated with water resource availability colours in Soar ALS area.ALS water resource availability colourOur approach to tradingHigh hydrological regimeOpportunities for trading water rights will be limited.Water available for licensingAllow trades of recent actual abstraction and licensed abstraction, but little demand for trading expected within water body as water available for new abstractions.Restricted water available for licensingThere may be opportunities for licence holders to trade up to their full licensed quantities, but the quantities of water available to trade may be restricted once levels of actual abstraction reach sustainable limits. We will not permit licence trades in water bodies where we are taking action to prevent deterioration unless the trade is consistent with achieving water body objectives.Water not available for licensingWe will only trade up to recent actual abstraction but no increase in recent actual abstraction is permitted in water body. Licensed abstraction will be recovered for the environment.23 of 28ALS water resource availability colourOur approach to tradingHMWBsOpportunities for trading will depend on local operating agreements and local management.4.2 Taking action on unsustainable abstractionWe need to take action on unsustainable abstraction causing diversion from the aims of the WFD i.e a situation where flow does not support good ecological status, or potential if the water body is heavily modified. Action is also needed to manage the risk of deterioration or correct instances of serious damage. The actions that we may take include:- Actions under the water industry national environment programme (WINEP)- Revocations of licences for non-use- Reductions of under-used and unused licences- Changes to time-limited licences4.2.1 Action being taken on unsustainable abstraction in the Soar ALS areaWithin the Soar ALS area currently there is only one Restoring Sustainable Abstraction (RSA) scheme ongoing. This project concerns the Charnwood reservoirs (Blackbrook, Cropston and Swithland) and have been investigated to assess the impact of abstraction on the SSSIs at the reservoir locations. These reservoirs have all been designated SSSIs principally because of the marginal vegetation. Therefore, the selected solution for the RSA programme is to add drawdown curves to the licences to enable better management of reservoir levels to benefit the marginal vegetation. The drawdown curves will ensure that the reservoirs are drawdown from 1st May to expose the marginal vegetation but from 1st September the reservoirs are allowed to refill so that the marginal vegetation becomes inundated and the reservoirs are full by 1st April.At Cropston and Swithland reservoirs the solution is also to add a requirement for compensation flows out of Cropston reservoir into the Quorn Brook (initially for 1 Ml/d, with the potential to increase to 2 Ml/d) and out of Swithland reservoir into the Quorn Brook (initially for 2 Ml/d, with the potential to increase to 4 Ml/d). This will benefit the aquatic environment of the Quorn brook downstream of the reservoirs which currently only receive water from the reservoirs when they overspill.4.2.2 Action being taken on unsustainable groundwater abstraction in the Soar ALS areaIf groundwater abstractions are found to impact the environment, we will seek to reduce or cease certain abstractions. This is aimed to prevent deterioration to groundwater aquifers and the surface waterbodies which are fed by these aquifers. There are no ongoing projects in this regards on the GWBs in the Soar ALS area.4.3 Regulating previously exempt abstractionAs the abstraction licensing system in England and Wales developed over the past 50 years, certain abstractions have remained lawfully exempt from licensing control. This24 of 28meant that unlimited supplies of water could be abstracted, even in areas that are water stressed, irrespective of availability and without regard to impacts on the environment or other abstractors.Following two public consultations Government have introduced new Regulations that took effect on 1st January 2018. The Water Resources (Transitional Provisions) Regulations 2017 have removed the majority of previous exemptions from licensing control, and current exempt abstractors will now require a licence to lawfully abstract water (known as New Authorisations). This is to help balance the needs of all abstractors and the environment. This will enable more effective water management by ensuring that all significant activities influencing the availability of water and its impact on the environment are undertaken in a sustainable way.The main activities that are impacted by the changes include:• transferring water from one inland water system to another in the course of, or as the result of, operations carried out by a navigation, harbour or conservancy authority;• abstracting water into internal drainage districts;• dewatering mines, quarries and engineering works, except in an emergency;• warping (abstraction of water containing silt for deposit onto ***agricultural*** land so that the silt acts as a fertiliser);• all forms of irrigation (other than spray irrigation, which is already licensable), and the use of land drainage systems in reverse (including transfers into managed wetland systems) to maintain field water levels;• abstracting within currently geographically exempt areas, including some rivers close to the borders of Scotland; and• abstractions covered by Crown and visiting forces (other than Her Majesty the Queen and the Duchies of Cornwall and Lancaster in their private capacity).Where we have details of these abstractions, we have included them in our assessments to consider how they impact on the catchment.25 of 285. List of abbreviationsALSAbstraction Licensing Strategy.APAssessment Point.CEDCommon End Date.DefraDepartment of Environment Food and Rural Affairs.EFIEcological Flow Indicator.GEPGood Ecological Potential.GESGood Ecological Status.GWGroundwater.GWMUGroundwater Management Unit.HMWBHeavily Modified Water Body.HoFHands off Flow.HoLHands off Level.Ml/dMegalitres per day.SACSpecial Areas of Conservation.SPASpecial Protection Areas.26 of 28SSSISites of Special Scientific Interest.UKTAGUnited Kingdom's Technical Advisory Group.WBWater body.WFDWater Framework Directive27 of 286. GlossaryAbstractionRemoval of water from a source of supply (surface or groundwater).Abstraction licenceThe authorisation granted by the Environment Agency to allow the removal of water.Assessment pointA significant point on a river, often where two major rivers join or at a gauging station.CatchmentThe area from which precipitation and groundwater will ***collect*** and contribute to the flow of a specific river.Consumptive abstractionAbstraction where a significant proportion of the water is not returned either directly or indirectly to the source of supply after use. For example for the use of spray irrigation.DischargeThe release of substances (for example, water, treated sewage effluent) into surface waters.Environmental flow indicatorFlow indicator to prevent environmental deterioration of rivers, set in line with new UK standards set by UKTAG.GroundwaterWater that is contained in underground rocks.Hands off flowA condition attached to an abstraction licence which states that if flow (in the river) falls below the level specified on the licence, the abstractor will be required to reduce or stop the abstraction.ImpoundmentA structure that obstructs or impedes the flow of inland water, such as a dam, weir or other constructed works.Surface waterThis is a general term used to describe all water features such as rivers, streams, springs, ponds and lakes.Water bodyUnits of either surface water or groundwater which we use to assess water availability.28 of 28Would you like to find out more about us or your environment?Then call us on03708 506 506 (Monday to Friday, 8am to 6pm)[*emailenquiries@environment-agency.gov.ukor*](mailto:emailenquiries@environment-agency.gov.ukor) visit our website[*www.gov.uk/environment-agencyincident*](http://www.gov.uk/environment-agencyincident) hotline0800 807060 (24 hours)floodline0345 988 1188 (24 hours)Find out about call charges ([*www.gov.uk/call-charges*](http://www.gov.uk/call-charges))Environment first:Are you viewing this onscreen? 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[***Federal Register: Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rules To List the Bi-State Distinct Population Segment of Greater Sage-Grouse With Section 4(d) Rule and To Designate Critical Habitat Pages 18054 - 18099 [FR DOC #2020-06384]***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5YJN-WJK1-F0YC-N40G-00000-00&context=1516831)

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Washington: Office of the Federal Register has issued the following notice:

Department of the Interior-----------------------------------------------------------------------Fish and Wildlife Service-----------------------------------------------------------------------50 CFR Part 17Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rules To List the Bi-State Distinct Population Segment of Greater Sage-Grouse With Section 4(d) Rule and To Designate Critical Habitat; Proposed RuleFederal Register / Vol. 85 , No. 62 / Tuesday, March 31, 2020 / Proposed Rules[[Page 18054]]-----------------------------------------------------------------------DEPARTMENT OF THE INTERIORFish and Wildlife Service50 CFR Part 17[Docket Nos. FWS-R8-ES-2018-0106 and FWS-R8-ES-2018-0107; FF09E21000 FXES11110900000 201]RINs 1018-BD87 and 1018-BD88Endangered and Threatened Wildlife and Plants; Withdrawal of the Proposed Rules To List the Bi-State Distinct Population Segment of Greater Sage-Grouse With Section 4(d) Rule and To Designate Critical HabitatAGENCY: Fish and Wildlife Service, Interior.ACTION: Proposed rule; withdrawal.-----------------------------------------------------------------------SUMMARY: We, the U.S Fish and Wildlife Service (Service), withdraw the proposed rule to list the Bi-State distinct population segment (DPS) of greater sage-grouse (Centrocercus urophasianus) in California and Nevada as threatened under the Endangered Species Act of 1973, as amended (Act). We concurrently withdraw the proposed rule under section 4(d) of the Act and the proposed rule to designate critical habitat for the DPS. These withdrawals are based on our conclusion that the threats to the DPS as identified in the proposed listing rule no longer are as significant as believed at the time of publication of the 2013 proposed rule. We find the best scientific and commercial ***data*** available indicate that the threats to the DPS and its habitat, given current and future conservation efforts, are reduced to the point that the DPS does not meet the Act's definition of an ``endangered species'' or of a ``threatened species.''DATES: The U.S Fish and Wildlife Service is withdrawing proposed rules published on October 28, 2013 (78 FR 64328 and 64358) as of March 31, 2020.ADDRESSES: Relevant documents are available on the internet at either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107 on [*http://www.regulations.gov*](http://www.regulations.gov). Relevant documents used in the preparation of this withdrawal are also available for public inspection, by appointment, during normal business hours at the Reno Fish and Wildlife Office (see FOR FURTHER INFORMATION CONTACT).FOR FURTHER INFORMATION CONTACT: Lee Ann Carranza, Deputy Field Supervisor, Reno Fish and Wildlife Office, 1340 Financial Boulevard, Suite 234, Reno, NV 89502; telephone 775-861-6300. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800-877-8339.SUPPLEMENTARY INFORMATION: Executive Summary Why we need to publish this document. Under the Act, a species may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. We issued a proposed rule to list a distinct population segment (DPS) of greater sage-grouse in California and Nevada (known as the Bi-State DPS) in 2013. However, this document withdraws that proposed rule because we now determine that threats identified in the proposed rule have been reduced such that listing is not necessary for this DPS. Accordingly, we also withdraw the proposed rule under section 4(d) of the Act and the proposed critical habitat designation. The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that threats have been reduced such that listing is not necessary for the Bi-State DPS of greater sage-grouse. Peer review. In accordance with our joint policy on peer review published in the Federal Register on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of five appropriate specialists regarding the species report. We received responses from three specialists, which informed this finding. The purpose of peer review is to ensure that our listing determinations, critical habitat designations, and 4(d) rules are based on scientifically sound ***data***, assumptions, and analyses. The peer reviewers have expertise in the biology, habitat, and threats to the greater sage-grouse.Acronyms and Abbreviations Used in This Document We use many acronyms and abbreviations throughout this document. To assist the reader, we provide a list of these here for easy reference:ac = acresAct or ESA = Endangered Species Act of 1973, as amended (16 U.S.C 1531 et seq.)BLM = Bureau of Land ManagementBSAP = Bi-State Action PlanBSLPG = Bi-State Local Planning GroupBSLSP = Bi-State Lek Surveillance ProgramCDFW = California Department of Fish and Wildlife (formerly California Department of Fish and Game (CDFG))CFR = Code of Federal RegulationsCOT = Conservation Objectives TeamCPT = conservation planning toolCRI = credible intervalsDPS = distinct population segmentEOC = Executive Oversight CommitteeFR = Federal Registerha = hectaresHTNF = Humboldt-Toiyabe National ForestIPM = integrated population modelLADWP = Los Angeles Department of Water and PowerLRMP = land resource management planNDOW = Nevada Department of WildlifeNEPA = National Environmental Policy Act (42 U.S.C 4321 et seq.)NFMA = National Forest Management Act (16 U.S.C 1600 et seq.)NRCS = Natural Resources Conservation ServiceOHV = off-highway vehiclePECE = Policy for Evaluation of Conservation Efforts When Making Listing DecisionsPEIS = Programmatic Environmental Impact StatementPMU = population management unitRHA = rangeland health assessmentRMP = resource management planService = U.S Fish and Wildlife ServiceTAC = Technical Advisory CommitteeUSDA = U.S Department of AgricultureUSFS = U.S Forest ServiceUSGS = U.S Geological SurveyWAFWA = Western Association of Fish and Wildlife AgenciesWNv = West Nile virusPrevious Federal Actions The Bi-State DPS of the greater sage-grouse has a long and complex rulemaking history. Here, we will discuss only the major Federal actions related to the species. For a detailed description of previous Federal actions, please refer to the previous withdrawal of the proposed listing rule, published on April 23, 2015 (80 FR 22828), and the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE) analysis we prepared as a supporting document for this determination (Service 2019, pp. 1-6). On October 28, 2013, we published a proposed rule to list the Bi-State DPS as a threatened species with a 4(d) rule (78 FR 64358). On that same day, we published a proposed rule to designate critical habitat for the Bi-State DPS (78 FR 64328). On April 23, 2015, we withdrew the proposed listing rule, the proposed 4(d) rule, and the proposed critical habitat rule (80 FR 22828). This withdrawal[[Page 18055]]was based on our conclusion that the threats to the DPS as identified in the proposed listing rule were no longer as significant as believed at the time of publication of the proposed rule. We found that the best scientific and commercial ***data*** available indicated that the threats to the DPS and its habitat, given current and future conservation efforts as analyzed under PECE, were reduced to the point that the DPS did not meet the Act's definition of an ``endangered species'' or of a ``threatened species.'' On March 9, 2016, Desert Survivors, the Center for Biological Diversity, WildEarth Guardians, and Western Watershed Project filed suit in the U.S District Court for the Northern District of California. The suit challenged the withdrawal of the proposal to list the Bi-State DPS. On May 5, 2018, the court issued a decision. The April 23, 2015, withdrawal was vacated and remanded to the Service for further consideration. The court's action reinstated the prior proposed rules to list and to designate critical habitat for the Bi-State DPS, thereby returning the process to the proposed rule stage, and the status of the Bi-State DPS effectively reverted to that of a species proposed for listing for the purposes of consultation under section 7 of the Act. The court's action also reinstated the proposed 4(d) rule and the proposed critical habitat designation for the Bi-State DPS. On April 12, 2019, we published in the Federal Register (84 FR 14909) a document that announced that the proposed rules were reinstated and the public comment periods were reopened for 60 days and that we would publish a final listing determination on or before October 1, 2019. On October 1, 2019, we announced a 6-month extension of the final listing determination to April 1, 2020 (84 FR 52058). We took that action based on substantial disagreement regarding the sufficiency and accuracy of the available ***data*** relevant to the proposed listing, which made it necessary to solicit additional information. That document reopened the public comment period on the proposed listing and critical habitat rules for an additional 30 days.Supporting Documents We prepared a species report for the Bi-State DPS (Service 2020, entire). The species report represents a compilation of the best scientific and commercial ***data*** available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species. The Service sent the species report to five independent peer reviewers and received three responses. The Service also sent the species report to all pertinent Federal, Tribal, and State partners, including scientists with expertise in sage-grouse and sage-brush habitat in the Bi-State area. We received reviews from six partners (Humboldt-Toiyabe National Forest (HTNB), Inyo National Forest, two Bureau of Land Management (BLM) offices: Bishop and Carson City, the California Department of Fish and Wildlife (CDFW), and the Nevada Department of Wildlife (NDOW)). These comments have been incorporated into the species report and informed this document.Summary of Changes From the Proposed Rule Based upon our review of the public comments, Federal and State agency comments, peer review comments, issues addressed at the public hearings, and any new relevant information that became available since the publication of the proposal and including new relevant information that has become available since the prior withdrawal decision, we reevaluated our proposed listing rule and made changes as appropriate in this withdrawal. Other than minor clarifications and incorporation of additional information on the species' biology and populations, this determination differs from the proposal in the following ways: (1) A different status determination. Based on our analyses of the potential threats to the species, and our consideration of partially completed, ongoing and future conservation efforts (as outlined below in Policy for Evaluation of Conservation Efforts When Making Listing Decisions), we have determined that the Bi-State DPS should not be listed as a threatened species. Specifically, we have determined that conservation efforts (as outlined in the Bi-State Action Plan (BSAP), Agency commitment letters, and our detailed PECE analysis (all of which are available at either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107 on   [*http://www.regulations.gov*](http://www.regulations.gov) as well as the Technical Advisory Committee (TAC) comprehensive project database)) will continue to be implemented because (to date) we have a documented track record of active participation and implementation by the signatory agencies and commitments to continue implementation into the future. Conservation measures, such as (but not limited to) pinyon-juniper removal, establishment of conservation easements for critical brood-rearing habitat, cheatgrass (Bromus tectorum) removal, permanent and seasonal closure of roads near leks, removal and marking of fencing, and restoration of riparian/meadow habitat have been occurring over the past decade, are currently occurring, and have been prioritized and placed on the agencies' implementation schedules for future implementation. Agencies have committed to remain participants in the BSAP and to continue conservation of the DPS and its habitat. Additionally, the BSAP has sufficient methods for determining the type and location of the most beneficial conservation actions to be implemented, including continued development of new population and threats information in the future that will guide conservation efforts. As a result of these actions, this document withdraws the proposed rules as published on October 28, 2013 (78 FR 64328; 78 FR 64358). We have also updated our Significant Portion of the Range analysis based on a recent court finding regarding the policy. (2) Addition of PECE analysis. This document includes the Policy for Evaluation of Conservation Efforts When Making Listing Decisions section, which includes some information presented in the Available Conservation Measures section of the proposed listing rule. (3) Population impacts. This document includes a discussion of the impacts of small population size and population isolation on the Bi-State DPS. (4) New information. Following publication of the proposed listing rule, we received new information pertinent to this rulemaking action. Some of the information was in response to our request for scientific peer review of the proposed listing rule, while other information was a result of new literature now available, or updated regulations. We incorporated all new information into the Species Report (Service 2020, entire), which is available on the internet at   [*http://www.regulations.gov*](http://www.regulations.gov) under either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107, as well as within this document where appropriate. New information includes (but is not limited to): A variety of biological or habitat clarifications, such as hen movement distances, nesting success, and invasive plant species influence on sagebrush-habitat dynamics. Updated trend and population analyses. Multiple new papers examining the population dynamics and trends of the Bi-State DPS (Coates et al. 2014, entire; Coates et al. 2018, entire; Mathews et al. 2018, entire; Coates et al.[[Page 18056]]2020, entire). These studies are incorporated into the Species Report and discussed throughout this document. Two genetic evaluations, one of which concluded there are three or four unique genetic clusters within the Bi-State area (Oyler-McCance et al. 2014, p. 8), and a second that concluded there were five unique genetic clusters (Tebbenkamp 2014, p. 18). Tebbenkamp (2014) did not evaluate the Pine Nut population; thus, six populations may have been identified by Tebbenkamp (2014) had the Pine Nut population ***data*** been available. New information on the effectiveness of pinyon-juniper removal has become available in recent years (Prochazka et al. 2017, entire; Severson et al. 2017, entire; Sandford et al. 2017, entire; Coates et al. 2017b, entire; Olsen 2019, entire). These studies are incorporated into the Species Report and discussed throughout this document. (5) New ESA factor D analysis. In the 2013 proposed listing rule, we analyzed the adequacy of existing regulatory mechanisms in a separate section. Here, we evaluate the effects of existing regulatory mechanisms within each threat analysis, rather than evaluating regulatory mechanisms in a separate section, so that it is clear how the existing regulatory mechanisms relate to the stressor being analyzed. (6) Significant portion of the range (SPR) analysis. Since 2013, we have a new policy regarding the Service's interpretation of the phrase ``significant portion of the range'' (79 FR 37578; July 1, 2014). We also have new guidance regarding application of that policy (Service 2017, entire), which was published subsequent to the 2015 withdrawal of the proposed rule. Additionally, certain parts of the policy have been invalidated by court orders. We have completed our SPR analysis for the Bi-State DPS in accordance with the 2014 policy and the 2017 guidance as further refined by applicable court decisions.Background In our 12-month findings on petitions to list three entities of sage-grouse (75 FR 13910, March 23, 2010), we found that the Bi-State population of greater sage-grouse in California and Nevada meets our criteria to qualify as a DPS of the greater sage-grouse under Service policy (61 FR 4722, February 7, 1996). We reaffirmed this finding in the October 28, 2013, proposed listing rule (78 FR 64358) and do so again in this document. This determination is based principally on genetic information (Benedict et al. 2003, p. 308; Oyler-McCance et al. 2005, p. 1307), where the DPS was found to be both markedly separated and significant to the remainder of the greater sage-grouse taxon. The Bi-State DPS defines the far southwestern limit of the species' range along the border of eastern California and western Nevada (Stiver et al. 2006, pp. 1-11; 71 FR 76058, December 19, 2006). Although the Bi-State DPS is a genetically unique and markedly separate population, the DPS has similar life-history and habitat requirements to the greater sage-grouse throughout the rest of its range. In the October 28, 2013, proposed listing rule (78 FR 64358), the species report, and this document, we use information specific to the Bi-State DPS where available but still apply scientific management principles for greater sage-grouse that are relevant to the Bi-State DPS's management needs and strategies. This practice is followed by the wildlife and land management agencies that have responsibility for management of both the DPS and its habitat. A detailed discussion of the Bi-State DPS's description, taxonomy, habitat (sagebrush ecosystem), seasonal habitat selection, life-history characteristics, home range, life expectancy and survival rates, historical and current range distribution, population estimates and lek (sage-grouse breeding complex) counts, population trends, and land ownership information is available in the species report (Service 2020, entire). The species report represents a compilation of the best scientific and commercial ***data*** available concerning the status of the Bi-State DPS, including the past, present, and future threats to this DPS. The species report and other materials relating to this final agency action can be found at   [*http://www.regulations.gov*](http://www.regulations.gov) under either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107.Habitat and Life History Sage-grouse depend on a variety of shrub and shrub-steppe vegetation communities throughout their life cycle (Schroeder et al. 2004, p. 364). Sagebrush is the most widespread vegetation in the intermountain lowlands of the western United States and is considered one of the most imperiled ecosystems in North America (West and Young 2000, p. 259; Knick et al. 2003, p. 612; Miller et al. 2011, p. 147). Most species of sagebrush are killed by fire; historical fire-return intervals are estimated to be as long as 350 years (West 1983, p. 341; Miller and Eddleman 2000, p. 17; West and Young 2000, p. 259; Baker 2011, pp. 191-192). Natural sagebrush recolonization in burned areas depends on the presence of adjacent live plants for a seed source or on the seed bank, if present, and requires from decades to over a century for full recovery (Miller and Eddleman 2000, p. 17; Baker 2011, pp. 194-195). Sage-grouse require large, interconnected expanses of sagebrush with healthy, native understories, in part to accommodate their seasonal shifts in habitat selection within the sagebrush ecosystem (Service 2020, p. 11). Sage-grouse exhibit strong site fidelity (loyalty to a particular area) to migration corridors and seasonal habitats, including breeding, nesting, brood-rearing, and wintering areas; they exhibit this fidelity even when a particular area may no longer be of value, limiting the species' adaptability to habitat changes (Service 2020, p. 11). However, recent research has suggested that this high degree of site fidelity may be more flexible than has traditionally been considered, at least with respect to certain restoration actions (e.g , tree removal; Sandford et al. 2017, p. 64; Severson et al. 2017, p. 55). During the spring breeding season, male sage-grouse gather to perform courtship displays at leks or traditional strutting grounds. Areas of bare soil, short-grass steppe, windswept ridges, exposed knolls, or other relatively open sites typically serve as leks (Patterson 1952, p. 83; Connelly et al. 2004, p. 3-7 and references therein). The proximity, configuration, and abundance of nesting habitat are key factors influencing lek location (Connelly et al. 1981, pp. 153-154; Connelly et al. 2000a, p. 970). Leks can be formed opportunistically at any appropriate site within or adjacent to nesting habitat (Connelly et al. 2000a, p. 970); therefore, lek habitat availability is not considered a limiting factor for sage-grouse (Schroeder et al. 1999, p. 4). Leks range in size from less than 0.04 ha (0.1 ac) to over 36 ha (90 ac) (Connelly et al. 2004, p. 4-3) and can host from a few to hundreds of males (Johnsgard 2002, p. 112). The distances sage-grouse move between seasonal habitats are highly variable across the occupied range (Connelly et al. 1988, pp. 119-121). Migration can occur between distinct winter, breeding, and summer areas or the seasonal-use areas may be variously integrated (e.g , winter and breeding areas may be the same and brood-rearing sites are disjunct). Information available regarding seasonal migrations and migratory corridors for sage-grouse in the Bi-State area is variable. Some local breeding complexes (a general[[Page 18057]]aggregation of birds associated with a particular lek or ***collection*** of leks in relatively close proximity to one another) remain fairly resident throughout the year while others demonstrate a more itinerant nature (Casazza et al. 2009, p. 8). Still, all sage-grouse gradually move from sagebrush uplands to more mesic areas (moist areas such as upland meadows) during the late brood-rearing/summer period (3 weeks post-hatch) in response to summer desiccation of herbaceous vegetation (Connelly et al. 2000a, p. 971; Atamian et al. 2010, p. 1538; Connelly et al. 2011b, pp. 76-77 and references therein; Pratt et al. 2017, p. 635). Brood-rearing foraging habitats with increased perennial forb cover and plant species richness, greater meadow to sagebrush edge (ratio of perimeter to area), and a greater distance from woodlands provide for an increased probability of successful recruitment (Casazza et al. 2011, pp. 162-163). Sage-grouse will use free water, although they do not require it since they obtain water from their food. However, natural water bodies and reservoirs provide mesic areas often rich in succulent forb and insect food sources, thereby attracting sage-grouse hens with broods (Connelly et al. 2004, p. 4-12). Non-migratory sage-grouse populations have been described as those with seasonal movements of less than 10 km (6.2 mi; Connelly et al. 2000a, pp. 968-969), while birds in migratory populations may travel well over 100 km (62 mi) (Tack et al. 2012, p. 65). Despite the documentation of extensive seasonal movements in this species, dispersal (permanent rather than seasonal movement) abilities of sage-grouse to other areas are assumed to be low (Fedy et al. 2012, p. 1066; Tack et al. 2012, p. 65; Davis et al. 2014, p. 716). Sage-grouse dispersal is overall poorly understood and appears sporadic, if not rare (Service 2020, p. 12).Range and Population Estimates The Bi-State DPS of greater sage-grouse historically occurred throughout most of Mono, eastern Alpine, and northern Inyo Counties, California (Hall et al. 2008, p. 97), and portions of Carson City, Douglas, Esmeralda, Lyon, Mineral, and perhaps Storey County in Nevada (Gullion and Christensen 1957, pp. 131-132; Espinosa 2019, pers. comm.). The current range of the DPS in California is presumed to be reduced from the historical range (Leach and Hensley 1954, p. 386; Hall 1995, p. 54; Schroeder et al. 2004, pp. 368-369), but the extent of range loss is not well understood. Current management of the Bi-State DPS employs Population Management Units (PMUs) for Nevada and California as tools for defining and monitoring sage-grouse distribution. The PMU boundaries represent generalized populations or local breeding complexes and were delineated based on aggregations of leks, known seasonal habitats, and telemetry ***data***. Six PMUs were designated for the Bi-State DPS (from north to south): Pine Nut, Desert Creek-Fales, Bodie, Mount Grant, South Mono, and White Mountains (Figure 1; Table 1). These six PMUs represent a combined total of approximately 50 active leks (see Table 1 below; Service 2020, pp. 21-33). Leks are considered either active (e.g , two or more strutting males during at least 2 years in a 5-year period), inactive (e.g , surveyed three or more times during one breeding season with no birds detected and no sign (e.g , droppings) observed), historical (e.g , no strutting activity for 20 years and have been checked according to State protocol at least intermittently), or unknown/pending (e.g , sign was observed, and one or no strutting males observed, or a lek that had activity the prior year but was not surveyed or surveyed under unsuitable conditions during the current year and reported one or no strutting males).BILLING CODE 4333-15-P[[Page 18058]][GRAPHIC] [TIFF OMITTED] TP31MR20.012BILLING CODE 4333-15-C[[Page 18059]] Table 1--Bi-State DPS PMUs, PMU Size, Estimated Suitable Sage-Grouse Habitat, Average Number of Leks, Average Number of Active Leks, and Range of Maximum Males on Leks Within Each PMU (2003-2018) [Number pairs in parentheses are lower and upper limits of the 95 percent credible interval. Area values for ``Total Size'' and ``Estimated Suitable Habitat'' may not sum due to rounding]---------------------------------------------------------------------------------------------------------------- Estimated Total size in suitable Average number Range in PMU hectares habitat in Average number of active leks maximum male (acres) (\*) hectares of leks (\*\*\*) (\*\*\*[dagger]) counts (\*\*\*\*) (acres) (\*\*)----------------------------------------------------------------------------------------------------------------Pine Nut..................... 232,440 77,848 7.3 (2.0, 9.0). 1.8 (0.3, 4.7). 0-67 (574,372) (192,367)Desert Creek-Fales 229,858 105,281 12.8 (8.3, 6.8 (5.0, 9.7). 61-220 [dagger][dagger]. (567,992) (260,155) 15.0).Mount Grant [dagger][dagger]. 282,907 45,786 9.6 (5.0, 11.0) 4.4 (1.3, 7.0). 12-220 (699,079) (113,139)Bodie[dagger][dagger]........ 141,490 105,698 17.3 (12.3, 13.1 (9.7, 137-512 (349,630) (261,187) 20.0). 16.7).South Mono................... 234,508 138,123 15.6 (12.3, 19) 13.3 (11.0, 172-418 (579,482) (341,311) 16.7).White Mountains.............. 709,768 53,452 2 + (not 2 + (not Not available (1,753,875) (132,083) available). available).Total (all PMUs combined).... 1,830,972 526,188 64.6 (41.9, 41.4 (29.3, 427-1,409 (4,524,430) (1,300,238) 76.0). 56.8).----------------------------------------------------------------------------------------------------------------\* BSLPG (2004, pp. 11, 32, 63, 102, 127, 153).\*\* Bi-State TAC (2012, unpublished ***data***); BLM (2014, unpublished ***data***).\*\*\* Derived from Mathews et al. 2018, Table 6 and Figure 17.\*\*\*\* Derived from NDOW and CDFW lek databases. Low and high counts occurred in 2008 and 2012, respectively. However, there was variation in annual peak male counts across PMUs; therefore, column does not sum to total.[dagger] Active--two or more strutting males during at least 2 years in a 5-year period.[dagger][dagger] Part of the North Mono population segment in some early population analyses. Sage-grouse populations in the Bi-State area appear to be isolated to varying degrees from one another (Casazza et al. 2009, entire; Oyler-McCance and Casazza 2011, p. 10; Tebbenkamp 2012, p. 66; Oyler-McCance et al. 2014, p. 8; Tebbenkamp 2014, p. 18). Birds in the White Mountains PMU as well as those in the South Mono PMU are largely isolated from sage-grouse populations in the remainder of the Bi-State DPS (Casazza et al. 2009, pp. 34, 41; Oyler-McCance and Casazza 2011, p. 10; Tebbenkamp 2012, p. 66). Traditionally, the Pine Nut PMU was presumed isolated; however, recent ***data*** show birds are capable of moving south into the Sweetwater Mountains in the Desert Creek-Fales PMU and even further south into the Bodie PMU (USGS 2014b, entire). It is not apparent that birds leaving the Pine Nuts are returning. While adults are unlikely to switch breeding populations, it is likely that genetic material is transferred among these northern populations through the natural movements of young of the year birds, as long as there are established populations available in which to emigrate. However, fine-scale genetic differentiation among sage-grouse populations is at a relatively small geographic scope (approximately 10 km (6 mi)), suggesting dispersal among populations is highly restricted (Jahner et al. 2016, pp. 8-9). Two independent genetic evaluations have concluded there are three or four (Oyler-McCance et al. (2014, p. 8) or five (Tebbenkamp 2014, p. 18) unique genetic clusters in the Bi-State area. The latter study did not evaluate the Pine Nut population (Pine Nut PMU), which has been found to be unique (Oyler-McCance et al. 2014, p. 8). Based on this information, we presume that there are likely three to six populations or groups of birds in the Bi-State area that largely operate demographically independent of one another. Four separate statistical approaches to assessing the population trend of the Bi-State DPS have been conducted, with two of these approaches being repeated following additional years of ***data*** ***collection***. The four approaches are: (1) Connelly et al. 2004; (2) WAFWA 2008, (3) Garton et al. (2011 and 2015); and (4) U.S Geological Survey (USGS) 2014, 2018, and 2019 (Coates et al. 2014, Coates et al. 2018, Mathews et al. 2018; Coates et al. 2020). In 2004, WAFWA conducted a partial population trend analysis for the Bi-State area (Connelly et al. 2004, chapter 6). The WAFWA recognizes four populations of sage-grouse in the Bi-State area, which represent the same overall extent delineated by the six PMUs described in the 2012 BSAP and this document. Two of the WAFWA populations (North Mono Lake and South Mono Lake) had sufficient ***data*** for trend analysis (Connelly et al. 2004, pp. 6-60 to 6-62). The North Mono Lake population encompasses the Bodie, Mount Grant, and Desert Creek-Fales PMUs, while the South Mono Lake population encompasses the South Mono PMU. The North Mono Lake population displayed a significant negative trend from 1965 to 2003, and the South Mono Lake population displayed a positive numerical trend, albeit not statistically significant, over this same period (Connelly et al. 2004, pp. 6-69 to 6-70). In 2008, WAFWA (2008, Appendix D) conducted a trend analysis on the same two populations identified above using a different statistical method for the periods from 1965 to 2007, 1965 to 1985, and 1986 to 2007. The trend for the North Mono Lake population, as measured by maximum male attendance at leks, was negative from 1965 to 2007 and 1965 to 1985, but variable from 1986 to 2007; results suggest an increasing trend beginning in about 2000. Results for the South Mono Lake population suggested a negative trend from 1965 to 2007, a stable trend from 1965 to 1985, and a variable trend from 1986 to 2007; these results also suggest a positive trend beginning around 2000. In 2011, Garton et al. (2011, pp. 324-330) used a new approach to conduct a third trend analysis on the same populations used in the two previous WAFWA analyses. In this study, the average number of males per lek in the[[Page 18060]]North Mono Lake population declined by 35 percent and the average number of males per active lek declined by 41 percent from the 1965-1969 to 2000-2007 assessment periods (Garton et al. 2011, p. 324). Based on a reconstructed minimum population estimate for males from 1965 to 2007, the overall population showed irregular fluctuations between peaks in 1970 and 1987 of 520 to 670 males, with lows above 100 and no consistent long-term trend over the 40-year period. In the South Mono Lake population, the average number of males per lek increased by 218 percent from the 1965-1969 to 1985-1989 assessment periods but declined by 49 percent from the 1985-1989 to 2000-2007 assessment periods (Garton et al. 2011, p. 325). Based on reconstructed minimum male counts, the population showed no obvious trend through time with between 200 and 600 males attending leks. The average annual rate of change for both populations suggested that population growth has been, at times, both positive and negative over the past 40 years (Garton et al. 2011, pp. 324-330). In 2015, the researcher updated this analysis by accumulating and analyzing several years of additional of ***data*** (Garton et al. 2015, entire). The updated estimates of population performance largely remained unchanged, while the outlook for persistence improved. For the North Mono Lake population, the estimated minimum number of males increased by 25 percent in 2013 as compared to 2007, while the probability of declining below a (researcher-defined) quasi-extinction threshold decreased (Garton et al. 2015, pp. 13-14). For the South Mono Lake population, the estimated minimum number of males decreased by six percent in 2013 as compared to 2007, although the probability of declining below the quasi-extinction threshold remained generally unchanged. For both populations, the predicted population size in 30 and 100 years increased in 2013 as compared to 2007 (Garton et al. 2011, pp. 376-377; Garton et al. 2015, p. 45). This approach suggests both of these populations will remain relatively small, as they have historically. Modeled weighted probabilities of either population declining below an effective population sizes of 50 individuals in 30 and 100 years are generally low (approximately 8 percent in 30 years and 22 percent in 100 years for both populations; Garton et al. 2015, p. 14). In 2014, the USGS completed an analysis of population trends in the Bi-State area spanning the years 2003 to 2012 (Coates et al. 2014, entire). This analysis, termed an Integrated Population Model (IPM), integrates a variety of ***data*** such as lek counts and vital rates to inform an estimate of lambda (population growth) within the DPS. This analysis evaluated several populations in the Bi-State area including the Pine Nuts (Pine Nut PMU), Fales (California portion of the Desert Creek-Fales PMU), Desert Creek (Nevada Portion of the Desert Creek-Fales PMU), Bodie Hills (Bodie PMU), Parker Meadows (South Mono PMU), and Long Valley (South Mono PMU). It did not evaluate the populations in the Mount Grant or White Mountains PMUs due to ***data*** limitations. Results at that time suggested a stable trend in population growth across the entire Bi-State area between 2003 and 2012 (i.e , both increasing and decreasing at an equal rate; Coates et al. 2014, p. 19). However, the trend in population growth was variable among populations (Coates et al. 2014, pp. 14-15). Since the 2013 proposed rule and the 2015 withdrawal of the proposed listing rule, this analysis has been updated, once using a 13-year dataset spanning the years 2003 through 2015, again using 15 years of ***data*** spanning the years 2003 through 2017, and most recently using an approach that segmented the trends into three time intervals (Coates et al. 2018, entire; Mathews et al. 2018, entire; Coates et al. 2020, p. 8). The later approach was adopted to account for population cycling in sage-grouse; that is, regular periods of growth and decline naturally experienced by sage-grouse rangewide (Garton et al. 2011, p. 338). Indeed, it became apparent after analyzing the 13-year and 15-year datasets that the resulting estimates of population growth rates were being biased low due to an overrepresentation of down cycle years. To alleviate this bias, the latest trend analysis analyzes three time intervals that span one, two, and three cycles, with the start and stop points occurring in the troughs of a cycle. The three time intervals are 1995-2018, 2001-2018, and 2008-2018. Not all populations had sufficient historical ***data*** to evaluate all three time periods and thus analysis was constrained to one or two time periods depending on the population. The most recent analysis includes results from the Mount Grant and White Mountains PMUs, which were previously excluded due to insufficient ***data***. The results of the most recent iteration of the IPM suggests a general pattern of population cycling within an otherwise stable population across the Bi-State DPS with additional evidence that oscillations were influenced by drought conditions in recent years (Coates et al. 2018, pp. 250, 252; Coates et al. 2020, p. 27). Furthermore, variation among individual PMU trends was apparent. The credible intervals (CRIs) reported in this study represent the range of interannual variation in lambda; that is, while annual median population growth for the Bi-State DPS as a whole in the period 1995-2019 is 1.018 (or approximately a 2 percent annual increase), the CRI reported (0.737-1.418) represents the variation in estimated lambda as it cycles from low to high over the study period, rather than the error in the median estimate for any given year. As discussed above, this analysis estimated that, across the Bi-State as a whole, estimated median population growth was 1.018 (CRI = 0.737-1.418) from 1995 through 2018, 0.989 (CRI = 0.677-1.343) from 2001 through 2018, and 0.988 (CRI = 0.704-1.304) from 2008 through 2018 (Coates et al. 2020, Table 3). More specifically, over the past decade only the Bodie Hills and Parker Meadows population demonstrated an average annual positive growth (lambda = 1.061 and lambda = 1.048, respectively). The remaining populations including Mount Grant (lambda = 0.989), Fales, (lambda = 0.965), Pine Nut (lambda = 0.835), Desert Creek (lambda = 0.938), Long Valley (lambda = 0.96), and the White Mountains (lambda = 0.85; Coates et al. 2020, Table 3) averaged slight negative growth, although in each case the 95 percent CRI overlapped 1. Additional analysis suggests that over the past 5 years performance of some individual leks in Long Valley, Fales, Bodie Hills, Mount Grant, and to a lesser extent Sagehen (a population in the South Mono PMU) have been trending (negatively) in a pattern that deviates from the Bi-State at large (Coates et al. 2020, Table 3). This analysis suggests that alternative factors (such as anthropogenic disturbance) and not climate or weather may be acting to influence these specific sites. In general, these four approaches (with some being run more than once) suggest that the trend in population growth within the Bi-State has fluctuated over the past 40 years (both increased and decreased), but over the entire timeframe has remained relatively stable. It appears that some populations (Pine Nut, Mount Grant, Bodie and Desert Creek) display greater variation in population growth (both positive and negative) and that trends among populations are variable (WAFWA 2008, Appendix D; Garton et al. 2011, p. 324, Coates et al. 2020, p. 34). Differences in[[Page 18061]]population trends across the same time periods in the newest study (compared to previous studies) may be due to the fact that the previous studies did not correct for the effects of population cycling (Coates et al. 2020, p. 30). Two studies forecasted the probability that some populations would become extirpated. Garton et al. (2015, p. 41) used their reconstructed male counts to forecast future probabilities of population persistence assuming that past conditions persist into the future (a potentially unrealistic assumption). They conclude that the probabilities of declining below a quasi-extinction threshold (as defined by less than 50 breeding adults per population) were approximately 8 and 22 percent over the next 30 and 100 years, respectively, for both the North Mono Lake and South Mono Lake populations. Furthermore, Garton et al. (2015, p. 41) indicate that long-term persistence (as defined by more than 500 breeding adults per population, a standard number for persistence studies) for both core populations has an estimated 100 percent probability of dropping below this 500-adult threshold in the next 30 years. However, the researchers acknowledge the cyclic nature of sage-grouse populations and note that these populations have already been both above and below this mark in previous years, which is part of that natural cycling. Furthermore, model projections suggest that, both over the near term (30 years) and the long term, the North Mono Lake and South Mono Lake populations have a relative high probability of maintaining between 50 and 500 breeding adults. Thus, in these two core populations immediate genetic concerns (e.g , inbreeding depression) are not apparent, but concern over maintaining long-term genetic and demographic viability remains. Coates et al. (2020, p. 41; Table 1) estimated 10-year extirpation probability based on the number of runs of the IPM where populations went to zero. Probabilities of extirpation ranged greatly for individual PMUs and populations within the PMUs, with highest extirpation probabilities in the Pine Nuts PMU (69.7 percent), the White Mountains PMU (75.1 percent), and the Sagehen and Parker Meadows populations of the South Mono PMU (74.8 and 64.3 percent, respectively) (Coates et al. 2020, Table 1). The Bi-State DPS as a whole has a 1.1 percent extirpation probability in the next 10 years, and the Desert-Creek Fales PMU (9.0 percent), the Bodie Hills PMU (2.4 percent), and the South Mono PMU as a whole (3.8 percent), as well as its largest population (Long Valley; 7.9 percent) all have low probabilities of extirpation (Coates et al. 2020, Table 1). Some of these extirpation probabilities are lower than those calculated by Garton et al. (2015), likely because of differences in methods. The two studies also used different ***data*** sets, with Garton et al. (2015) using reconstructed male counts, and Coates et al. (2020) using multiple ***data*** sources for the IPM, including demographic and lek count ***data***. Thus, even though some populations in this most recent model have high probabilities of extirpation over the next ten years, the DPS as a whole is likely to persist over this time period. These extinction probabilities are created from continuing and forecasting past trends into the future, and thus likely do not reflect the effects of conservation measures started or completed in recent years. Finally, the most recent population study included a PMU distribution analysis to examine short-term changes in population distribution across the Bi-State DPS. This analysis concluded that some parts of the Bi-State DPS are contracting, with the greatest contractions in acres of occupied habitat occurring in the Pine Nut, Fales, Sagehen, and White Mountains populations (Coates et al. 2020, p. 51-54). However, distributional area in the Bodie Hills is increasing (Coates et al. 2020, p. 54). As a whole, the Bi-State DPS showed some evidence of range contraction between 2008 and 2018, though the 95 percent CRI overlapped zero ((-0.07 [-0.19, 0.07]) (Coates et al. 2020, p. 51). Following are brief accounts of each PMU. (1) The Pine Nut PMU has the fewest sage-grouse (Median = 33; CRI = 0-73 individuals in 2018; Coates et al. 2020, p. 33) and the least number of active leks of the Bi-State PMUs. The population in the Pine Nut PMU has some level of connectivity with the Desert Creek-Fales PMU and potentially also with the Bodie and Mount Grant PMUs. The most significant impacts in this PMU are wildfire, invasive species, woodland encroachment, urbanization, and infrastructure. Historically, a single lek in the northern portion of the Pine Nut Mountains (known as Mill Canyon Dry Lake) was the only known consistently active lek in this PMU. From 2000 through 2013, the average male attendance at the Mill Canyon Dry Lake lek was approximately 14 males (Bi-State TAC 2012, p. 17). Since 2013, activity on this lek has essentially ceased. An additional lek in the southern extent of the Pine Nut mountain range has periodically been reported but at this point is not considered active. Aerial surveys over the past few years typically detect birds in this area but actual strutting activity is uncertain. It is unclear if this southern lek has been abandoned, or if the original documentation just captured a rare event or simply misclassified random bird sightings for actual strutting activity. Over the past several years, two newly discovered lek sites in the Buckskin Range appear to be the only reliably active strutting grounds in this PMU (NDOW 2018, unpublished ***data***). Both lek sites are small with two to five males apiece. The most recent results from the IPM suggests population growth in this PMU has declined on average six percent annually over the past decade (2008-2018; Median [lambda] = 0.835; CRI = 0.234-1.94; Coates et al. 2020, p. 41). Ongoing conservation efforts in this PMU include an acquisition of land containing high priority targets identified in the 2012 BSAP, which will help limit the effects of urban and exurban development. This 5,870 ha (14,500 ac) acquisition by the Carson City BLM has been approved and is anticipated to finalize in the spring of 2020. Other completed, ongoing, or planned conservation actions in the Pine Nut PMU include pinyon-juniper removal, horse gathers, removal of nonnative invasive plants, fuel reduction treatments, road closure, and fence removal (Bi-State TAC 2019, entire). (2) The Desert Creek-Fales PMU straddles the Nevada-California border and contains two populations, one in each State. This PMU includes two breeding complexes: Desert Creek (Nevada) and Fales (California). The populations in the Desert Creek-Fales PMU have some level of connectivity with the Pine Nut PMU and potentially also with the Bodie and Mount Grant PMUs. The most significant impacts in this PMU are wildfire, invasive species (specifically conifer encroachment), infrastructure, and urbanization. The NDOW uses ***data*** from six active leks to evaluate the trend and to tally maximum male attendance in the Desert Creek breeding complex. The long-term average male attendance is approximately 17.7 males per lek (Bi-State TAC 2017, p. 8). This average is influenced by one of these leks becoming inactive, with no males counted within the last 8 years. This lek might have moved locations, but this possibility remains unconfirmed. In 2012, a previously undocumented lek was discovered to the east of Nevada State Route 338 near Dalzell Canyon; 24[[Page 18062]]males were documented strutting on this lek. Over the last 7 years, this lek has remained active but counts have been small (<5). Three additional lek sites have also been discovered over the past 5 years. The most recent results from the IPM suggest population growth in this PMU has declined in the past decade. Estimated median population abundance in 2018 was 325 (CRI = 163-542; Coates et al. 2020, p. 34) individuals. Estimated median population growth from 2001 through 2018 was 0.939 (CRI = 0.348-1.499) and from 2008 through 2018 was 0.938 (CRI = 0.337-1.535; Coates et al. 2020, p. 34). The Fales breeding complex is located in northern Mono County, California. It is composed of three active and three inactive leks. Two active leks are located near Sonora Junction, in proximity to the intersection of Highway 395 and California Highway 108, and one additional lek is located in the northeast corner of Mono County in the Sweetwater Mountains. No males have been documented on a previously occupied lek since possible activity in 2012 (CDFW 2014a, unpublished ***data***; CDFW 2018, unpublished ***data***). In 2018, peak male count on the two remaining leks was at a historic low of 16 males total. One of the two remaining leks may also potentially be affected by the recent Boot fire (2018) and the construction of a new outbuilding approximately 200 meters (218 yards) away. The most recent results from the IPM suggest population growth has been negative over the past decade, but evidence of decline is less robust than in other breeding areas, especially when considering the longer timeframes. Estimated median population abundance in 2018 was 121 (CRI = 54-208; Coates et al. 2020, p. 34) individuals. Estimated median lambda from 1995-2018 was 0.999 (CRI = 0.59-1.641), from 2001-2018 was 0.984 (CRI = 0.539-1.525), and from 2008-2018 was 0.965 (CRI = 0.544-1.397; Coates et al. 2020, p. 34). Overall, the combined Desert Creek and Fales subpopulation has declined 4.5 percent annually over the past 18 years (Coates et al. 2020, Table 3). Completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal, fence removal, road closures, livestock management (to reduce impacts to critical brood-rearing habitat), nonnative invasive plant removal, road closure, fence removal, and post-fire restoration (Bi-State TAC 2019, entire). (3) The Mount Grant PMU is composed of three connected areas: Two high-elevation areas associated with Aurora Peak and the Wassuk Range (centered on Mount Grant), and one low-elevation area called Ninemile Flat (located in the East Fork Walker River valley) between the two high-elevation areas. This PMU is also connected with the Bodie PMU (a portion of the sage-grouse population in each PMU moves seasonally to the other). Surveys in the Mount Grant PMU have been sporadic due to difficulty accessing several locations and survey ***data*** ***collection*** has been influenced by apparent confusion over lek names and potential vagaries in lek locations. Woodland succession, and potentially to a lesser extent historical and current mining activity, has most negatively influenced bird distribution within the Mount Grant PMU (Bi-State TAC 2012, pp. 36-37). More recently, recreational OHV use has become a more prevalent activity under consideration for its influence on birds (Service 2020, p. 27). The largest known lek in the Mount Grant PMU is located near Aurora Peak along the Nevada-California border, and it is generally considered the eastern extension of the Bodie PMU breeding complex. The high count of 94 males for this lek was recorded in 2006, with a low of 10 in 2013. Over the past 5 years, peak male counts have ranged between 14 and 41 individuals (NDOW 2018, unpublished ***data***). Leks in the Wassuk Range have not been surveyed consistently due to lack of access, which requires aerial survey methods. In 2005 and 2006, a total of 19 and 33 males, respectively, were counted on five active leks in the Wassuk Range (NDOW 2009, unpublished ***data***; Bi-State TAC 2012, p. 35). During 2012, on four leks surrounding Mount Grant, researchers counted a total of 139 birds (males and females) (BSLSP 2012, p. 13). In 2013, researchers counted 38 males on 3 leks, the largest of which contained 30 males, and over the past 4 years, total male counts have ranged between 8 and 35 across 3 to 5 leks, with the largest lek containing 23 males. However, these results are calculated from limited ***data*** due to access limitations and survey method. The most recent results from the IPM suggest population growth in this PMU has generally been stable over the past decade, largely mirroring the pattern across the Bi-State DPS overall. Estimated median population abundance in 2018 was 374 (CRI = 205-619; Coates et al. 2020, p. 34) individuals. Estimated median lambda from 2008 through 2018 was 0.989 (CRI = 0.551-1.536; Coates et al. 2020, p. 34). Completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal, sagebrush restoration, horse gathers (roundup and removal of wild horses on public lands), road closures, and fence removal (Bi-State TAC 2019, entire). (4) The Bodie PMU contains one population (Bodie Hills), which is one of the two core (largest) populations for the Bi-State DPS. Most of the PMU is located to the east of Highway 395, but a small portion extends west of Highway 395 to the Sierra Nevada Mountains. Loss of historical sage-grouse range in the Bodie PMU has been most influenced by woodland succession (The Nature Conservancy 2009, entire; Bi-State TAC 2012, p. 30; USGS 2012, unpublished ***data***). Significant stands of pinyon pine and to a lesser extent juniper occur at mid to low elevations on all flanks of the Bodie Hills as well as across the Sierra Nevada Mountains side of the PMU. Perennial water and meadow habitats in the Bodie PMU are generally privately owned and provide important sage-grouse habitat during the brood-rearing/summer season. While natural vegetation succession processes (woodland establishment)--in the absence of disturbance--have resulted in loss of sagebrush habitat that continues to fragment and isolate the population within this PMU, the extent of habitat loss and fragmentation attributable to land use change (urban development and ***agricultural*** conversion) appears minimal. Approximately eight leks have been regularly surveyed in the Bodie PMU since the late 1980s with some locations being counted as far back as the 1950s. Additional active leks and numerous satellite leks (sites used sporadically in years of high sage-grouse abundance) have also been identified in the Bodie PMU. The majority of leks are located in the Bodie Hills east of Highway 395, but at least one long-term lek and several associated satellite leks occur west of the Highway. Since 1953, the long-term average total male attendance in the Bodie PMU is 192 (Bi-State TAC 2017, p. 11). The minimum count recorded was 64 males on 6 leks in 1998, and the maximum was 524 males on 14 leks in 2014. The sage-grouse population in the Bodie PMU has no discernible long-term trend (Garton et al. 2011, p. 324; referred to as the Mono Lake population). The average number of males per active lek declined by 41 percent between 1965 and 2007, but since 1991 the minimum number of males counted has been trending upward (Garton et al. 2011, p. 324). Recent survey years are encouraging because they demonstrate a substantial increase in the peaks associated with the population fluctuations. These increasing peaks, coupled with the[[Page 18063]]general increase in the number of males counted since the early 1990s, suggests the Bodie PMU may be moving toward a cycle that oscillates at generally higher numbers as compared to the other PMUs. The most recent results from the IPM suggest growth in this population has remained stable, with evidence of increase. Estimated median population abundance in 2018 was 1,521 (CRI = 1,181-1,941; Coates et al. 2020, p. 34) individuals. Estimated median lambda from 1995 through 2018 was 1.07 (CRI = 0.76-1.758), from 2001 through 2018 was 1.029 (CRI = 0.74-1.457), and from 2008 through 2018 was 1.061 (CRI = 0.783-1.471; Coates et al. 2020, p. 34). Changes in population from 1995 through 2018 indicate that sage-grouse numbers as of 2018 were approximately four times higher compared to the low point 24 years ago (Coates et al. 2020, p. 34). Completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal; conservation easements; fence modification and removal; road closure; post-fire rehabilitation; and sagebrush and brood-rearing habitat restoration (Bi-State TAC 2019, entire). (5) The South Mono PMU comprises three generally discrete locations or breeding complexes: Long Valley, Parker Meadow, and Granite Mountain. In the South Mono PMU, sage-grouse were likely historically distributed in many of the same areas utilized today (BSLPG 2004, p. 162), although there has been an estimated reduction in sagebrush extent of approximately 13 percent (USGS 2012, unpublished ***data***) due to woodland succession. In addition, loss and fragmentation of habitat due to other causes (infrastructure, wildfire, and water development) has likely altered sage-grouse occurrence in certain locations such as the Mono Basin and Adobe Valley. In Long Valley, there may be specific locations where distribution has been reduced, but these areas appear limited in extent and confined to peripheral locations within the breeding complex. Changes in the sage-grouse population size in the Parker Meadow and Granite Mountain portions of the PMU are unclear, but likely greater. The Granite Mountain and Adobe Valley area (north of Highway 120) contains an expanse of sagebrush habitat and has been known to support birds during severe winters as well as historically (USFS 1966, p. 4; BSLPG 2004, p. 161). However, no consistent use of Adobe Valley is currently occurring, and use of the Granite Mountain area is limited. This inconsistent use is presumed to be caused by the general lack of water and meadow habitat in the area, which has likely decreased in the past century. To the east of Adobe Valley in the vicinity of Pizona Creek, a potential connectivity corridor exists between populations in the South Mono and White Mountains PMUs. However, the vegetation within this corridor has apparently changed due to woodland succession, and an aerial survey suggests that current vegetation is not suitable sage-grouse habitat (BSLSP 2012, p. 36). Although surpassed by the Bodie PMU in 2012, traditionally the South Mono PMU has had the highest estimated population size as compared to the other PMUs within the range of the Bi-State DPS. The Long Valley breeding complex includes at least 10 to 12 consistently active leks and associated satellite sites located along the upper Owens River drainage and the Crowley Lake Basin. The Granite Mountain breeding complex includes two inactive leks located in the Adobe Valley and two active leks located in the Sagehen Summit area. The Parker Meadow breeding complex includes one consistently active lek site located south of Parker Creek at the northwest end of the June Lake Loop Road. Both the Granite Mountain and Parker Meadow breeding complexes are small, with generally less than 10 strutting males per complex documented per year. Long Valley represents the largest population in the South Mono PMU and, in conjunction with the Bodie PMU, these two PMUs represent the core populations of the Bi-State DPS. Sage-grouse have been counted in the Long Valley breeding complex since the early 1950s. Historical maximum male attendance counts occurred in 1962, 1963, 1986, and 2012 when 408, 405, 406, and 418 male were counted, respectively, on 6-7 leks (Bi-State TAC 2012, p. 44). The long-term average peak male attendance between 1953 and 2018 is approximately 200, counted on an average of 9 leks. The high count during this period was 418 males in 2012, and the low count was 130 males in 2019 (CDFW 2019, unpublished ***data***). The population in Long Valley has demonstrated positive and negative growth rates over the past 40 years (Garton et al. 2011, p. 329), although fluctuations have been relatively tempered and the population trend appears generally stable based on these ***data***. The most recent results from the IPM suggest growth in this population has declined on average approximately four percent annually over the past decade, with more evidence of decrease than increase and apparently deviating from the remainder of the DPS. Estimated median population abundance in 2018 was 818 (CRI = 614-1,053; Coates et al. 2020, p. 35) individuals. Estimated median lambda from 1995 through 2018 was 0.996 (CRI = 0.676-1.427), from 2001 through 2018 was 0.986 (CRI = 0.655-1.433), and from 2008 through 2018 was 0.96 (CRI = 0.68-1.361; Coates et al. 2020, p. 35). Four leks are known to exist in the Granite Mountain breeding complex (Adobe, Gaspipe, Big Sand Flat, and Sagehen Summit). Estimated median population abundance in 2018 was 20 individuals (CRI = 0-75; Coates et al. 2020, Table 1). Estimated median lambda from 1995 through 2018 was 0.916 (CRI = 0.282-1.964), from 2001 through 2018 was 0.844 (CRI = 0.18-1.819), and from 2008 through 2018 was 0.834 (CRI = 0.222-1.658; Coates et al. 2020, Table 3). Sage-grouse have been known to occur in the Parker Meadow breeding complex area since the 1950s, although lek monitoring did not occur until 2002. One small lek is active, and on occasion, satellite sites have experienced strutting activity (CDFW 2012, unpublished ***data***). Since 2002, a high count of 18 males occurred in 2018, and a low count of 3 males occurred in 2010 (Bi-State TAC 2012, p. 45; CDFW 2018, unpublished ***data***). The most recent results from the IPM suggest growth in this population is generally stable. Estimated median population abundance in 2018 was 48 (CRI = 21-86; Coates et al. 2020, Table 1) individuals. Estimated median lambda from 2001 through 2018 was 0.968 (CRI = 0.254-0.7.16), and from 2008 through 2018 was 1.048 (CRI = 0.361-5.814; Coates et al. 2020, Table 3). While growth in this population has little influence on the South Mono PMU as a whole, Parker Meadows likely facilitated connectivity between the Bodie and South Mono PMUs historically and potentially still does so today. In 2017, an experimental translocation program was initiated to bolster low numbers in the Parker Meadows population (Mathews et al. 2018, p. 7). Given its infancy, the efficacy of this program has not yet been determined. However, the recent high male lek count in 2018 (which excluded translocated males) offers some optimism as translocations in 2017 improved reproductive success and ultimately recruitment in 2018. Apart from the translocation, completed, ongoing, and planned conservation measures in this PMU include pinyon-juniper removal, land acquisition, road closures, landfill removal, and fence modification and removal (Bi-State TAC 2019, entire).[[Page 18064]] (6) The White Mountains PMU is the southernmost PMU in the Bi-State DPS, encompassing the White Mountains along the border of Nevada and California. It extends from the Candelaria Hills and Truman Meadows areas in the north to California Highway 168 in the south and from California Highway 6 in the west to the Silver Peak Range, Nevada, in the east. Historical and current distributions of sage-grouse in the White Mountains are not well understood. The area is difficult to access and, due to elevation, heavy snow conditions are typical during the spring breeding season. In addition, the number, size, and activity of leks in the White Mountains are not well known due to infrequent and opportunistic surveys. Historical accounts in Esmeralda County, Nevada, suggest bird densities there have likely always been low. Current impacts such as exurban development (e.g , Chiatovich Creek area (BSLSP 2012, p. 38)), grazing, recreation, and invasive species may be influencing portions of the population and are likely to increase in the future, but current impacts are considered minimal due to the remote locations of most known sage-grouse use areas. Potential future impacts from infrastructure (power lines, roads) and mineral developments could lead to fragmentation of the remote, contiguous nature of the habitat if conservation efforts were not conducted. There are currently two active leks in the Nevada portion of the White Mountains PMU. Both were discovered in 2012 and are relatively small with between zero and nine males documented per lek per year (NDOW 2018, unpublished ***data***). Since 2016, no males have been detected at one of these sites. The most recent run of the IPM suggests more evidence of decline than increase, although this estimate is derived from fairly limited ***data***. Estimated median population abundance in 2018 was 45 (CRI = 9-86; Coates et al. 2020, p. Table 1) individuals. Estimated median lambda from 2008 through 2018 was 0.85 (CRI = 0.343-1.957; Coates et al. 2020, p. Table 3). Completed, ongoing, and planned conservation measures in this PMU include conservation easements and horse gathers (Bi-State TAC 2019, entire).Regulatory and Analytical FrameworkRegulatory Framework Section 4 of the Act (16 U.S.C 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an ``endangered species'' or a ``threatened species.'' The Act defines an endangered species as a species that is ``in danger of extinction throughout all or a significant portion of its range,'' and a threatened species as a species that is ``likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether any species is an ``endangered species'' or a ``threatened species'' because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence. These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects. We use the term ``threat'' to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term ``threat'' includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term ``threat'' may encompass--either together or separately--the source of the action or condition or the action or condition itself. However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an ``endangered species'' or a ``threatened species.'' In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats--in light of those actions and conditions that will ameliorate the threats--on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an ``endangered species'' or a ``threatened species'' only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future. Our proposed rule described ``foreseeable future'' as the extent to which we can reasonably rely on predictions about the future in making determinations about the future conservation status of the species. The Service since codified its understanding of foreseeable future in 50 CFR 424.11(d) (84 FR 45020). In those regulations, we explain the term ``foreseeable future'' extends only so far into the future as the Service can reasonably determine that both the future threats and the species' responses to those threats are likely. The Service will describe the foreseeable future on a case-by-case basis, using the best available ***data*** and taking into account considerations such as the species' life-history characteristics, threat-projection timeframes, and environmental variability. The Service need not identify the foreseeable future in terms of a specific period of time. These regulations did not significantly modify the Service's interpretation; rather they codified a framework that sets forth how the Service will determine what constitutes the foreseeable future based on our long-standing practice. Accordingly, though these regulations do not apply to this determination for the Bi-State DPS of greater sage-grouse because it was proposed prior to their effective date, they do not change the Service's assessment of foreseeable future for the Bi-State DPS of greater sage-grouse as contained in our proposed rule and in this determination.Analytical Framework The Species Report documents the results of our comprehensive biological status review for the species, including an assessment of the potential threats to the species. The Species Report does not represent a decision by the Service on whether the species should be proposed for listing as an endangered or threatened species under the Act. It does, however, provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies. The following is a summary of[[Page 18065]]the key results and conclusions from the Species Report; the full report can be found at either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107 on   [*http://www.regulations.gov*](http://www.regulations.gov). In this determination, we used the three conservation biology principles of resiliency, redundancy, and representation to assess the viability of the Bi-State DPS (Shaffer and Stein 2000, pp. 306-310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we will consider the DPS' overall response to threats and the DPS' viability as a whole.Summary of Biological Status and Threats In this discussion, we review the biological condition of the species and its resources, the influence of those conditions on the species' overall viability, and the risks to that viability. Following are summary evaluations of 11 threats analyzed in the Species Report for the Bi-State DPS: Urbanization and habitat conversion (Factor A); infrastructure (Factor A); mining (Factor A); grazing and rangeland management (Factor A); nonnative invasive plants and native woodland succession (Factor A); wildfires and altered fire regime (Factor A); climate change, including drought (Factor A); recreation (Factor E); disease (Factor C); predation (Factor C); and small population size and population isolation (Factor E). We also evaluate the inadequacy of existing regulatory mechanisms (Factor D) on the magnitude of threats. Please see the Species Report (Service 2020, pp. 39-136) for a more detailed discussion of each threat. In the Species Report, we also considered four additional threats: Renewable energy (Factor A), commercial and recreational hunting (Factor B); scientific and educational uses (Factor B); and contaminants (including pesticides) (Factor E). We concluded that though these threats are currently having some impact on individual sage-grouse and their habitat, their overall effect now and into the future is expected to be minimal. Therefore, we will not present summary analyses of those threats in this document but will consider them in our overall conclusions of impacts to the species. For full descriptions of all these threats and how they impact the species, please see the Species Report (Service 2020, pp. 63-124). For the purposes of this assessment, we consider the foreseeable future to be the amount of time on which we can reasonably determine a likely threat's anticipated trajectory and the anticipated response of the species to those threats. For some threats impacting the Bi-State DPS, we consider the time for which we can reliably project threats and the anticipated response to be 30 years. This time period represents our best professional judgment of the foreseeable future conditions related to climate change, native woodland succession, nonnative invasive plants, and wildfire cycles, as well as the Bi-State DPS population cycles, probability of population persistence analyzed and described by Garton et al. (2015, entire), and regeneration time of sagebrush habitat. For other threats and the anticipated species response, we can reliably project impacts and the species response for less than 30 years, such as infrastructure, urbanization and habitat conversion, grazing and rangeland management, recreation, disease, and predation.Urbanization and Habitat Conversion Urbanization and habitat conversion (Factor A) have both direct and indirect effects on sagebrush habitat. In this section, we will discuss direct impacts to sagebrush habitat and to sage grouse populations. Indirect effects (such as those associated with infrastructure, increases in invasive plant species, and increases in domestic animals and wildlife predator species) will be addressed in later sections. Traditional land use in the Bi-State area was primarily farming and ranching operations. These operations can have both beneficial and detrimental effects on sage-grouse conservation. Continuing farming and ranching operations have limited development of exurban subdivisions in the Bi-State area, but they have also affected the extent of remaining sagebrush through conversion to alternate vegetation types (such as pasture grass) (Service 2020, p. 35). The extent of impacts from the conversion of habitat depends on the amount of sagebrush lost, the type of seasonal habitat affected, and the arrangement of habitat lost (large blocks or small patches) (Knick et al. 2011, pp. 208-211). While conversion of sagebrush vegetation communities to ***agricultural*** land continues to occur in the Bi-State area, the rate of this conversion remains difficult to quantify. Some reports state that conversion has lessened and that some of these lands are instead being sold and converted to low-density residential housing developments (Bi-State TAC 2012, pp. 18, 24, 41). Several studies have demonstrated that these increases in human population density could have strong effects on sage-grouse occupancy beyond the areas directly converted to human development. Sage-grouse extirpation was more likely in areas having a human population density of at least four people per 1 km\2\ (10 people per 1 mi\2\) (Aldridge et al. 2008, pp. 991-992). Increase in human populations from this moderate level did not infer a greater likelihood of extirpation, likely because much of the additional growth occurred in areas no longer suitable for sage-grouse (Aldridge et al. 2008, pp. 991-992). Additionally, human density is 26 times greater in extirpated sage-grouse areas than in the currently occupied range (Wisdom et al. 2011, p. 463). In modeling several measures of human population on greater sage-grouse persistence, including current population density, historical population density, and human population growth, the best predictor of sage-grouse extirpation was human population density in 1950 (Aldridge et al. 2008, p. 985). This finding suggests that human development has had long-term impacts on habitat suitability and sage-grouse persistence (Aldridge et al. 2008, pp. 991-992). Thus, even small increases in human population density can have a strong effect on sage-grouse populations. Another indicator of human development pressure on sage-grouse can be inferred from existing sagebrush availability. To persist in an area, sage-grouse require a minimum of 25 percent sagebrush; a high probability of persistence required 65 percent sagebrush or more (Aldridge et al. 2008, p. 990; and Chambers et al. 2014, p. 12). When ***data*** were analyzed in 2014 across the Bi-State, no leks contained less than 25 percent sagebrush cover in the immediate area. However, 30 out of the 55 leks (55 percent) contained between 25 and 65 percent sagebrush cover, suggesting an intermediate probability of persistence (Chambers et al. 2014, p. 12). The remaining 25 leks (45 percent)[[Page 18066]]contained greater than 65 percent sagebrush cover surrounding a lek site. Historical and recent alterations, as well as ongoing conversion of sagebrush vegetation to support ranching operations and urban/exurban expansion, poses the greatest risk to persistence of sage-grouse in the Pine Nut, Desert Creek-Fales, and South Mono PMUs and to a lesser degree in the Bodie, and White Mountains PMUs (BSLPG 2004, pp. 24-169; Bi-State TAC 2012, pp. 18-46). Approximately 11 percent of suitable sage-grouse habitat in the Bi-State area occurs on private lands. In each PMU, sage-grouse home ranges include private lands that are critical to fulfilling annual habitat needs (Casazza 2009, p. 9), including a significant proportion of mesic areas (e.g , upland meadows) within the range of the Bi-State DPS needed by sage-grouse during the late brood-rearing period. Sage-grouse are known to display strong site fidelity to traditional seasonal habitats, and loss or degradation of specific sites (especially brood-rearing habitat) can have negative population impacts. The majority of local agency land in the South Mono PMU is owned by the City of Los Angeles and managed by the Los Angeles Department of Water and Power (LADWP). Many of these parcels are irrigated pasture, which provide important brood-rearing habitat to upwards 40 percent of the entire Bi-State DPS population. The LADWP is considering altering the extent to which these lands are irrigated. If realized, this potential additive stressor has the potential to negatively affect brood-rearing success (an influential demographic vital rate), given that the Long Valley population has demonstrated slightly negative population growth on average over the past 10 years. To address this concern, in 2019 LADWP provided a letter to the Service that reaffirms its prior commitment to allocate a sufficient amount of water to maintain sage-grouse habitat in Long Valley. Determining the amount of water needed to achieve this commitment will be informed by a collaborative, science-based approach (LADWP 2019, in litt.). The goal of LADWP's natural resource management is to employ Best Management Practices for land and water uses that maintain water supplies to the City of Los Angeles while protecting water quality, habitat, biodiversity, as well as species recognized under the ESA throughout the related watersheds. In 2014 (August 18, 2014), LADWP and their governing Board of Water and Power Commission approved a Conservation Strategy for the Bi-State DPS on their lands in Mono County, California. A component of this Strategy included commitments to maintain sage-grouse lekking, nesting, and brood rearing habitat. Consistent with this Strategy, LADWP has consistently managed the activities on their lands such as habitat restoration, livestock grazing, recreation, control of noxious and invasive weeds, fire suppression, infrastructure, and management of water in a manner that is compatible with the conservation of the Bi-State DPS. These past efforts and ongoing commitments will continue to provide benefits to conservation of the species. The remainder of private lands in the South Mono PMU is rangeland, although potential for commercial, residential, or recreational development exists. Ongoing efforts to develop fee acquisition of properties or enroll them into conservation easements may help ameliorate current and anticipated effects of urbanization and habitat conversion. We estimate that approximately 10,415 ha (25,737 ac) of private land, which may provide suitable habitat for sage-grouse in the Bi-State DPS, are currently enrolled in various easement programs. The easements are targeted primarily at development and water rights and vary in length from 30 years to in perpetuity; thus, they can ameliorate the threat of development but do not necessarily ensure that habitat remains suitable. The majority of these easement lands are located in the Bodie PMU, with the remainder of easements occurring in the Desert Creek-Fales, South Mono, Pine Nut, and White Mountains PMUs. Of the approximately 60,326 ha (149,071 ac) of private land that may provide suitable habitat for sage-grouse within the Bi-State area, approximately 17 percent is under easements. An additional approximate 9,045 ha (22,352 ac) of previously private land within the Bi-State DPS has been acquired by State and Federal agencies over the past decade. In total, approximately 19,460 ha (48,089 ac) of land, either through conservation easements or acquisitions, has been substantially protected from urbanization challenges. These acres represent approximately 31 percent of total private lands containing suitable sage-grouse habitat across the Bi-State area. In addition, approximately 7,280 ha (18,000 ac) of lands identified as important by the 2012 BSAP have funding obligated and are working through the easement development process, with many of these efforts anticipated to be completed in a few years. An effort to acquire approximately 5,867 ha (14,500 ac) of additional lands in the Pine Nut PMU by the Carson City BLM has been approved but will likely not finalize until sometime in 2020. Combining the realized and reasonably anticipated efforts, approximately 57 percent of high-priority private lands in the Bi-State area will be protected. Currently, 89 percent of the Bi-State DPS is Federal lands. On Federal lands, existing regulatory mechanisms protect sagebrush habitat from development. Approximately 54 percent of all lands within the sage-grouse Bi-State area is BLM-administered land; this includes approximately 1 million ha (2.5 million ac). The Federal Land Policy and Management Act of 1976 (43 U.S.C 1701 et seq.) is the primary Federal law governing most land uses on BLM lands, and directs development and implementation of resource management plans (RMPs) that direct management at a local level. The sage-grouse is designated as a sensitive species on BLM lands in the Bi-State area (Sell 2010, pers. comm.). The BLM's objectives for sensitive species is two-fold: (1) To conserve and recover ESA-listed species and the ecosystem on which they depend so that ESA protections are no longer needed, and (2) to initiate proactive conservation measures that reduce or eliminate threats to species to minimize the likelihood of and need for listing of these species under the ESA (BLM 2008, p. 3). The USFS manages approximately 35 percent of the land in the Bi-State area or approximately 600,000 ha (1.5 million ac). Management of activities on national forest system lands is guided principally by the National Forest Management Act (NFMA). The NFMA specifies that the USFS must have a land resource management plan (LRMP) (16 U.S.C 1600) to guide and set standards for natural resource management activities on each National Forest or National Grassland. The greater sage-grouse is designated as a USFS Sensitive Species in the Intermountain (R4) and Pacific Southwest (R5) Regions, which includes the Humboldt-Toiyabe National Forest (Bridgeport and Carson Ranger Districts) and the Inyo National Forest in the Bi-State area. Designated sensitive species require special consideration during land use planning and activity implementation to ensure the viability of the species on USFS lands and to preclude any population declines that could lead to a Federal listing (USFS 2008, p. 21). In addition, sensitive species designations require analysis for any activity that could have an adverse impact to the species, including analysis[[Page 18067]]of the significance of any adverse impacts on the species, its habitat, and overall population viability (USFS 2008, p. 21). The specific protection that sensitive species status confers to sage-grouse on USFS lands is largely dependent on LRMPs and site-specific project analysis and implementation. These regulatory mechanisms prevent urban development on Federal lands. Through NFMA, LRMPs, Federal Land Policy and Management Act, RMPs, and the On-Shore Oil and Gas Leasing Reform Act (1987; implementing regulations at 36 CFR part 228, subpart E), land-managing agencies have the authority to manage, prevent, restrict, or attach protective measures to mineral extraction, wind development, and other energy permits on Federal lands. Thus, some habitat loss due to these developments may still occur on Federal land. Despite this, regulatory mechanisms in place are overall reducing the magnitude of threats associated with urbanization and habitat conversion. Historical and recent conversion of sagebrush habitat on private lands for ***agriculture***, housing, and associated infrastructure within the Bi-State area has likely negatively affected sage-grouse distribution and population extent in the Bi-State DPS, thus potentially influencing current and future recovery opportunities in the Bi-State area. These alterations to habitat have been most pronounced in the Pine Nut and Desert Creek-Fales PMUs and to a lesser extent in the Bodie, South Mono, and White Mountains PMUs. Although only a subset of the 11 percent of suitable sage-grouse habitat that occurs on private lands could potentially be developed, conservation actions on adjacent public lands could be compromised due to the significant percentage of late brood-rearing habitat that occurs on the private lands. Furthermore, the influence of land development and habitat conversion on the population dynamics of sage-grouse is greater than a simple measure of spatial extent because of the indirect effects from the associated increases in human activity. These threats are not universal across the Bi-State area, but localized areas of impacts have been realized and additional future impacts are anticipated. Currently, approximately 31 percent of total private lands containing suitable sage-grouse habitat across the Bi-State area are enrolled under an easement program or have been acquired by Federal and State agencies, and this number will increase to 57 percent when combining additional efforts that are ongoing and reasonably likely to occur. Urbanization was not considered a significant threat at the time of the 2013 proposed listing rule. Currently, the effects of urbanization are having a minimal impact on the resiliency of populations within the Bi-State DPS. Absent any protections or conservation measures, the magnitude of impacts could increase into the foreseeable future as unprotected private lands become further fragmented. However, due to protections associated with regulatory mechanisms, and in particular because of efforts to acquire important private lands associated with the BSAP, we conclude that the magnitude of effects associated with this threat and its potential impacts on population resiliency should not increase to a detrimental level. The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as urbanization and habitat loss. Because we have determined that the partially completed and future conservation measures/efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, above), we believe that urbanization and human disturbance is not a significant impact on the species within the foreseeable future.Infrastructure We characterize infrastructure as features that assist or are required for human development or an associated action. We focus on five infrastructure features that are apparent in the Bi-State area and that have been implicated in impacting sage-grouse: Three linear features (roads, power lines, and fences) and two site-specific features (landfills and communication towers). Infrastructure can have direct impacts on sage-grouse, such as mortality through collision with power lines or fences, or direct impacts on sagebrush, such as habitat fragmentation or habitat loss. Fragmentation of sagebrush habitat has been cited as a primary cause of the decline of sage-grouse populations because the species requires large expanses of contiguous sagebrush (Service 2020, p. 45). Estimating the impact of habitat fragmentation caused by infrastructure on sage-grouse is complicated by the nonrandom placement of these features and by time lags in species response to habitat changes (Garton et al. 2011, p. 371), particularly since these relatively long-lived birds continue to return to altered breeding areas (leks, nesting areas, and early brood-rearing areas). Roads are a linear feature on the landscape that can contribute to habitat loss and avoidance of areas close to roads, create barriers to migration corridors or seasonal habitats, and increase human disturbance in remote areas (Service 2020, p. 46). Additionally, roads can provide corridors for predators to move into previously unoccupied areas. For some mammalian and avian species (such as common ravens (Corvus corax)), dispersal along roads and other linear features like power lines has greatly increased their distribution (Forman and Alexander 1998, p. 212; Knight and Kawashima 1993, p. 268; Forman 2000, p. 33; Connelly et al. 2004, p. 12-3). Road networks also contribute to the spread of nonnative invasive plants via introduced road fill, vehicle transport, and road maintenance activities (Forman and Alexander 1998, p. 210; Forman 2000, p. 32; Gelbard and Belnap 2003, p. 426; Knick et al. 2003, p. 619; Connelly et al. 2004, p. 7-25). Direct mortality of sage-grouse from vehicle collisions does occur (Patterson 1952, p. 81; Wiechman and Reese 2008, p. 3), but mortalities are typically not monitored or recorded. Additionally, roads can have impacts on sage-grouse behavior. For example, roads within 7.5 km (4.7 mi) of leks negatively influence male lek attendance (Service 2020, pp. 46-47). The mechanism by which road presence reduces male lek attendance is not entirely clear, but chronic noise may contribute to these decreases. Male sage-grouse rely on acoustical signals to attract females to leks (Gibson and Bradbury 1985, p. 82; Gratson 1993, p. 692). Therefore, if noise interferes with mating displays, and thereby female attendance, younger males will not be drawn to the lek and eventually leks could become inactive (Amstrup and Phillips 1977, p. 26; Braun 1986, pp. 229-230). In general, locations associated with mineral development (Mount Grant PMU), recreational activity (Bodie and South Mono PMUs), and major travel corridors (Desert Creek-Fales PMU) have the most significant daily road traffic. Our analysis of the best available ***data*** in the Bi-State area documents that 54 out of 55 known active or pending leks are within 3 km (1.8 mi) or less of an existing minor road (such as dirt two-track roads). Furthermore, of the 55 known active or pending leks, 64 percent (n=35) are within 5 km (3.1 mi) of paved secondary highways (Service 2013c, unpublished ***data***). An extensive network of roads and trails currently occurs throughout the range of the Bi-State DPS. In the Bi-State area, all Federal lands have restrictions limiting off-road vehicular travel. In addition, road closures and[[Page 18068]]rehabilitation of redundant roads by USFS and BLM are occurring to benefit Bi-State DPS conservation (Service 2020, p. 49). We anticipate limited additional road and trail development will occur within suitable and potentially suitable habitat in the Bi-State area based on recent land use plan amendments, USFS and BLM travel management plans, and our current understanding of travel management direction. However, because an extensive road and trail network already occurs throughout the Bi-State area and because roads are known to result in both direct and indirect impacts to sage-grouse, we anticipate some impacts to birds and leks in the future, although we are uncertain to what degree these potential impacts will affect populations in the Bi-State area. Power lines can directly affect sage-grouse by posing collision and electrocution hazards (Braun 1998, pp. 145-146; Connelly et al. 2000a, p. 974). They can have indirect effects by decreasing lek recruitment, increasing predator presence, facilitating the invasion of nonnative invasive annual plants by creating soil conditions favorable to their spread, potentially acting as a barrier to movement, and ultimately negatively affecting population performance (Service 2020, pp. 50-52). Due to the potential spread of invasive species and facilitation of predator occurrence as a result of power line construction, the indirect influence power lines can have on vegetation community dynamics and species occurrence often extends out further than the physical footprint (Knick et al. 2011, p. 219). Recent research has demonstrated that power lines are influencing sage-grouse behavior, demographic vital rates, and population growth rates due to associated impacts from raven abundance and predation (Gibson et al. 2018, p. 17). Power lines occur in all Bi-State PMUs, but the extent of exposure varies by location. Based on available ***data*** (generally restricted to transmission lines), we estimate approximately 210 km (130 mi) of existing power lines are present across suitable habitat in the Bi-State. Overall, approximately 21 percent of 55 active and pending leks in the Bi-State area are within 2 km (1.2 mi) or less of existing transmission lines and approximately 38 percent of active and pending leks are within 5 km (3.1 mi) or less of existing transmission lines (Service 2013c, unpublished ***data***). This suggests a potential loss, due to sage-grouse avoidance, of approximately 25,200 ha (62,270 ac) of otherwise suitable habitat (Gillan et al. 2013, p. 307). These transmission lines have the potential to further negatively influence over 250,000 ha (617,700 ac) or approximately 47 percent of suitable habitat, assuming their presence leads to the increased presence of ravens and other predators (Gibson et al. 2018, p. 17). Given that the predator community population size likely fluctuates through time, the scale of this potential impact will likely vary. Therefore, we are uncertain to what degree these potential impacts will affect populations in the Bi-State area. Of ongoing concern, however, is the potential time lag in effects from construction of power lines, as ravens and other predators may not utilize those lines until several years after their construction. We anticipate that while existing power lines will persist on the landscape in the future, new power lines will be limited to smaller distribution lines associated with expansion of urbanization on a portion of the private lands within and around the Bi-State area. Bi-State habitat is currently managed as a right-of-way avoidance area by Federal land managers, such that larger lines (>120 kilovolts) and associated facilities will not be authorized (outside of existing corridors; BLM 2016, p. 15; HTNF 2016, p. 13). In the Bodie PMU, one decommissioned power line has been removed (Bi-State TAC 2018). Fences are used to delineate property boundaries and for livestock management (Braun 1998, p. 145; Connelly et al. 2000a, p. 974). The effects of fencing on sage-grouse include direct mortality through collisions, creation of predator perch sites, and habitat fragmentation (Service 2020, p. 55). Fences present a risk to sage-grouse in all Bi-State PMUs (BSLPG 2004, pp. 54, 80, 120, 124, 169) due to known fence collisions and their potential to degrade habitat quality. Not all fences present the same direct mortality collision risk to sage-grouse. Collision risk factors include fencing design, landscape topography, and spatial relationship with seasonal habitats (Christiansen 2009, p. 2). Management methods can decrease the impact of fences on sage-grouse. Visual markers have been employed in some of the high-risk areas to make fences more readily seen by birds; this method does appear to substantially reduce mortality due to collisions. Markers have been installed on a total of approximately 101 km (63 mi) of fence across the Bi-State DPS since 2012. Recent land use plan amendments encourage evaluation of existing fences with respect to sage-grouse conservation and discourage new installations that may negatively affect sage-grouse and its habitat (BLM 2016, pp. 12, 15; HTNF 2016, p. 14). ***Data*** on the total extent (length and distribution) of existing fences and new fence construction projects are not available for the Bi-State area. However, based on ***data*** contained within the Greater Sage-grouse Bi-State Distinct Population Segment Forest Plan Amendment (USFS and BLM 2014, p. 99), there is likely on the order of 650 km (400 mi) of existing fences across the entire DPS. While we expect fencing to continue and possibly expand in the future within every PMU in the Bi-State area, efforts associated with conservation and regulatory mechanisms are currently ongoing (and expected to continue into the future) to ameliorate some of their impacts (Bi-State TAC 2012, p. 5; BLM 2016, pp. 12, 15; HTNF 2016, p. 14). While direct mortality through collision may be minimized by these approaches, indirect impacts caused by predation and other forms of habitat degradation may remain. The overall severity of these impacts to the Bi-State DPS throughout its range is not known, but based on the best available ***data*** the impacts are widespread but minor. Millions of birds are killed annually in the United States through collisions with communication towers (including cellular towers) and their associated structures (e.g , guy wires, lights) (Shire et al. 2000, p. 5; Manville 2002, p. 10), although most documented mortalities are of migratory songbirds. In a comparison of sage-grouse locations in extirpated areas of their range (as determined by museum species and historical observations) and currently occupied habitats, proximity to cellular towers had a strong correlation with likelihood of extirpation, and the distance to cellular towers was nearly twice as far from grouse locations in currently occupied habitats than extirpated areas (Wisdom et al. 2011, p. 463). However, there was no information as to whether the towers were a factor in the extirpation of those areas, or if their presence was linked to other threats in those areas (Wisdom et al. 2011, p. 467). Within the range of the Bi-State DPS, approximately eight communication towers have been constructed in the past decade (Federal Communications Commission (FCC) 2018, unpublished ***data***); each PMU has at least one such facility located within occupied sage-grouse habitat. These eight sites are likely an underrepresentation of the actual number of tower sites within the Bi-State area, as tower facilities shorter than 61 m (199 ft.) above ground level are not required to register with the FCC[[Page 18069]](FCC 2018, unpublished ***data***). We are unable to determine if any sage-grouse mortalities have occurred as a result of collisions with registered or unregistered communication towers or their supporting structures, as most towers are not monitored, and those that are monitored lie outside the range of the species (Kerlinger 2000, p. 2; Shire et al. 2000 p. 19). Based on regulatory mechanisms associated with existing land use plans as well as existing land designations (wilderness and wilderness study areas), which significantly restrict new communication site development, we do not expect many new facilities on federally managed land in the Bi-State area (BLM 1993, p. 18; BLM 2016, p. 13; HTNF 2016, pp. 42-43). However, we anticipate that existing communication towers will remain in place and potentially new communication towers will be added at existing tower sites. Typically, rights-of-way grants afforded these facilities are for 30 years, and would likely be renewed indefinitely. It is also probable that new communication towers will be developed on non-federally managed lands along existing Federal Highways and State Routes. Thus, future communication tower placements will most likely affect the Desert Creek-Fales and South Mono PMUs, potentially affecting sage-grouse habitat in those locations. Municipal solid waste landfills and associated roads contribute to increases in synanthropic predators (predator species adapted to conditions created or modified by people) (Knight et al. 1993, p. 470; Restani et al. 2001, p. 403; Webb et al. 2004, p. 523). One landfill exists in the Bi-State area. The Benton Crossing Landfill in Mono County is located north of Crowley Lake in Long Valley on a site leased from the LADWP. Common ravens and California gulls (Larus californicus) heavily use the landfill (Coates 2008, pers. comm.; USGS 2017, p. 17). Sage-grouse nest success in Long Valley (South Mono PMU) was lower than in other PMUs within the Bi-State area (Kolada et al. 2009b, p. 1344), which may be attributable to increased avian predators subsidized by landfill operations (Casazza 2008, pers. comm.; USGS 2017, p. 74; Coates et al.. 2018, p. 256). At this time, the future closing of the landfill appears probable, as LADWP has stated that they do not intend to renew the lease and Mono County has been funding planning studies for relocation, but any action on relocation is unlikely before the lease expires in 2023. In the Bi-State area, linear infrastructure impacts each PMU both directly and indirectly to varying degrees. Existing roads, power lines, and fences may degrade sage-grouse habitat and contribute to direct mortality through collisions. In addition, roads, power lines, and fences influence sage-grouse use of otherwise suitable habitats adjacent to current active areas, increase predators, and increase invasive plants. The impact caused by these indirect effects extends beyond the immediate timeframe associated with the infrastructure installation. Across the entire range of the greater sage-grouse, the mean distance to highways and transmission lines for extirpated populations was approximately 5 km (3.1 mi) or less (Wisdom et al. 2011, p. 463). In the Bi-State area, 64 percent of active or pending leks are within 5 km (3.1 mi) of highways, and approximately 38 percent are within this distance to existing transmission lines (Service 2013c, unpublished ***data***). The similarity apparent between these Bi-State DPS lek locations and extirpated greater sage-grouse populations suggests that persistence may be influenced by their juxtaposition with these anthropogenic features. The geographic extent, density, type, and frequency of linear infrastructure disturbance in the Bi-State area have changed over time. While new development of some of these features (highways) will likely not occur, other infrastructure features have the potential of increasing (secondary roads, power lines, fencing, and communication towers). Furthermore, while development of new highways is unlikely, road improvements are possible and traffic volume will likely increase, and in certain areas these actions may be more important than road development itself. We concluded in the 2013 proposed listing rule that infrastructure impacts (particularly fencing, power lines, and roads) were a significant factor for proposing to list the DPS as a threatened species, and today, we affirm that impacts from infrastructure occur in various forms throughout the Bi-State DPS's range and are an ongoing threat impacting population resiliency across its range and degrading habitat both currently and into the future. This conclusion is based on a variety of range-wide impacts that are currently occurring and expected to continue or increase in the future that result in habitat fragmentation; limitations for sage-grouse recovery actions due to an extensive road network, power lines, and fencing; and a variety of direct and indirect impacts such as direct loss of individuals from collisions or structures that promote increased potential for predation. Collectively, these threats may result in perturbations that influence both demographic vital rates of sage-grouse (e.g , reproductive success and adult sage-grouse survival) and habitat suitability in the Bi-State area. Importantly, conservation efforts that address infrastructure impacts have continued to be implemented since publication of the proposed listing rule, including (but not limited to): Removing power lines; implementing both permanent and seasonal road closures; removing racetrack fencing; and the likely relocation of the landfill in Long Valley. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), infrastructure-related impacts are significantly reduced. The BSAP (Bi-State TAC 2012, entire) includes measures to counter negative effects from infrastructure. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), we believe that effects associated with infrastructure may no longer be considered a significant impact into the future.Mining Surface and subsurface mining for mineral resources (gold, silver, aggregate, and others) can result in direct loss of sagebrush habitat. Construction of mining infrastructure can result in additional direct loss of habitat from establishment of structures, staging areas, roads, railroad tracks, and power lines. Sage-grouse and their nests could be directly affected by crushing or vehicle collision. Sage-grouse also can be impacted indirectly from an increase in human presence, land use practices, ground shock, noise, dust, reduced air quality, degradation of water quality and quantity, and changes in vegetation and topography (Moore and Mills 1977, entire). However, whereas theoretical effects are relatively clear and logical, information relating sage-grouse response to mineral developments is not extensive. Mineral development is classified as leasable (fluid) minerals (in the Bi-State area, this is limited to geothermal resource), saleable minerals (sand and gravel pits), and locatable minerals (precious metals). Through existing regulatory mechanisms, Federal managers have discretion to condition or deny proponents of leasable or saleable mineral projects, and existing[[Page 18070]]land use management plans have provisions that significantly restrict the likelihood of these developments (BLM 1993, p. 18; BLM 2016, pp. 12-13; HTNF 2016, pp. 19-21). Locatable minerals are administered under the General Mining Act of 1872. Federal land managers have very limited ability to prevent or preclude these activities from occurring. Mineral extraction has a long history throughout the Bi-State area. Mining continues today to a limited extent in all PMUs and is expected to continue into the future. Although mining occurs year-round in the Bi-State DPS, direct loss of key seasonal habitats or population disturbances during critical seasonal periods are of greatest impact. Currently, the PMUs with the greatest exposure are Bodie, Mount Grant, Pine Nut, and to a lesser degree South Mono (BSLPG 2004, pp. 89, 137, 178). There are currently several active Plans of Operations that overlap Bi-State sage-grouse habitat and thousands of active mining claims on Federal, State, and private lands. There is potential for additional mineral developments to occur in the Bi-State area in the future. While all PMUs have the potential for mineral development, based on current land designations and past activity, it appears the Pine Nut and Mount Grant PMUs are most likely to experience new activity (Service 2020, pp. 61-63). Currently operational mines are not within the core population areas of the Bi-State DPS, although existing inactive mining sites, exploration actions, and potential future developments could impact important lek complexes and population connectivity. In general, potential exists for mining operations to expand both currently and into the future, but the scope of impacts from existing mining expansion is not considered extensive. We concluded in the 2013 proposed listing rule and reaffirm here that, by itself, mining is not currently considered a significant impact to the Bi-State population, though mining exploration continues, and mining activity could occur at any time in the future. Conservation efforts that address the impacts from mining have continued to be implemented since publication of the proposed listing rule, such as reducing human-related disturbances (e.g , road noise/traffic). The BSAP includes conservation actions targeting development and human disturbances that will reduce the minor or potential impacts from mining (Bi-State TAC 2012, entire). Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), we believe impacts associated with mining in the Bi-State population area are not a reasonably anticipated concern into the future.Grazing and Rangeland Management Livestock grazing continues to be the most widespread land use across the sagebrush biome (Connelly et al. 2004, p. 7-29; Knick et al. 2003, p. 616; Knick et al. 2011, p. 219), including within the Bi-State area. Links between grazing practices and population levels of sage-grouse are still not well defined (Braun 1987, p. 137; Connelly and Braun 1997, p. 231). Depending on timing and intensity, grazing can have both positive and negative impacts to greater sage-grouse populations. Sage-grouse populations responded favorably to higher grazing levels after peak vegetative productivity, but declined when grazed earlier (Monroe et al. 2017, p. 1102). Livestock grazing can reduce the available food sources needed during breeding and brood-rearing periods (Braun 1987, p. 137; Dobkin 1995, p. 18; Connelly and Braun 1997, p. 231; Beck and Mitchell 2000, pp. 998-1000). But while some studies have reported grass height as important for sage-grouse nesting habitat, others have reported weak or no effects, and other studies concluded no influential effects of grass-related variables on nesting success (Service 2020, pp. 65-66). In the Bi-State area, studies have suggested that grazing, or more importantly maintenance of residual grass cover, may not influence nest success in the Bi-State area as much as in other regions (Kolada et al. 2009b, pp. 1343-1344; Coates et al. 2017a, p. 55). This may be because the most prevalent nest predator in the Bi-State area, the common raven, is potentially less influenced by grass cover than mammalian predators (Coates et al. 2008, entire). Studies suggest that a threshold may exist whereby grazing can occur without detriment to sage-grouse resources. We note, however, the specifics of this threshold remain uncertain (Service 2020, p. 66). Potential negative effects of livestock grazing on the sagebrush ecosystem include reduced water infiltration rates, reduced cover of herbaceous plants and litter, compacted soils, and increased soil erosion (Braun 1998, p. 147; Dobkin et al. 1998, p. 213). These impacts change the proportions of shrubs, grasses, and forbs in affected areas, and increase the propensity for invasion by nonnative invasive plant species (Service 2020, p. 67). Additionally, as far back as the mid-1900s, livestock grazing has been implicated in facilitating the spread of cheatgrass (Leopold 1949, p. 165; Billings 1951, p. 112). Livestock grazing reduces invasion resistance by imposing a competitive disadvantage on native herbaceous understory species and altering soil properties (Reisner et al. 2013, p. 10). While livestock grazing has been used strategically in sage-grouse habitat to control some invasive weeds (Merritt et al. 2001, p. 4; Olsen and Wallander 2001, p. 30; Connelly et al. 2004, p. 7-49) and woody plant encroachment (Riggs and Urness 1989, p. 358), there is limited evidence that controlling established cheatgrass through grazing is feasible. Rest from grazing may, in fact, be a more effective strategy of building resistance to invasion into a site (Reisner et al. 2013, p. 10). Collectively, these studies suggest managed livestock grazing at moderate intensities in the Bi-State area may be benign or even beneficial to some seasonal sage-grouse habitats, but when grazing intensity exceeds this moderate use level, livestock grazing can have negative effects on sage-grouse habitat and individuals (Boyd et al. 2014, p. 60). Historically, extensive rangeland management has been conducted by Federal agencies and private landowners to reduce shrub cover and improve forage conditions for livestock in the sagebrush-steppe ecosystem (Connelly et al. 2004, p. 7-28; Knick et al. 2011, p. 220; Pyke 2011, p. 534). Today, ongoing removal or control of sagebrush in the Bi-State area is limited. The BLM and USFS have stated that, with rare exceptions, they no longer convert sagebrush to other habitat types, and that future treatments shall maintain, improve, or restore Bi-State sage-grouse habitat (BLM 2016, p. 11; HTNF 2016, p. 16). Federal land managers currently focus on improving the diversity of the native plant community, reducing conifer encroachment, or reducing the risk of large wildfires. On private lands in the Bi-State area, our understanding of sagebrush treatments is limited. Known instances of the elimination of sagebrush by chemical and mechanical means are apparent, but their extent remains to be quantified. The ability to restore or rehabilitate overgrazed areas depends on the condition of the area relative to its site potential (Knick et al. 2011, p. 232). Active restoration is required where the native understory is reduced (Pyke 2011, p. 539). If an area has soil loss or invasive species, returning the native plant community may be impossible (Daubenmire 1970,[[Page 18071]]p. 82; Knick et al. 2011, p. 232; Pyke 2011, p. 539). Infrastructure related to livestock management such as water developments (e.g , springs, tanks, guzzlers) and fences in shrub-steppe habitats are common on public lands (Connelly et al. 2004, p. 7-35). Development of springs and other water sources can artificially concentrate domestic livestock and wild ungulates in mesic areas, thereby exacerbating grazing and trampling impacts to sage-grouse nesting and brood-rearing areas (Braun 1998, p. 147; Knick et al. 2011, p. 230). Diverting water sources can result in the loss of riparian or wet meadow habitat that sage-grouse depend upon as sources of forbs and insects. However, water developments can also be beneficial to sagebrush vegetation communities, as this practice can help distribute livestock to water troughs and away from riparian areas, minimizing concentrated impacts of livestock grazing. In the Bi-State area, there are 149 grazing allotments identified across all PMUs. Of these, 122 are considered active allotments, encompassing approximately 73 percent of suitable sage-grouse habitat. Most grazed lands are managed by the BLM and USFS, although much of the meadow habitats are located on private lands (BSLPG 2004, entire). Several rangeland health assessments (RHAs) or their equivalent have been completed on 120 allotments (104 that are active) and have not been conducted on the remaining 29 allotments (18 that are active). While there are public allotments or portions of allotments exhibiting adverse impacts from current or historical livestock grazing (e.g , vegetation condition or composition is generally less than desired), our understanding is the majority of allotments in the Bi-State area are in good condition (Axtell 2008, pers. comm.; Murphy 2008, pers. comm.; Nelson 2008, pers. comm. BLM 2014b, in litt.; Bi-State TAC 2017, pp. 31-33), and livestock grazing is generally thought to have a limited impact on sage-grouse habitat (Bi-State TAC 2012, entire). Livestock grazing will continue into the indefinite future within the Bi-State area at its current or slightly decreased level, and thus remain a discretionary action where Federal agencies have the ability to alter use when renewing grazing permits. Also, it appears that Federal land managers are moving in a direction that affords greater discretion to sage-grouse habitat needs when evaluating livestock management and the majority of allotments have or will have pending renewals and associated terms and conditions that consider sage-grouse habitat, including the establishment or placement of infrastructure (Nelson 2008, pers. comm.; BLM 2016, pp. 11-12; HTNF 2016, pp. 16-18). In addition to domestic livestock, feral horses can negatively impact meadows and brood-rearing habitats used by sage-grouse, and these impacts can be more severe given horses cannot be managed on a seasonal basis (Connelly et al. 2004, p. 7-37; Crawford et al. 2004, p. 11). Horse presence may negatively affect sagebrush vegetation communities and habitat suitability for sage-grouse by decreasing grass cover, fragmenting shrub canopies, altering soil characteristics, decreasing plant diversity, and increasing the abundance of invasive cheatgrass. In areas utilized by both horses and cattle, it is unknown whether grazing impacts are synergistic or additive (Beever and Aldridge 2011, p. 286). The most substantial impacts from feral horses in the Bi-State area occur in the Pine Nut, Mount Grant, and White Mountains PMUs (Axtell 2008, pers. comm.; Bi-State TAC 2012, pp. 19, 37, 41), although they are also known to occur within the Bodie and South Mono PMUs. We are unaware of the specific severity and scope of impacts caused by feral horses on the Bi-State DPS and sage-grouse habitat, although localized areas of concern in all PMUs are apparent. Most important are probable impacts to mesic areas within the Pine Nut, Mount Grant, and White Mountains PMUs. Management of herd size by Federal agencies is an ongoing challenge as horse management is expensive and often controversial. Based on this understanding, we anticipate future impacts caused by wild horses to increase, especially as horse herds are growing by 20 percent annually. However, despite this increase, the threat will have a minor impact on sagebrush habitat. Existing regulatory mechanisms such as BLM land management plans and USFS LRMPs further reduce the magnitude of threats associated with grazing and rangeland management. For example, the Central California Standards and Guidelines of the Bishop RMP provide additional direction for the management of permitted livestock grazing on public lands administered by the Bishop Field Office. Standards are set for soil, species, riparian, and water quality, and metrics by which the achievement of these standards could be measured were established. This enables BLM to manage livestock grazing to ensure that species such as sage-grouse are ``healthy and in numbers that appear to ensure stable to increasing populations; habitat areas are large enough to support viable populations or are connected adequately with other similar habitat areas.'' Additionally, the Carson City District Land Use Plan Amendment for the Nevada and California Greater Sage-grouse Bi-State Distinct Population Segment addresses conservation of the Bi-State area by providing specific direction to management of the DPS and its habitat, including grazing management and wild horse and burro management (BLM 2016, entire). Numerous land use allocations restrict or substantially limit new habitat and bird disturbances and identify Best Management Practices to further minimize allowable actions. For more details on plans that address the impacts of grazing and rangeland management, see the Existing Regulatory Mechanisms of the Species Report (Service 2020, pp. 124-136). Analyzing the overall impacts of grazing is difficult, as there is little direct evidence linking grazing effects and sage-grouse population responses. Analyses for grazing impacts at landscape scales important to sage-grouse are confounded by the fact that almost all sage-grouse habitat has at one time been grazed and thus no ungrazed control areas exist for comparisons (Knick et al. 2011, p. 232). Overall, impacts from historic grazing and current rangeland management occur within localized areas throughout the Bi-State DPS's range, though it is more pronounced in some PMUs than others. Domestic livestock and feral horses have the potential to negatively affect sage-grouse habitats by decreasing grass cover, fragmenting shrub canopies, altering soil characteristics, decreasing plant diversity, and increasing the abundance of invasive plant species, although their impacts and management potential can differ. Grazing and domestic livestock management has the potential to result in sage-grouse habitat degradation, though there is some conflicting information on whether some of the impacts of grazing are positive or negative. The Pine Nut and Mount Grant PMUs may be most sensitive to impacts from grazing as both PMUs are generally lower in elevation and receive less precipitation, making their sagebrush habitat less resistant to withstanding changes. Across the remainder of the PMUs, localized areas of meadow degradation are apparent, and these conditions may influence sage-grouse populations, as meadows are essential for recruitment of young. Overall, impacts from past grazing and rangeland management occur within localized areas in all PMUs,[[Page 18072]]although impacts are more pronounced in some PMUs than others. We concluded in the 2013 proposed listing rule that grazing and rangeland management was a factor (albeit not significant) for proposing to list the DPS as a threatened species as a result of ongoing habitat degradation impacts that may affect sage-grouse habitat in the Bi-State area, resulting in an overall reduction in aspects of habitat quality (e.g , fragmentation, lack of understory plants, increased presence of nonnative plant species), especially in the Pine Nut and Mount Grant PMUs. While we recognize that livestock and feral horses may negatively impact sage-grouse habitat, we affirm that it does not appear that this is a significant concern in the Bi-State area today. Importantly, conservation efforts that address the impacts from grazing and rangeland management have continued to be implemented since publication of the proposed listing rule, including (but not limited to): (1) Completing drafts and beginning to implement the new BLM and USFS Land Use Plan amendments (U.S Department of the Interior and USDA 2015, entire), which are a considerable improvement for conservation of the Bi-State DPS and its habitat; repairing watering facilities, irrigation structures, and fencing around natural riparian areas to control grazing activity; increasing monitoring and management of horse and burrow herds; and restoring meadow/riparian habitat in critical brood-rearing habitat areas. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), impacts from grazing and rangeland management are significantly reduced. The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as livestock and wild horse grazing. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), we believe impacts associated with grazing and rangeland management are not a concern now or in the foreseeable future.Nonnative Invasive Plants and Native Woodland Succession Shifting vegetation communities within the Bi-State area are altering sagebrush habitat that supports sage-grouse. Nonnative invasive plants such as cheatgrass alter sagebrush community structure, composition, productivity, ***nutrient*** cycling, and hydrology (Vitousek 1990, p. 7). Nonnative plants may also cause declines in native plant populations through mechanisms such as competitive exclusion and niche displacement (Mooney and Cleland 2001, p. 5446). They can create long-term changes in ecosystem processes, such as altering fire cycles and other disturbance regimes; these changes can persist even after an invasive plant is removed (Zouhar et al. 2008, p. 33). Nonnative plants degrade existing sage-grouse habitat, replacing vegetation essential to sage-grouse for food and cover (Connelly et al. 2000a, pp. 971-972; Miller et al. 2011, pp. 160-164). The presence of cheatgrass influences lek persistence, nest site selection, and ultimately population performance (Blomberg et al. 2012, p. 7; Knick et al. 2013, p. 1544; Lockyer et al. 2015, p. 791; Coates et al. 2016b, p. 12747). Nonnative plants affect sage-grouse habitat and population demographics both in the short term (e.g , nest site selection, loss of forbs and associated insects) and in the long term (e.g , population growth, sagebrush displacement and habitat fragmentation). A variety of nonnative invasive plants are present within the Bi-State area, although cheatgrass is of greatest concern. Local managers and scientists consider cheatgrass to be a low-level threat across four PMUs (White Mountains, South Mono, Bodie, and Desert Creek-Fales), a moderate threat in the Mount Grant PMU, and a high threat in the Pine Nut PMU (Bi-State TAC 2012, pp. 19, 26, 32, 37, 41, 49). Areas of greatest concern are in the Pine Nut PMU where cheatgrass abundance is greatest and where there are restoration challenges following several recent wildfires. Averaged across the entire Bi-State, percent cover of cheatgrass is generally low (Peterson 2003, entire), and conversion to an annual grass dominated community is currently limited to only a few locations. Anecdotal reports suggest this assessment remains generally true, though it is apparent that the abundance and distribution of cheatgrass has increased over the past decade. Efforts are ongoing to restore or rehabilitate sage-grouse habitat affected by nonnative plant species, but the techniques for accomplishing these efforts remain mostly unproven, experimental, and often logistically difficult (Pyke 2011, pp. 543-544). Regardless, restoration efforts such as localized weed treatments have been applied within all the Bi-State PMUs. Based on our understanding and past experience with nonnative invasive species in the Great Basin Region, we anticipate that impacts from nonnative species will continue or increase into the future. According to a mapping of sagebrush habitats across the range of greater sage-grouse that categorized these habitats based on their resistance and resilience to disturbance, both resistance and resilience are low in the warm and dry sagebrush habitats contained within the Nevada portion of the Bi-State (Pine Nut, Mount Grant, and Desert Creek portion of the Desert Creek-Fales PMUs) and most of the South Mono PMU (Chambers et al. 2014, pp. 16-17). That is, these areas have lower productivity and higher susceptibility to cheatgrass or other invasive annual grass incursion and will therefore face greater restoration challenges should fire occur. In the wetter and cooler sagebrush habitats found in the White Mountains, Bodie, Fales portion of the Desert Creek--Fales PMUs, and high-elevation sites of the Mount Grant PMU, resilience and resistance were ranked as moderately high to high, implying these locations have greater productivity and are generally less suitable to invasive annual grass establishment (Chambers et al. 2014, p. 43). In addition to nonnative plant invasions within sagebrush habitat, some native tree species are increasing in sagebrush habitat and impacting the suitability of the habitat for the various life processes of the sage-grouse. Pinyon-juniper woodlands are a native vegetation community that can encroach upon, infill, and eventually replace sagebrush habitat. The cause of this conversion from shrubland to woodland is debatable but may be due to a suite of causes acting in concert with active wildfire suppression including: Domestic livestock grazing (reduced competition from native grasses and forbs and facilitation of tree regeneration by increased shrub cover and enhanced seed dispersal), climatic fluctuations favorable to tree regeneration, enhanced tree growth due to increased water use efficiency associated with carbon dioxide fertilization, and recovery from past disturbance (natural and anthropogenic) (Miller et al. 2008, p. 10; Baker 2011, p. 200; Miller et al. 2011, pp. 167-169; Bukowski and Baker 2013, p. 560). Each of these factors have likely influenced the current pattern of vegetation in the Bi-State area today and have led to an estimated 40 percent decline in sagebrush extent due to woodland succession and isolation of sage-grouse populations across the DPS. Land managers in the Bi-State area consider pinyon-juniper encroachment a substantial threat to sage-grouse because it impacts habitat quality, quantity, and connectivity, and[[Page 18073]]increases the risk of avian predation to sage-grouse populations (BSLPG 2004, pp. 20, 39, 96; Bi-State TAC 2012, pp. 18-47). Previously occupied sage-grouse locations throughout the Bi-State area are thought to have been abandoned due to woodland succession (Bi-State TAC 2012, pp. 18-47). The extent of the conversion to pinyon-juniper woodland varies by PMU, with the South Mono PMU being the least impacted (approximately 13 percent loss) and the Pine Nut PMU being the most influenced (approximately 50 percent loss). The remainder of the PMUs (White Mountains, Mount Grant, Desert Creek-Fales, and Bodie) are each estimated to have experienced approximately a 40 percent loss of historical sagebrush vegetation to woodland succession. In total, over the past 150 years, an estimated 390,000 ha (963,000 ac) of sagebrush habitat has converted to woodland vegetation, resulting in a loss of availability of total sagebrush habitat in the Bi-State area (which is not synonymous with suitable sage-grouse habitat as presented in Table 1) from slightly over 1,000,000 ha (2,580,000 ac) in 1850 to approximately 650,000 ha (1,600,000 ac) today across the Bi-State DPS (USGS 2012, unpublished ***data***). In order to counter the impact of pinyon-juniper encroachment, treatments to thin or remove woodland species are ongoing. Recent research supports previous assertions that these treatments would expand sage-grouse habitat and ultimately be used successfully by birds (Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Olsen 2019, pp. 21-22). Sage-grouse response to woodland encroachment has been negative to the incursion but in some instances responsive to treatment actions. Sage-grouse encountering pinyon-juniper communities coupled with the rate of movement through these communities negatively affected bird survival (Prochazka et al. 2017, p. 46); however, sage-grouse readily nested in conifer treatment sites after trees had been removed (Severson et al. 2017, p. 53). Woodland treatments increased suitable available breeding habitat and enhanced nest and brood success (Sandford et al. 2017, p. 63). Sage-grouse avoided pinyon-juniper communities across varying degrees of community dominance; this avoidance increased survival (Coates et al. 2017b, pp. 31-33). Removal of pinyon-juniper trees encroaching into sagebrush vegetation communities can increase sage-grouse population growth through improving juvenile, yearling, and adult survival as well as improving nest survival (Olsen 2019, pp. 21-22). This research found population growth was 11.2 percent higher in treatment than in control sites within 5 years of conifer removal. Therefore, woodland encroachment into occupied sage-grouse habitat reduces, and likely eventually eliminates, sage-grouse occupancy. However, treatment action to remove trees increases sagebrush habitat, and these habitats are used successfully by sage-grouse. Prior to the development of the BSAP in 2012, approximately 18 woodland thinning or removal projects had been undertaken, removing approximately 5,454 ha (13,479 ac) of woodland (Bi-State TAC 2012, p. 5). Since this time, an additional 81 projects have been initiated, treating approximately 18,798 ha (46,450 ac). While it is premature to detect a population-level response of sage-grouse to these treatments in the Bi-State region, increases in occupied habitat and increases in nest and brood success as well as survival parameters are anticipated based on recent research finding a positive overall outcome for population performance and connectivity (Coates et al. 2017b, pp. 31-33; Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Olsen 2019, pp. 21-22). Furthermore, preliminary analysis of marked birds in the Bi-State area demonstrates grouse use of these treatments and offers support for these research findings (Mathews et al. 2018, pp. 33-34). Implementation and planning of additional woodland treatment projects are also under way over the next several years covering tens of thousands of acres. Using the best available ***data***, we estimate that the current acres of conifer removal treatments is within the range of estimated acres of woodland expansion and, further, that these treatments will continue based on ongoing commitments provided by land managers to implement the BSAP. Overall, we consider woodland succession to pose a substantial threat to the Bi-State DPS. However, we consider impacts from woodland succession to be reduced by conservation measures with a high degree of implementation and effectiveness, recognizing that restoring historical connectivity and preventing further loss of suitable habitat requires continued focused active management. Both nonnative invasive plants and native woodland succession are impacting the sage-grouse and its habitat in the Bi-State area. In general, nonnative plants are not abundant throughout the Bi-State area, with the exception of cheatgrass that occurs in all PMUs and is most extensive and of greatest concern in the Pine Nut PMU. Cheatgrass is a nonnative annual species that will likely continue to expand throughout the Bi-State region in the future and increase the adverse impact that currently exists to sagebrush habitats and sage-grouse through outcompeting beneficial understory plant species and altering the fire ecology of the area. Land managers have had limited success preventing cheatgrass invasion in the West, and elevational barriers to occurrence are becoming less restrictive. The best available ***data*** suggest that future conditions that could promote expansion of cheatgrass will be most influenced by precipitation and winter temperatures (Bradley 2009, p. 200). Cheatgrass is a serious challenge to the sagebrush shrub community, and its spread will be detrimental to sage-grouse in the Bi-State area. In addition, the encroachment of native woodlands (particularly pinyon-juniper) into sagebrush habitats continues to occur throughout the Bi-State area. Currently, however, treatment actions are on par with the expansion rate. Overall, invasive nonnative and native plants occur throughout the entire Bi-State DPS's range. We concluded in the proposed listing rule that their spread was a significant factor for proposing to list the DPS as a threatened species based on the extensive amount of pinyon-juniper encroachment and cheatgrass invasion that is occurring throughout the DPS's range, and the interacting impact these invasions have on habitat quality (e.g , reduces foraging habitat, increases likelihood of wildfire) and habitat fragmentation. Today, we affirm that nonnative and native invasive species occur throughout the Bi-State DPS's range and are significant threats to the species both currently and in the future. We expect this threat will increase across the range into the future unless it is actively managed. Several regulatory mechanisms identified in existing federal land use plans address the impact of nonnative invasive plants and native woodland succession, the BSAP (Bi-State TAC 2012, entire) includes measures to counter the effects of these threats. In the past few years, we have gained increased certainty about the effectiveness of removal efforts for pinyon-juniper woodland. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), the threat of native woodland succession is being reduced, though it is still impacting[[Page 18074]]sagebrush habitat throughout the DPS. Conservation measures are less effective at controlling and ameliorating the effects of nonnative invasive plants, and thus they will continue to affect sagebrush habitat into the foreseeable future.Wildfires and Altered Fire Regime Wildfire is the principal disturbance mechanism affecting sagebrush communities. The nature of historical fire patterns, particularly in big sagebrush, is not well understood; however, it was historically infrequent (Miller and Eddleman 2000, p. 16; Zouhar et al. 2008, p. 154; Baker 2011, pp. 189, 196). Most sagebrush species have not developed evolutionary adaptations such as re-sprouting and heat-stimulated seed germination found in other shrub-dominated systems, such as chaparral, that are exposed to relatively frequent fire events. Natural fire regimes and landscapes were shaped by a few infrequent large fire events; historical fire rotation was 50-200 years in mountain big sagebrush communities and 200-350 years in Wyoming big sagebrush communities (Baker 2011, p. 196; Bukowski and Baker 2013, pp. 556-558). In general, fire extensively reduces sagebrush within burned areas, and big sagebrush varieties, the most widespread species of sagebrush, can take decades to reestablish and even longer to return to pre-burn conditions (Service 2020, p. 79). While no specific studies have been conducted within the Bi-State area to inform our knowledge of fire rotation, we expect the pattern in Wyoming big sagebrush and mountain big sagebrush communities in the Bi-state area to be similar to those described above for the remainder of the species' range. Both increases and decreases in the natural fire regime can have detrimental effects on sagebrush. When intervals between wildfire events become unnaturally long, woodlands can encroach into sagebrush communities as the prolonged interval between fires allows seedlings to establish and trees to mature (Miller et al. 2011, p. 167). Currently, active wildfire suppression continues to occur throughout the Bi-State DPS. Conversely, the invasion and establishment of nonnative invasive annual grasses, such as cheatgrass and medusahead rye (Taeniatherum caput-medusae) can increase wildfire frequency within sagebrush ecosystems and negatively influence the likelihood of recovery (Zouhar et al. 2008, p. 41; Miller et al. 2011, p. 167; Balch et al. 2013, p. 178). Cheatgrass shortens historical fire patterns by providing an abundant and easily ignitable fuel source that facilitates fire spread and recovers within 1-2 years of a wildfire event, leading to a recurring wildfire cycle that prevents sagebrush reestablishment (Young and Evans 1978, p. 285; Eiswerth et al. 2009, p. 1324; Balch et al. 2013, pp. 180-181). It is difficult and usually ineffective to restore sagebrush after annual grasses become established due to the positive feedback with fire, invasive species seed bank establishment, and alterations to soil and hydrologic processes (Paysen et al. 2000, p. 154; Connelly et al. 2004, pp. 7-44-7-50; Pyke 2011, p. 539). Fire can have direct impacts on sage-grouse and their habitat. If fire does not completely remove sagebrush, it can reduce suitable nesting habitat, herbaceous understory vegetation used for forage and cover by sage-grouse hens and chicks, and potentially insects used for feeding by chicks. Additionally, isolation and fragmentation of populations due to habitat losses from wildfire presents a higher probability of extirpation in disjunct areas (Knick and Hanser 2011, p. 395; Wisdom et al. 2011, p. 469). This is a concern within the Bi-State area, specifically throughout the Pine Nut and portions of the South Mono and Desert Creek-Fales PMUs where burned habitat may be influencing already small and disjunct populations. As areas become fragmented and isolated through disturbances such as wildfire, persistence may be hampered by the limited ability of individuals to disperse into areas that are otherwise not self-sustaining. Thus, while direct loss of habitat due to wildfire has been shown to be a significant factor associated with population persistence for sage-grouse (Beck et al. 2012, p. 452), the indirect effect posed by loss of connectivity among populations may greatly expand the influence of this threat beyond the physical fire perimeter (Knick and Hanser 2011, pp. 401-404). Sagebrush recovery rates following wildfire are highly variable, and precise estimates are often hampered by limited ***data*** from older burns. Factors contributing to the rate of shrub recovery include the amount of and distance from unburned habitat, abundance and viability of seed in soil seed bank (sagebrush seeds are typically viable for one to three seasons depending on species), rate of seed dispersal, and pre- and post-fire weather, which influences seedling germination and establishment (Young and Evans 1989, p. 204; Maier et al. 2001, p. 701; Ziegenhagen and Miller 2009, p. 201). Full recovery to pre-burn conditions in mountain sagebrush communities ranges between 25 and 100 years, and in Wyoming big sagebrush communities potentially ranges between 50 and 120 years (Baker 2011, pp. 194-195). By 25 years post-fire, Wyoming big sagebrush typically has less than 5 percent pre-fire canopy cover (Baker 2011, p. 195). Wildfire is considered a relatively high risk across all the PMUs in the Bi-State area due to its ability to affect large landscapes in a short period of time (Bi-State TAC 2012, pp. 19-49). Furthermore, the future potential of this risk is exacerbated by the presence of people, invasive species, and climate change. While numerous wildfires have occurred in the Pine Nut, and South Mono PMUs (fewer in the other PMUs) over the past 18 years, to date there have been relatively few large-scale events (Service 2020, Table 3). In general, current ***data*** also do not indicate an increase of wildfires in the PMUs over time with the exception of the Pine Nut PMU where fire occurrence is more frequent (Service 2018, unpublished ***data***). Furthermore, cheatgrass has a more substantial presence in the Pine Nut PMU, which appears to mirror (much more than the rest of the Bi-State area) the damaging fire and invasive species cycle impacting sagebrush habitat across much of the Great Basin. The loss of habitat due to wildfire across the West is anticipated to increase due to the intensifying synergistic interactions among fire, people, invasive species, and climate change (Miller et al. 2011, p. 184). The past- and present-day fire regimes across the sage-grouse's range have changed with a demonstrated increase of wildfires in the more arid Wyoming big sagebrush communities and a decrease of wildfire across many mountain sagebrush communities (Miller et al. 2011, pp. 167-169). Both altered fire regime scenarios have caused significant losses to sage-grouse habitat through facilitating conifer expansion at high-elevation interfaces and nonnative invasive weed encroachment at lower elevations (Miller et al. 2011, pp. 167-169). In the face of climate change, both scenarios are anticipated to worsen (Baker 2011, p. 200; Miller et al. 2011, p. 179), including in the Bi-State area. Predicted changes in temperature, precipitation, and carbon dioxide are all anticipated to influence vegetation dynamics and alter fire patterns, resulting in increasing loss and conversion of sagebrush habitats (Neilson et al. 2005, p. 157). Furthermore, climate scientists suggest that, in addition to the predicted change in climate toward a warmer and generally drier Great Basin, variability[[Page 18075]]of annual and decadal wet-dry cycles will likely increase and act in concert with fire, disease, and invasive species to further stress the sagebrush ecosystem (Neilson et al. 2005, p. 152, Ault et al. 2014, p. 7538). The anticipated increase in suitable conditions for wildland fire will likely further interact with people and infrastructure. Human-caused fires have increased and are correlated with road presence across the sage-grouse range (Miller et al. 2011, p. 171). Based on the best available information, approximately 117 wildfire events have affected approximately 83,859 ha (207,220 ac) of sagebrush habitat across the Bi-State area since 2000, but conversion of sagebrush habitat to a nonnative invasive vegetation community has been largely restricted (Pine Nut PMU withstanding). It appears that a lack of historical fire has facilitated the establishment of woodland vegetation communities and loss of sagebrush habitat. Both the ``too little'' and ``too much'' fire scenarios present challenges for the Bi-State DPS. The former influences the current degree of connectivity among sage-grouse populations in the Bi-State DPS and the extent of available sagebrush habitat, likely affecting sage-grouse population size and persistence. The latter, under current conditions, now has the potential to quickly alter substantial percentages of remaining sagebrush habitat. Restoration of sagebrush communities is challenging, requires many years, and may be ineffective in the presence of nonnative invasive grass species. Research in the Great Basin found that sage-grouse habitat features are unlikely to occur in many burned areas even 20 years post-restoration (Arkle et al. 2014, p. 15). Several regulatory mechanisms target the potential impact of wildfires and altered fire regime. Within the Bi-State area, participants in the BSAP (Bi-State TAC 2012, entire) have treated areas to reduce the threat of wildfire by using broadcast burns and mechanical treatment (e.g , fuel breaks and conifer removal projects). To lower the risk of wildfire, approximately 1,806 ha (4,462 ac) of fuels reduction treatments have been conducted to remove conifers (Bi-State TAC 2018, unpublished ***data***). Additionally, the reseeding of 7,699 ha (19,025 ac) from past fires has been completed. The efficacy of these treatments to achieve desired results is generally unknown. Overall, the threat of wildfire and the existing altered fire regime occurs throughout the Bi-State DPS's range. We concluded in the proposed listing rule that significant impacts would be expected to continue or increase in the future based on a continued fire frequency pattern that exacerbates pinyon-juniper encroachment into sagebrush habitat in some locations, but also an increased fire frequency in other locations that promotes the spread of cheatgrass and other invasive species that in turn can hamper recovery of sagebrush habitat. Within the Bi-State DPS, the continued reduced fire frequency exacerbates pinyon-juniper encroachment into sagebrush habitat in some locations. However, an increased fire frequency in other locations promotes the spread of cheatgrass and other invasive species that in turn can hamper recovery of sagebrush habitats in other locations. While it is not currently possible to predict the extent or location of future fire events in the Bi-State area, we anticipate fire frequency to increase in the future due to the increasing presence of cheatgrass, human footprint, and the projected effects of climate change. The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as wildfire ignition risks and catastrophic fire. Fuels reduction projects and rehabilitation efforts post-wildfire have been and will continue to be implemented into the future to address the potential impacts from wildfire, including (but not limited to): Conducting conifer (pinyon-juniper) removal and conducting weed treatments for invasive, nonnative plants such as cheatgrass. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), we conclude that impacts due to the threat of wildfires and altered fire regime have been reduced since the time of the 2013 proposed listing rule. We expect that, into the future, continued implementation of the BSAP will further reduce the impacts of wildfire and altered fire regime.Climate In considering future climate projections for the Bi-State area, we analyzed multi-model ensembles that made use of multiple greenhouse gas emission scenarios. In general, downscaled climate change model predictions in the Bi-State area tend to agree on an increasing temperature regime (Cayan et al. 2008, pp. S38-S40; He et al. 2018, p. 11; Gonzalez et al. 2018, Chapter 25) and stable to increasing local precipitation, with a shift in timing of local precipitation events (Diffenbaugh et al. 2005, p. 15776; Cayan et al. 2008, p. S28; He et al. 2018, p. 14: Reich et al. 2018, p. 21). The environment will be relatively drier due to elevated temperature, increased rates of evapotranspiration, more precipitation falling as rain instead of snow, and more frequent and prolonged drought (Neilson et al. 2005, p. 150; He et al. 2018, pp. 9, 11, 16). The precipitation variables are an important predictor of sagebrush occurrence as well as to greater sage-grouse occurrence, as timing and quantity of precipitation greatly influences plant community composition and extent--specifically forb production, which in turn affects nest and chick survival and ultimately population performance (Blomberg et al. 2012, p. 7; Coates et al. 2018, p. 252). Impacts associated with climate change may increase the magnitude of threats impacting the Bi-State DPS, as its effects interact with other stressors such as disease, invasive species, prey availability, moisture, vegetation community dynamics, disturbance regimes, habitat degradation, and habitat loss (Service 2020, p. 89). Downscaled climate change projections in the Great Basin and Eastern Sierra also predict acceleration in fire frequency, with fires potentially becoming larger and more severe, and fire seasons becoming longer (Service 2020, pp. 87-88). Furthermore, drought frequency and persistence are anticipated to increase (Ault et al. 2014, p. 7545; Reich et al. 2018, p. 31; Gonzalez et al. 2018, entire). In the Bi-State area, drought is a natural part of the sagebrush ecosystem. Sage-grouse population performance in the Bi-State region responds to alterations in annual precipitation (Coates et al. 2018, p. 252; Coates et al. 2020, p. 27). While there is variation among subpopulations, on average findings suggest a 50 percent increase in precipitation corresponds to a 15.5 percent increase in population growth the following year. Moreover, these results indicate that precipitation needs to be approximately 20 percent greater than average for population recovery following drought, consistent with results from the Great Basin in the absence of wildfire (Coates et al. 2016b, p. 12747; Coates et al. 2018, p. 255). Sage-grouse are affected by drought through the loss of vegetative habitat components, reduced insect production (Connelly and Braun 1997, p. 9), and potentially exacerbation of West Nile virus (WNv) and predation exposure (Gibson et al. 2017, p. 177; Prochazka et al. 2017, p. 47; Coates et al. 2018, p. 255). Drought reduces vegetation cover (Milton et al. 1994, p. 75; Connelly et al. 2004, p. 7-18), potentially resulting in[[Page 18076]]increased soil erosion and subsequent reduced soil depths, decreased water infiltration, and reduced water storage capacity. These habitat component losses can result in declining sage-grouse populations due to increased nest predation and early brood mortality associated with decreased nest and brood cover and food availability (Braun 1998, p. 149; Moynahan et al. 2007, p. 1781). Furthermore, there are known occasions where the reduced condition of brood-rearing habitat due to weather has resulted in little to no recruitment within certain PMUs (Bodie, Pine Nut) (Gardner 2009, pers. comm.; Coates 2012, pers. comm.). Within the Bi-State area, several projects have been undertaken to improve meadows and riparian areas for sage-grouse that could help increase population resiliency in response to increasing frequency of drought. These projects include grazing exclosures, changes to grazing management plans, prescribed fires, invasive plant control, mechanical treatments, and conservation easements intended to improve the resiliency of meadow habitats on privately owned lands (Bi-State TAC 2018, unpublished ***data***). Climate change is not known to currently impact the Bi-State DPS to such a degree that the viability of the species is at stake, although climate change has been shown to influence the impact of drought and the annual water cycle and these in turn have been shown to influence grouse population performance in the Bi-State area (Coates et al. 2018, p. 251; Reich et al. 2018, pp. 31, 33). However, while it is reasonable to assume the Bi-State area will experience vegetation changes into the future (as presented above), we do not know the degree to which these changes will ultimately have impacts on the Bi-State DPS. An analysis conducted by NatureServe, which incorporates much of the information presented above, suggests a substantial contraction of both sagebrush and sage-grouse range in the Bi-State area by 2060 (Comer et al. 2013, pp. 142, 145). Occurrence of cheatgrass has generally been restricted to elevations below approximately 1,700 m (5,500 ft.) above mean sea level (Bradley 2010, p. 202). More recently, this barrier appears less certain in the Bi-State area as cheatgrass occurs at elevations previously thought to be relatively unfavorable based on the grass's ecology. This situation suggests that few locations in the Bi-State area are immune to cheatgrass invasion. Climate change may strongly influence the spread of this species as the available climate ***data*** suggests changes in timing of precipitation and increasing winter temperatures favorable to this species (Bradley 2009, p. 200). Predictions on the timing, type, and amount of precipitation contain the greatest uncertainty. In the Bi-State area, model scenarios that result in the greatest expansion of cheatgrass suggest much of the area remains suitable to cheatgrass presence with some additional high-elevation sites in the Bodie Hills, White Mountains, and Long Valley becoming more suitable than they are today (Bradley 2009, p. 204). On the opposite end of the spectrum, model scenarios that result in the greatest contraction in cheatgrass range suggest low-elevation sites such as Desert Creek-Fales and Mount Grant PMUs become less suitable for this invasive species but high-elevation sites (Bodie and White Mountains PMUs), where habitat conditions are generally marginal today, become more suitable in the future. Based on this information we assume that climate change (acting both alone and in concert with impacts such as wildfire and nonnative invasive species) could be pervasive throughout the range of the Bi-State DPS, potentially degrading habitat to such a degree that all populations would be negatively affected with some low-elevation sites or populations currently exposed to greater cheatgrass abundance (Pine Nut, Desert Creek-Fales, South Mono and portions of the Mount Grant PMUs). Therefore, given the scope and potential severity of climate change when interacting with other threats in the future, the overall impact of climate change to the Bi-State DPS at this time is considered moderate to high. We concluded in the proposed listing rule that climate change will potentially act in combination with other impacts to the Bi-State DPS, further diminishing habitat and increasing population isolation, making the DPS more susceptible to demographic and genetic challenges or disease. Although no regulatory mechanisms are available that can ameliorate the effect of changing climate or increasing drought, ongoing implementation of various conservation measures in the BSAP increases the resilience of the habitat to the effects of threats exacerbated by climate change and drought, such as wildfire and invasive plants (e.g , through removal of pinyon-juniper woodland). We expect that, into the future, continued implementation of the BSAP will further reduce the impacts of these threats associated with climate change.Recreation Recreational activities such as fishing, hiking, horseback riding, and camping, off-highway vehicle (OHV) use (including snowmobiles), and mountain biking occur throughout the range of the greater sage-grouse, including throughout the Bi-State DPS area. These activities can degrade wildlife resources, water, and land by distributing refuse, disturbing and displacing wildlife, increasing animal mortality, and decreasing diversity of plant communities (Boyle and Samson 1985, pp. 110-112). The effects of OHV use on sage-grouse have not been directly studied (Knick et al. 2011, p. 219). However, sage-grouse avoidance of activities associated with development suggests they are disturbed by persistent human presence (Holloran 2005, pp. 43, 53, 58; Doherty et al. 2008, p. 194). Sage-grouse response to disturbance may be influenced by the type of activity, recreationist behavior, predictability of activity, frequency and magnitude, activity timing, and activity location (Knight and Cole 1995, p. 71). Disruption of sage-grouse during vulnerable periods at leks, or during nesting or early brood-rearing, could affect reproduction and survival (Baydack and Hein 1987, pp. 537-538). Indirect effects to sage-grouse from recreational activities may include impacts to vegetation and soils and facilitation of the spread of invasive species. One study found long-term (2-year) reductions in sagebrush shrub canopy cover as the result of repeated OHV trips (Payne et al. 1983, p. 329). Increased sediment production and decreased soil infiltration rates were observed after disturbance by motorcycles and four-wheel drive trucks on two desert soils in southern Nevada; noise from these activities can also cause additional disturbance (Eckert et al. 1979, p. 395; Knick et al. 2011, p. 219; Blickley et al. 2012, p. 467). Unpaved roads fragment sagebrush landscapes and subsidize predators adapted to humans; they also provide disturbed surfaces that facilitate the spread of invasive plant species (Knick et al. 2011, p. 219). Potential disturbance caused by non-motorized forms of recreation (fishing, camping, hiking, big game hunting, dog training) are most prevalent in the South Mono and Bodie PMUs. These PMUs are also exposed to tourism-associated activity centered on Mono Lake and the towns of Mammoth Lakes and Bodie. The exact amount of recreational activity or user days occurring in the area is not known; however, the number of people in the area appears to increase[[Page 18077]]annually (Nelson 2008, pers. comm.; Taylor 2018, pers. comm.). A 2012 assessment reported recreation and human disturbance to be low-level threats in the Bodie and Mount Grant PMUs but relatively high threats in the Pine Nut and South Mono PMUs (Bi-State TAC 2012, pp. 19, 32, 37, 49). To address these apparent challenges, across the Bi-State, vehicular travel is limited to designated roads and trails and development of new roads is largely restricted. In addition, organized OHV events are prohibited during specific dates and in specific habitats (breeding and winter) limiting the exposure of birds (BLM 2016, pp. 13-14; HTNF 2016, p. 43). Currently, there are few quantifiable ***data*** available to assess the degree of the impacts of recreation. The level of recreational activity associated with a specific road, for instance, is not known even though anecdotal information suggests that the level of activity (OHV numbers) is generally increasing. All the PMUs are relatively close to urban centers; thus, we anticipate recreational activity will continue and likely increase. However, all public lands in the Bi-State restrict OHV use to designated roads and trails and existing land use plans afford management oversite of this activity, thereby lessening the likelihood of broad scale habitat degradation. Overall, recreation occurs throughout the Bi-State DPS's range, although we do not have ***data*** that would indicate impacts to sage-grouse or their habitat are significant. We concluded in the proposed listing rule and reaffirm here that, by itself, recreation is not considered a significant impact at this time. However, if left unchecked, some forms of recreation could become a concern based on anticipated increases of recreational use within the Bi-State area in the future. Conservation efforts that address recreational impacts have continued to be implemented since publication of the proposed listing rule, including (but not limited to): Reducing human-related disturbances in high-use recreation areas (e.g , installing sage-grouse educational signs), conducting seasonal closures of lek viewing areas, and implementing both permanent and seasonal road closures. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), impacts from recreation are significantly reduced. The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as human disturbance to the Bi-State DPS, including recreation-related impacts. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), we believe impacts associated with recreation are not a concern into the future.Disease Sage-grouse are hosts for a variety of parasites and diseases (Thorne et al. 1982, p. 338; Connelly et al. 2004, pp. 10-4-10-7; Christiansen and Tate, 2011, p. 114). The disease of greatest concern to the Bi-State DPS is WNv, which can cause serious impacts to grouse species, potentially influencing population dynamics (Petersen 2004, p. 46). WNv has spread across North America since 1999 (Marra et al. 2004, p. 394). It is thought to have caused millions of wild bird deaths since its introduction, but most WNv mortality goes unnoticed or unreported (Ward et al. 2006, p. 101; Walker and Naugle 2011, p. 128). Sage-grouse are considered to have high susceptibility to WNv and high levels of mortality (Clark et al. 2006, p. 19; McLean 2006, p. 54). Sage-grouse deaths resulting from WNv have been detected in 10 States--including in the Bi-State area--and in 1 Canadian Province (Walker and Naugle 2011, pp. 133, 135). Since 2002, mortalities have been documented annually. Mortality from WNv has been shown to cause population declines in populations throughout the West (Service 2020, pp. 106-107). Scientists have expressed concern regarding the potential for exacerbating WNv persistence and spread due to the proliferation of surface water features (Friend et al. 2001, p. 298; Zou et al. 2006, p. 1040; Walker et al. 2007b, p. 695; Walker and Naugle 2011, p. 140). WNv persists on the landscape after it first occurs as an epizootic, suggesting this virus will remain a long-term issue in affected areas (McLean 2006, p. 50). The long-term response of different sage-grouse populations to WNv infections is expected to vary markedly depending on factors that influence exposure and susceptibility, such as temperature, land uses, and sage-grouse population size (Walker and Naugle 2011, p. 140). Small, isolated, or genetically limited populations are at higher risk as an infection may reduce population size below a threshold where recovery is no longer possible, as observed in an extirpated population in Wyoming (Walker and Naugle 2011, p. 140). Larger populations may be able to absorb impacts resulting from WNv as long as the quality and extent of available habitat supports positive population growth (Walker and Naugle 2011, p. 140). However, impacts from this disease may act in combination with other stressors resulting in reduction of population size, bird distribution, or persistence (Walker et al. 2007a, p. 2652). Small populations, such as the populations within the Bi-State area, may be at high risk of extirpation simply due to their low population numbers and the additive mortality WNv causes (Christiansen and Tate, 2011, pp. 125-126). The documented loss of four sage-grouse to WNv in the Bodie (n=3) and Desert Creek-Fales (n=1) PMUs (Casazza et al. 2009, p. 45) has heightened our concerns about the potential impact of this disease in the Bi-State area. At that time, these disease-caused mortalities represented only 4 percent of the total sage-grouse mortalities observed in the Bi-State area, but additional mortality attributed to predation could have been due in part to disease-weakened individuals. Mortality caused by disease acts in a density-independent or additive manner. The fact that it can act independently of habitat and suppress a population below carrying capacity makes it a concern. Existing and developing models suggest that the occurrence of WNv is likely to increase throughout the range of the species, and, based on projected increases in temperature caused by changes in climate, occurrence in the Bi-State may also increase (Paz 2015, p. 3). Based on our current knowledge of the virus, the relatively high elevations and cold temperatures common in much of the Bi-State area likely reduce the chance of a DPS-wide outbreak. However, warmer, lower elevation sites such as portions of the Mount Grant and Desert Creek-Fales PMUs may be more suitable for outbreaks. The impact on individual populations from WNv outbreaks may influence the dynamics of the Bi-State DPS as a whole through the loss of population resiliency and the associated challenges of recolonizing extirpated sites through natural emigration. Climate change may also influence the spread of disease. Temperature and precipitation both directly influence potential for WNv transmission (Walker and Naugle 2011, p. 131). In sage-grouse, WNv outbreaks appear to be most severe in years with higher summer temperatures (Walker and Naugle 2011, p. 131) and under drought conditions (Epstein and Defilippo 2001, p. 105). Therefore, current climate change projections for higher summer temperatures, more frequent or severe drought, or both make more severe WNv outbreaks likely in low-elevation sage-grouse habitats where WNv is already[[Page 18078]]endemic, and also make WNv outbreaks possible in higher elevation sage-grouse habitats that have been WNv-free due to relatively cold conditions. The development or maintenance of anthropogenic water sources in the Bi-State area, some of which likely provide suitable conditions for breeding mosquitoes, potentially increases the likely prevalence of the virus above that which could be sustained naturally by existing water bodies such as streams and meadows. To partially ameliorate this concern, Federal land managers require livestock water troughs to be emptied when not in use (BLM 2016, p. 11; HTNF 2016, p. 17). We concluded in the proposed listing rule, and reaffirm here, that by itself, WNv is not considered a significant impact at this time because it is currently limited by ambient temperatures that do not allow consistent vector and virus maturation. However, WNv could be a concern for the future if predicted temperature increases associated with climate change result in this threat becoming more consistently prevalent. No current regulatory mechanisms address the impacts of WNv. However, with continued implementation of conservation actions (WNv surveillance and mosquito abatement measures) associated with the BSAP (Bi-State TAC 2012, entire), the minor or potential impacts from WNv are reduced to the point that we find disease is not currently impacting the resiliency of the Bi-State DPS, nor do we expect it to impact the DPS in the foreseeable future.Predation Predation of sage-grouse is the most commonly identified cause of direct mortality during all life stages (Schroeder et al. 1999, p. 9; Connelly et al. 2000b, p. 228; Casazza et al. 2009, p. 45; Connelly et al. 2011a, p. 65). Major predators of adult sage-grouse include several species of diurnal raptors (especially the golden eagle (Aquila chrysaetos)), coyotes (Canis latrans), red foxes (Vulpes vulpes), and bobcats (Lynx rufus) (Hartzler 1974, pp. 532-536; Schroeder et al. 1999, pp. 10-11; Schroeder and Baydack 2001, p. 25; Rowland and Wisdom 2002, p. 14; Hagen 2011, p. 97). Juvenile sage-grouse also are killed by many raptors as well as common ravens, badgers, red foxes, coyotes and weasels (Mustela spp.) (Braun 1995, entire; Schroeder et al. 1999, p. 10). Nest predators include badgers, weasels, coyotes, common ravens, American crows, and magpies (Pica spp.); sage-grouse eggs have also been consumed by elk (Cervus canadensis) (Holloran and Anderson 2003, p. 309) and domestic cows (Bovus spp.) (Coates et al. 2008, pp. 425-426; Dinkins et al. 2013, p. 305). However, sage-grouse have co-evolved with a variety of predators, and their cryptic plumage and behavioral adaptations have allowed them to persist (Schroeder et al. 1999, p. 10; Coates 2007, p. 69; Coates and Delehanty 2008, p. 635; Hagen 2011, p. 96). Although many predators consume sage-grouse, none specialize on the species (Hagen 2011, p. 97). Generalist predators may still have a significant effect on ground-nesting birds, because unlike specialist predators, generalist predator numbers are independent of prey density (Coates 2007, p. 4). Predation is typically the principal cause of nest loss, which is a key determinant in sage-grouse population dynamics (Schroeder et al. 1999, p. 15; Taylor et al. 2012, p. 342). Sage-grouse nest depredation can be total (all eggs destroyed) or partial (one or more eggs destroyed). However, hens abandon nests in either case (Coates 2007, p. 26). Nest success across the California portion of the Bi-State area is within the normal range, with some locations even higher than previously documented (Kolada 2009a, p. 1344; Mathews et al. 2018, p. 54). However, the lowest estimates occur in Long Valley (South Mono PMU; 21 percent; Kolada 2009a, p. 1344), which is of concern as this is a core population for the species in the Bi-State area and is also the population most likely exposed to the greatest amount of nest predators (Kolada et al. 2009b, p. 1344; Mathews et al. 2018, p. 53). The negative impact from reduced nesting success in this location is presumably being offset by other demographic ***statistics*** such as chick or adult survival (Service 2020, p. 116). A number of factors have been reported to influence the density and diversity of predators, including ***agricultural*** development, landscape fragmentation, livestock presence, habitat alterations, and human populations, among others (Service 2020, p. 113). These factors have the potential to increase predation pressure on all life stages of sage-grouse by forcing birds to nest in less suitable or marginal habitats with no cover to shield them, and by increasing travel time through habitats where they are vulnerable to predation. Where sage-grouse habitat has been altered, the influx of predators can decrease annual recruitment into a population (Service 2020, p. 113). Raven abundance has increased as much as 1,500 percent in some areas of western North America since the 1960s (Coates and Delhanty 2010, p. 244). Human-made structures in the environment increase the magnitude of raven predation, particularly in low-canopy cover areas, by providing ravens with perches and nesting substrate (Braun 1998, pp. 145-146; Coates 2007, p. 155; Bui 2009, p. 2). Reduction in patch size and diversity of sagebrush habitat, as well as the construction of fences, power lines, landfills, and other infrastructure (as discussed in Infrastructure) also are likely to encourage the presence of the common raven (Coates et al. 2008, p. 426; Bui 2009, p. 4; Howe et al. 2014, p. 41). High sage-grouse nest densities in small patches of quality habitat (which result from habitat fragmentation or disturbance associated with the presence of edges, fencerows, or trails) may increase predation rates by making foraging easier for predators (Holloran 2005, p. C37). The presence of ravens is negatively associated with grouse nest and brood fate (Bui 2009, p. 27; Gibson et al. 2018, pp. 14-15). Raven abundance was strongly associated with sage-grouse nest failure in northeastern Nevada, with resultant negative effects on sage-grouse reproduction; an increase of 1 raven per 10-km (6-mi) survey transect was associated with a 7.4 percent increase in nest failure (Coates and Delehanty 2010, p. 243). In the Virginia Mountains (just north of the Bi-State DPS), ravens were the most common nest predator, accounting for almost 47 percent of nest depredations (Lockyer et al. 2013, p. 246). Threats associated with livestock grazing and predation may interact. In general, all recorded encounters between livestock and grouse nests resulted in hens flushing from nests (Coates et al. 2008, p. 462), which could expose the eggs to predation. There is strong evidence that visual predators like ravens use hen movements to locate sage-grouse nests (Coates 2007, p. 33); this is a concern for the Bi-State DPS given that ravens are the primary predators of sage-grouse in the Bi-State area. Livestock may also trample nests and sagebrush bushes and seedlings, thereby impacting future sage-grouse food and cover (Connelly et al. 2004, p. 7-31). Additionally, the odds of common raven occurrence, a pervasive sage-grouse nest predator, increased by approximately 46 percent in areas where livestock were present (Coates et al. 2016a, p. 10). The presence of infrastructure might also increase the magnitude of predation; increased raven presence may be attributable to the presence of water developments and associated perching structures[[Page 18079]](windmills and fences) (Coates et al. 2016a, p. 10). Predator removal efforts have sometimes shown short-term gains that may benefit seasonal survival rates, but there is limited support of these efforts influencing sustainable population growth (Cote and Sutherland 1997, p. 402; Hagen 2011, p. 9; Leu and Hanser 2011, p. 27; Dinkins et al. 2016, pp. 54-55; Peebles et al. 2017, p. 475). For example, raven removal has been shown to have a positive effect on nest success (Dinkins et al. 2016, p. 54); however, ultimate results on population growth rates are negligible or not as well understood. Removal of ravens from an area in northeastern Nevada caused only short-term reductions in raven populations (less than 1 year) as apparently transient birds from neighboring sites repopulated the removal area (Coates 2007, p. 151). Raven removal in one Wyoming study resulted in a 50 percent reduction in raven densities during 2008-2014, while non-removal sites saw a 42 percent increase in raven densities (Peebles et al. 2017, p. 476). The authors reported increases in lek counts following a 1-year lag during raven removal; however, other factors were also associated with increased lek counts in this study that included minimum temperatures and precipitation during the brood-rearing period. As specified in the BSAP and associated project spreadsheet (Bi-State TAC 2012, entire), the participants have worked to reduce threats to sage-grouse in the Bi-State DPS from predators. Removal of infrastructure (e.g , landfills, tall structures) may be a crucial step to reducing the presence of sage-grouse predators (Bui 2009, pp. 36-37; Leu and Hanser 2011, pp. 270-271). In the Bodie PMU, perching and nesting sites have been eliminated by infrastructure removal (e.g , windmill, transmission line). In the Desert Creek/Fales PMU, 3 km (1.85 mi) of fence in the Sweetwater Summit area was fitted with perch deterrents. Additionally, nearly 24,281 ha (60,000 ac) of conifer-encroached sagebrush have been treated in the Bodie, Desert Creek/Fales, Pine Nut, Mount Grant, and South Mono PMUs to remove conifers and reduce perch sites for predators. Overall, predation is currently known to occur throughout the Bi-State DPS's range. It is facilitated by habitat fragmentation and composition, infrastructure (fences, power lines, and roads) and other human activities that may be altering natural population dynamics in specific areas throughout the Bi-State DPS's range. The impacts of predation on sage-grouse can increase where habitat quality has been compromised by anthropogenic activities and ultimately influence population performance (Coates 2007, pp. 154, 155; Bui 2009, p. 16; Hagen 2011, p. 100). Landscape fragmentation, habitat degradation, and human populations have likely increased predator populations through increasing the ease of securing prey, and through human structures like landfills adding food sources. Other human structures can provide nest or den substrates for predator species. Certain sage-grouse populations are exhibiting deviations in vital rates below those anticipated, and the deviation may be related to predation. The populations with this issue are the Long Valley population (South Mono PMU), which is one of the two largest (core) populations in the Bi-State DPS, as well to the Desert Creek population (Desert Creek-Fales PMU) and the Pine Nut PMU. If assuming potential predation is connected to the deviations, the Bodie and White Mountains PMUs are likely least affected by predation. At natural levels and in unaltered habitat, it is unlikely that predation would be a significant impact to the DPS, given that the sage-grouse have coevolved with a number of predators, and no predators specialize on sage-grouse. However, we recognize that, in concert with altered habitat, it may become an increasing concern in the future. As more habitats face development (including roads, power lines, and other anthropogenic features such as landfills, airports, and urbanization), we expect the risk of increased predation to spread, possibly with negative effects on the sage-grouse population trends. We concluded in the proposed listing rule, and reaffirm here, that, by itself, predation is not considered a significant impact at this time. There are no regulatory mechanisms addressing predation directly, but regulatory mechanisms and conservation efforts that indirectly influence predation have continued to be implemented since publication of the proposed listing rule, including (but not limited to): Removing and limiting structures that attract predators (e.g , fencing, power lines), and conducting initial procedures to remove the landfill in Long Valley. With continued implementation of conservation actions associated with the BSAP (Bi-State TAC 2012, entire), impacts from predation are significantly reduced. The BSAP (Bi-State TAC 2012, entire) includes measures to counter effects such as predation risks to the Bi-State DPS. Because we have determined that the partially completed and future conservation efforts will be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, below), we believe that predation is not a concern into the future.Small Population Size and Population Isolation The Bi-State DPS is relatively small and both geographically and genetically isolated from the remainder of the greater sage-grouse distribution. All isolated populations of sage-grouse are more vulnerable to genetic, demographic, or stochastic events. However, available ***data*** indicate genetic diversity in the Bi-State area is currently high (Oyler-McCance and Quinn 2011, p. 18). Thus, we currently have no indication that genetic factors such as inbreeding depression, hybridization, or loss of genetic diversity are acting on the Bi-State DPS. However, populations in the Bi-State area have unique detectable qualities that allow differentiation from one another (Oyler-McCance et al. 2014, entire; Tebbenkamp 2014, entire). Also, the Parker Meadows area (a single isolated lek system located in the South Mono PMU) is experiencing a disproportionately high degree of nest failures due to nonviable eggs (Gardner 2009, pers. comm.), suggesting a possible manifestation of genetic challenges; this small breeding complex has the lowest reported genetic diversity in the Bi-State area (Oyler-McCance et al. 2014, p. 1304). We do not know if this is caused by inbreeding depression, loss of genetic diversity, or other factors, but to address this, a translocation project was developed in conjunction with the USGS and implemented in 2017. There has been some initial success in survival of transferred broods (Mathews et al. 2018, p. 37). The Bi-State DPS comprises approximately 50 active leks representing several relatively discrete populations. Fitness and population size across a variety of taxa are strongly correlated, and smaller populations are more challenged by environmental and demographic stochasticity (Keller and Waller 2002, pp. 239-240; Reed 2005, p. 566). These small, isolated populations may face future genetic challenges. When coupled with mortality stressors related to human activity and significant fluctuations in annual population size, long-term persistence of small populations (in general) can be challenging (Traill et al. 2010, entire). The Pine Nut PMU has the smallest number of sage-grouse of all Bi-State area PMUs (usually less than 100[[Page 18080]]individuals as observed from ***data*** ***collected*** between 2003 and 2017, representing approximately 5 percent of the DPS). However, each population in the Bi-State DPS is relatively small, as is the entire DPS on average (estimated at approximately 3,280 individuals). One way to address population health and viability is through analysis of effective population size. Effective population size is defined as the size of the idealized population of breeding adults that would experience the same rate of loss of heterozygosity, change in the average inbreeding coefficient, or change in variance in allele frequency through genetic drift as the actual population (Frankham et al. 2002, pp. 312-317). As effective population size decreases, the rate of loss of genetic diversity increases. The consequences of this loss of genetic diversity, reduced fitness through inbreeding depression and reduced adaptive (evolutionary) potential, are thought to elevate extinction risk (Frankham 2005, p. 135). Studies suggest effective population size should exceed 50 to 100 individuals to avoid short-term extinction risk caused by inbreeding depression, and mathematical models suggest that effective population size should exceed 500 individuals to retain evolutionary potential and avoid long-term extinction risk (Franklin 1980, entire; Soule 1980, entire). Some estimates of effective population size have been as high as 5,000 individuals, but these estimates are thought to be highly species specific and influenced by many extrinsic factors (Lande 1995, p. 789). Sage-grouse have one of the most polygamous mating systems observed among birds (Deibert 1995, p. 92). Asymmetrical mate selection (where only a few of the available members of one sex are selected as mates) should result in reduced effective population sizes (Deibert 1995, p. 92), meaning the actual amount of genetic material contributed to the next generation is smaller than predicted by the number of individuals present in the population. Furthermore, variation in female reproductive success, fluctuating population size, unequal sex ratios, the fact that not all males breed each year, and other sage-grouse characteristics all reduce effective population size (Frankham 1995, p. 796; Aldridge and Brigham 2003, p. 30; Stiver et al. 2008, p. 473; Bush 2009, p. 108). Each of these influencing factors on effective population size occurs in the Bi-State DPS and suggests population sizes in sage-grouse must be greater than in non-lekking bird species to maintain long-term genetic diversity. The effective population size of a wildlife population is often much less than its actual size. We are unaware of specific ***data*** or literature that definitively identifies the number of sage-grouse needed to maintain an effective population size of birds that would also result in a viable population. However, some literature exists to help us understand the complexities of answering this question for the Bi-State DPS or any other region within the range of the greater sage-grouse. One study concluded that up to 5,000 individual sage-grouse may be necessary to maintain an effective population size of 500 birds (Aldridge and Brigham 2003, p. 30). Their estimate was based on individual male breeding success, variation in reproductive success of males that do breed, and the death rate of juvenile birds. Similarly, a meta-analysis based on a wide array of species determined that a minimum viable population size (actual population size) necessary for long-term persistence should be on the order of 5,000 adult individuals (Traill et al. 2010, p. 32), though others have argued a minimum viable population would be from 2 to 10 times this figure (Franklin and Frankham 1998, p. 70; Lynch and Lande 1998, p. 72). However, another analysis countered that there is no single minimum population size number for all taxa, and that extinction risk depends on a complex interaction between life-history strategies, environmental context, and threat (Flather et al. 2011, entire). Based on ***data*** from 2018, the median abundance estimate of the Bi-State DPS spring breeding population is approximately 3,305 individuals (95 percent CRI = 2,247-4,683; Coates et al. 2020, p. 26). This estimate (as well as PMU specific estimates) was derived using the integrated population model outputs of male abundance based on lek count and demographic (telemetry) ***data***, as well as by multiple post-hoc adjustments, given results of ancillary research. Adjustments included reported distributions for detection probability (Coates et al. in press, entire), lek attendance probability (Wann et al. 2019, p. 7), and sex ratio (Hagen et al. 2018, p. 4). Also included was an adjustment to account for `unknown' leks, based on a 95 percent assumed known lek value. This value was derived from expert knowledge by members of the Bi-State Technical Advisory Committee. Using this estimate and the studies identified above describing effective population size being on the order of 10 to 20 percent of the actual population size, in the Bi-State area, the estimated average effective population size (for the entire Bi-State area in 2018) is approximately 330 to 661 sage-grouse, below the 5,000 individual threshold recommended by some researchers, but above the 50 individual threshold. Genetic and radio-telemetry studies, however, indicate that some sage-grouse populations in the Bi-State area are isolated, suggesting that the effective population size is actually less (Table 2). Based on these ***data***, we calculate the effective population size for four generally discrete populations in the Bi-State (as described in Oyler-McCance et al. 2014, Figure 4) to provide context surrounding long-term genetic viability of these units (Table 2).Table 2--2018 Estimated Population Size and Range of Estimated Effective Population Size by Genetic Cluster for the Bi-State Area, Nevada and California------------------------------------------------------------------------ Estimated median Estimated effective PMU population size population size 2018 range 2018------------------------------------------------------------------------Pine Nut....................... 33 3-6Desert Creek-Fales, Mount 2,342 234-468 Grant, Bodie..................Long Valley.................... 818 81-163White Mountains................ 45 4.5-9Bi-State DPS................... 3,305 330-661------------------------------------------------------------------------ Empirical ***data*** from Colorado showed the effective population size in Gunnison sage-grouse to be about 20 percent of actual population size (Stiver et al. 2008, p. 478). We are unaware of any other published estimates of[[Page 18081]]minimal population sizes necessary to maintain genetic diversity and long-term population sustainability in sage-grouse and specifically for the Bi-State DPS, and whether the described effective population sizes above are of concern. Most populations of the Bi-State DPS have been below the possible minimum population sizes as described above, in large part due to the natural cycling of sage-grouse populations, yet continue to persist. Small population size and a discontinuous population structure occur throughout the Bi-State DPS's range, which could make the Bi-State DPS more vulnerable to impacts of threats described herein both currently and likely in the future in the absence of any ameliorating conservation efforts. However, conservation efforts addressing the threats acting upon these small populations have been implemented since publication of the proposed listing rule, including (but not limited to) translocation of sage-grouse into the Parker Meadows subpopulation, restoring critical brood-rearing habitat areas, and addressing invasive nonnative and native plants. Because we expect conservation implementation to continue under the BSAP (Bi-State TAC 2012, entire), the risks associated with small population size will be reduced.Summary of Threats Throughout the threats discussion, we considered individual threats and, where appropriate, how they interact with other threats. Here, we consider the threats holistically to determine their impact on the Bi-State sage-grouse and its habitat. Currently and into the future, the threats with the highest impact to the DPS are wildfire and altered fire regimes, and nonnative invasive and native woodland succession. Threats from urbanization and habitat conversion; infrastructure; mining; grazing and rangeland management; climate change; predation, and small population size and population isolation are also occurring. Threats from recreation and disease affect only a few individuals a year, and we do not expect that rate to increase into the foreseeable future. All of these threats are exacerbated by the population isolation and discontinuous population structure. In summarizing the impacts of threats, we also consider impacts of renewable energy, commercial and recreational hunting, scientific and educational uses, and contaminants (including pesticides). Though impacts from these threats are expected to be minimal relative to the overall condition of the DPS (Service 2020, pp. 63-124), and though we did not present summary analyses of these threats in this Federal Register document, we still consider them when evaluating the cumulative impact of all threats on the DPS. Small, isolated populations such as those found in the Bi-State area are more challenged by stochastic events such as disease epidemics, prey population crashes, or environmental catastrophes. Interactions between climate change, drought, wildfire, WNv, and the limited potential to recover from population downturns or extirpations place significant challenges to the persistence of the Bi-State DPS of sage-grouse. One of the most substantial interactions of threats is the cycle between climate change, cheatgrass, and altered fire regimes. Warmer temperatures and greater concentrations of atmospheric carbon dioxide create conditions favorable to cheatgrass, thus continuing the positive feedback cycle between the invasive annual grass and fire frequency (Chambers and Pellant 2008, p. 32; Global Climate Change Impacts in the United States 2009, p. 83; Halofsky et al. 2018, pp. 276-277). Fewer frost-free days also favor frost-sensitive woodland vegetation, which facilitates expansion of woodlands into the sagebrush biome, especially in the southern Great Basin (Neilson et al. 2005, p. 154). Thus, sagebrush habitats in the Great Basin will likely be lost at more southerly latitudes and low-elevation sites, and upper elevation areas will be more susceptible to woodland succession and cheatgrass invasion. In the Bi-State area, substantial changes in vegetation communities could occur between 2025 and 2100 (Neilson et al. 2005, p. 155; Bradley 2010, p. 204; Comer et al. 2013, p. 142; Finch 2012, p. 10). Overall, the cumulative impact of all threats affecting the Bi-State DPS can be influenced by interactions with co-occurring threats, resulting in significant impacts to the resiliency, redundancy, and representation of the DPS as a whole. However, as a result of conservation actions associated with the 2012 BSAP (Bi-State TAC 2012, entire), impacts from all threats individually and combined are generally being reduced from their current levels and will continue to be reduced even more in the future.Policy for Evaluation of Conservation Efforts When Making Listing Decisions The purpose of PECE (68 FR 15100; March 28, 2003) is to ensure consistent and adequate evaluation of recently formalized conservation efforts when making listing decisions. The policy provides guidance on how to evaluate conservation efforts that have not yet been implemented or have not yet demonstrated effectiveness. The evaluation focuses on the certainty that the conservation efforts will be implemented and the effectiveness of the conservation efforts in making listing a species unnecessary. The policy presents nine criteria for evaluating the certainty of implementation and six criteria for evaluating the certainty of effectiveness for conservation efforts. These criteria are not considered comprehensive evaluation criteria. The certainty of implementation and the effectiveness of a formalized conservation effort may also depend on species-specific, habitat-specific, location-specific, and effort-specific factors. We consider all appropriate factors in evaluating formalized conservation efforts. The specific circumstances will also determine the amount of information necessary to satisfy these criteria. To consider that a formalized conservation effort contributes to forming a basis for not listing a species, or listing a species as threatened rather than endangered, we must find that the conservation effort is sufficiently certain to be (1) implemented and (2) effective, so as to have contributed to the elimination or adequate reduction of one or more threats to the species identified through section 4(a)(1) analysis under the Act. The elimination or adequate reduction of section 4(a)(1) threats may lead to a determination that the species does not meet the definition of threatened or endangered, or is threatened rather than endangered. An agreement or plan may contain numerous conservation efforts, not all of which are sufficiently certain to be implemented and effective. Those conservation efforts that are not sufficiently certain to be implemented and effective cannot contribute to a determination that listing is unnecessary, or a determination to list as threatened rather than endangered. Regardless of the adoption of a conservation agreement or plan, however, if the best available scientific and commercial ***data*** indicate that the species meets the definition of ``endangered species'' or ``threatened species'' on the day of the listing decision, then we must proceed with appropriate rulemaking activity under section 4 of the Act. Further, it is important to note that a conservation plan is not required to have absolute certainty of implementation and effectiveness in order to contribute to a[[Page 18082]]listing determination. Rather, we need to be reasonably certain that the conservation efforts will be implemented and effective such that the threats to the species are reduced or eliminated. Prior to the Bi-State DPS becoming a candidate species in 2010, a variety of conservation initiatives were put in place to conserve the DPS and its habitat. The most significant initiative was the creation of the Nevada Governor's Sage Grouse Conservation Team in June 2002 who, in cooperation with local stakeholders (the Bi-State Local Area Working Group), developed the first edition of the Greater Sage Grouse Conservation Plan for the Bi-State area in 2004 (BSLPG 2004, entire) to begin a cooperative effort to address threats to the Bi-State DPS and its habitat. The 2004 Action Plan served as the foundation for the conservation of the Bi-State DPS and its habitat. These efforts were later enhanced by both local- and national-level conservation strategies for sage-grouse conservation (including in the Bi-State area) associated with organizations including the Sage Grouse Initiative, and the Bi-State LAWG, the latter of which is specifically focused on Bi-State DPS conservation. In December 2011, the Bi-State Executive Oversight Committee (EOC) was formed to leverage ***collective*** resources and assemble the best technical support to achieve long-term conservation of the Bi-State DPS and its habitat. The EOC comprises resource agency representatives from the Service, BLM, USFS, NRCS, USGS, NDOW, and CDFW. Recognizing that conservation efforts were already under way by this point in time, the EOC directed a Bi-State TAC, comprising technical experts/members from each agency, to summarize the conservation actions completed since 2004, and to develop a comprehensive set of strategies, objectives, and actions that would be effective for the long-term conservation of the Bi-State DPS and its habitat. These strategies, objectives, and actions comprise the 2012 BSAP (Bi-State TAC 2012, entire), which is actively being implemented by the signatory agencies identified above, as well as Mono County, who is committed to implementing all relevant actions within the County (which harbors the two core populations of the Bi-State DPS). A majority of the conservation efforts outlined in the BSAP have already been started or completed (see sections 2.2 and 2.3 of the Action Plan (Bi-State TAC 2012, pp. 4-13) and the updated project spreadsheet (Bi-State TAC 2019), and the Past and Ongoing Management Efforts discussion in the Species Report (Service 2020, pp. 137-144). Additionally, in February 2013, a Conservation Objectives Team (COT) of State agencies and Service representatives prepared the Greater Sage-Grouse (Centrocercus urophasianus) Conservation Objectives Final Report (COT Report; Service 2013a, entire). This peer-reviewed report serves as a benchmark, delineating reasonable objectives necessary for the conservation and survival of greater sage-grouse, including the Bi-State DPS. The guidance includes management recommendations for the species and its habitat and establishes thresholds based on the degree to which threats need to be reduced or ameliorated to conserve greater sage-grouse so that it would not be in danger of extinction or likely to become in danger of extinction within the foreseeable future. Conservation success is expected to be achieved by removing or reducing threats, such that population trends would eventually be stable or increasing, even if numbers are not restored to historical levels. The 2012 BSAP is the main document guiding implementation of conservation actions, and the COT provides additional scientific background and guidelines for those actions. Based on information provided in the 2013 proposed rules and discussions with the EOC, TAC, and LAWG, signatory agencies in 2014 provided a package of information examining their commitments, including staffing and funding, to implement the actions needed for conservation of the Bi-State DPS and its habitat, as outlined in the BSAP. They also provided an updated prioritization of various conservation actions and site-specific locations in which to implement such actions, as needed, based on the Conservation Planning Tool (CPT--linked, ***data***-driven predictive models and interactive maps that identify and rank areas for management actions and provide a basis to evaluate those actions) and the BSAP's Adaptive Management Strategy (Bi-State EOC 2014, in litt.). The agency commitment letters, which were one component of the information provided by the EOC (BLM 2014a, in litt.; CDFW 2014b, in litt.; Mono County 2014, in litt.; NDOW 2014, in litt.; USDA 2014, in litt.; USGS 2014a, in litt.), outlined many partially completed or new conservation actions that will be implemented and completed to address the threats that were identified in our October 28, 2013, proposed listing rule (78 FR 64358). The EOC evaluated the [then current] Bi-State DPS survey and trend information and concluded that their unified and collaborative approach addresses the conservation needs of the Bi-State DPS (Bi-State EOC 2014, in litt.). Additionally, the EOC concluded that each partner agency is committed to implementing the BSAP and providing the necessary resources to do so regardless of the outcome of the Service's listing decision (Bi-State EOC 2014, in litt.). In the past year, several agencies have provided updated letters reaffirming their commitment to the BSAP and the TAC (BLM 2019, in litt.; Mono County 2018, in litt.; NDOW 2018, in litt.; NRCS 2018, in litt.; USFS 2018, in litt.). The information provided by the EOC indicates that significant conservation efforts are currently being implemented and that further actions are proposed for implementation in the future. These combined actions address the threats that (synergistically) are resulting in the most severe impacts on the DPS and its habitat now and into the future. These conservation actions are described in our detailed PECE analysis (Service 2019, entire). Using the criteria in our PECE policy (68 FR 15100, March 28, 2003), we evaluated the certainty of implementation (for those measures not already implemented) and effectiveness of conservation measures in the BSAP. Below is a summary of our full PECE analysis, which can be found at   [*http://www.regulations.gov*](http://www.regulations.gov) under either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107. The BSAP (Bi-State TAC 2012, entire) was designed to reduce or ameliorate threats impacting the Bi-State DPS. We have determined that the conservation efforts in the BSAP meet the PECE criteria with regard to certainty of implementation because of (but not limited to): (1) The agency commitments of staffing and significant funding (over $45 million in the period 2015-2024); and (2) continued participation on the Bi-State EOC, TAC, and LAWG to ensure the most important conservation efforts are occurring at any given time considering ongoing research and monitoring that may influence changes in management strategies, as outlined in the BSAP's Science-based Adaptive Management Plan and through use of the CPT. Additionally, we have certainty of implementation by the various agencies for conservation efforts that address many different impacts. In particular, we have certainty of implementation for those completed and ongoing conservation efforts expected to provide the most significant[[Page 18083]]conservation value to the Bi-State DPS and its habitat, including actions (as outlined in the agencies' 2014, 2018, and 2019 commitment letters and work plans, and the comprehensive project database (Bi-State TAC 2019)) that: (1) Protect and restore critical brood-rearing habitat (reduces impacts from development/habitat conversion, grazing and rangeland management, and effects resulting from climate change). Lead agencies under the BSAP implementing conservation actions to reduce these impacts are NRCS (e.g , conservation easements, riparian/meadow restoration), USFS (e.g , private-public land exchanges, riparian/meadow restoration or improvement, grazing management, wild horse management), BLM (e.g , riparian/meadow restoration, meadow irrigation and structure repair, racetrack fence removal, wild horse management), and Mono County (e.g , fencing modification). (2) Restore habitat impacted by the spread of invasive, nonnative plants and pinyon-juniper encroachment (reduces impacts from nonnative, invasive and certain native plants, wildfire, predation, and effects resulting from climate change). Lead agencies under the BSAP implementing conservation actions to reduce these impacts are NRCS (e.g , pinyon-juniper removal), USFS (e.g , pinyon-juniper removal, riparian/meadow restoration, invasive weed treatments), and BLM (e.g , pinyon-juniper removal, riparian/meadow restoration, invasive weed treatments, wildfire fuel break treatments, fencing removal). (3) Ensure stable or increasing sage-grouse populations and population structure to: (a) Prioritize management actions related to synergistic impacts on already fragmented habitat, such that management efforts occur in locations that benefit the DPS the most (reducing impacts such as infrastructure, urbanization, and recreation), and (b) develop and implement sage-grouse translocation from stable subpopulations to other small subpopulations that may be experiencing a high risk of extirpation (reduces impacts from small population size and population structure). Lead agencies under the BSAP implementing conservation actions to reduce these impacts are USGS, NDOW, and CDFW. Actions under way by CDFW include conducting telemetry, research, or monitoring surveys that inform the CPT of adjustments to the BSAP conservation strategy that provide the greatest benefit to the DPS or its habitat (see section 6.5 in the BSAP (Bi-State TAC 2012, pp. 75-76) and implementing translocation programs from stable subpopulations to subpopulations that may be at high risk of extinction). Actions under way by BLM include permanent and seasonal road closures, nesting habitat seasonal closures, and fencing removal or marking; actions under way by USFS include permanent and seasonal road closures and power line removal. Actions under way by Mono County include coordination with private landowners to encourage reduced infrastructure and closure and relocation of the Long Valley landfill. We also note that BLM, USFS, NRCS, and Mono County have provided specific plans and timetables laying out various conservation efforts for implementation from 2015 through 2024 (BLM 2014a, in litt.; Mono County 2014, in litt.; USDA 2014, in litt.), while CDFW, NDOW, and USGS have provided textual descriptions of their intended actions and contributions from 2015 through 2024 (CDFW 2014b, in litt.; NDOW 2014, in litt.; USGS 2014a, in litt.); many agencies sent letters reaffirming their commitment to the EOC and the TAC (BLM 2019, entire; Mono County 2018, in litt.; NDOW 2018, in litt.; NRCS 2018, in litt.; USFS 2018, in litt.). Additionally, the collaboration between the Service, BLM, USFS, NRCS, Mono County, USGS, NDOW, and CDFW requires regular meetings and involvement from the parties, whether at the level of the Bi-State EOC, TAC, or LAWG, in order to implement the BSAP fully. These meetings have occurred regularly since 2014. We are confident that the conservation efforts (as outlined in the BSAP, agency commitment letters, and our detailed PECE analysis, as well as the TAC comprehensive project database) will continue to be implemented because we have a documented track record of active participation and implementation by the signatory agencies and commitments to continue implementation into the future. Conservation measures, such as pinyon-juniper removal, establishment of conservation easements for critical brood-rearing habitat, cheatgrass removal, permanent and seasonal closure of roads near leks, removal and marking of fencing, and restoration of riparian/meadow habitat have been completed over the past 15 years, are currently occurring, and have been prioritized and placed on the agency's implementation schedules for future implementation. Agencies have committed to remain participants and continue conservation of the DPS and its habitat. The BSAP has sufficient methods (science advisors, the CPT, and a Science-based Adaptive Management Strategy) for determining the type and location of the most beneficial conservation actions to be implemented, including continued receipt of new population and threats information in the future that will guide conservation efforts. We have determined that the conservation efforts in the BSAP meet the PECE criteria with regard to certainty of effectiveness to remove or reduce threats facing the Bi-State DPS because of, but not limited to, past project effectiveness within the Bi-State area or within sagebrush habitat areas across the range of the greater sage-grouse, and documented effective methodologies for addressing the threats identified as impacting the Bi-State DPS. For example: (1) Development and Habitat Conversion--Conservation efforts to reduce development and habitat conversion are anticipated to occur in critical brood-rearing habitats across five PMUs, including through conservation easements and land exchanges (see detailed PECE analysis, Section 3.0). In total, 12,243 ha (30,254 ac) have been entered into conservation easements or acquired through land purchase or exchange since 2012 (Bi-State TAC 2018, p. 25). Our analysis of the database and the agency commitment letters reveals partially completed and future conservation efforts will occur in the Pine Nut, Bodie, Desert Creek-Fales, Mt. Grant, and South Mono PMUs, totaling approximately 7,284 ha (18,000 ac) of lands identified as important for conservation by the TAC. These efforts have funding obligated and are in various stages of easement development, with many anticipated to be completed in a few years (BSAP 2019). Further, an effort to acquire approximately 5,870 ha (14,500 ac) of lands in the Pine Nut PMU by the Carson City BLM has been approved and is anticipated to finalize in spring of 2020. These areas include high-priority targets identified in the BSAP, and are consistent with the COT Report's ex-urban conservation objective to limit urban and exurban development in sage-grouse habitats (Service 2013a, p. 50). In total, approximately 31 percent of all private lands containing suitable sage-grouse habitat across the Bi-State are enrolled under an easement program or have been acquired by federal and State agencies and this number is expected to increase to 57 percent when combining additional efforts that are ongoing and reasonably likely to occur. Furthermore, these acquisitions represent approximately 67[[Page 18084]]percent of private lands identified as important for conservation of the species in the 2012 Action Plan. These actions are considered effective at reducing impacts from development and habitat conversion because conserving and managing lands in perpetuity are the most successful tools for permanent protection of critical sage-grouse habitat (as demonstrated by Pocewicz et al. (2011) in Wyoming). (2) Grazing and Rangeland Management--Conservation actions under the BSAP continue to reduce grazing impacts and ensure management of livestock consistent with the needs of the DPS. This includes 46 projects across the range of the DPS that have been completed since 2012, including (but not limited to): Maintaining, improving, or restoring riparian/meadow sites impacted by grazing animals across multiple PMUs, improving BLM grazing allotment permit terms and conditions to protect riparian areas, and reducing the risk of overgrazing that can facilitate the dominance of cheatgrass in upland habitats (Bi-State TAC 2019, in litt.). An additional 32 projects focused on maintaining area closures to permitted livestock, monitoring compliance with permitted terms and conditions, maintenance of ``let-down'' fencing, and meadow irrigation have also been conducted on an annual and ongoing basis since 2012. The conservation efforts database identifies seven projects that are either in progress or not yet started, including new grazing permit processing and the restoration of degraded sagebrush and meadow habitat at several sites in the Desert-Creek Fales, Bodie, and Mount Grant PMUs (Bi-State TAC 2019, in litt.). Additionally, the BSAP identifies a specific strategy (MER6) to address grazing issues related to wild horse populations, which are known to negatively impact meadows and brood-rearing habitats used by the Bi-State DPS (Bi-State TAC 2012, p. 92). The effectiveness of these grazing and rangeland management conservation efforts are confirmed by published literature (Boyd et al. 2014, entire; Stevens et al. 2012, p. 301; Davies et al. 2011, pp. 2575-2576; Pyke 2011, p. 537), which articulate the value of maintaining functional working landscapes that include grazing activities with site-specific management as necessary (e.g , restoring meadows to improve sage-grouse brood-rearing habitat) to ensure longevity of sagebrush ecosystems and the habitat areas deemed most critical to the Bi-State DPS. (3) Nonnative Invasive Plants and Native Woodland Succession--Because both nonnative invasive plants and particularly native woodland species (pinyon-juniper encroachment) displace the sagebrush ecosystem necessary for the Bi-State DPS, significant conservation efforts are being and will continue to be implemented to address these problems. With regard to nonnative invasive plants, the Bi-State EOC and TAC recognize that effective control programs can be labor intensive and costly; however, the Bi-State EOC and TAC believes there is value for the Bi-State DPS in being strategic in implementing the conservation efforts that potentially reduce the impact these plants have on the DPS's habitat (e.g , treating nonnative, invasive plants in strategic areas to potentially reduce the likelihood of an outbreak or improve a priority habitat area) (Espinosa 2014, in litt.). Since 2012, chemical or mechanical treatments of nonnative plant species have occurred on nearly 526 ha (1,300 ac), and weed monitoring was completed on 858 ha (2,121 ac) across multiple PMUs (Bi-State TAC 2018, p. 30). Two projects are currently under way or planned for the future that target invasive, nonnative plants on more than 243 ha (600 ac) in the Desert Creek-Fales and Pine Nut PMUs (cheatgrass is considered a high threat in Pine Nut compared to other PMUs). Additionally, the USFS committed to control least 40.5 ha (100 ac) of cheatgrass each year from 2015 through 2024 in the Pine Nut PMU (USDA 2014, in litt.). While combatting invasive annual grasses remains a challenge, the most effective method to date is through the retention of a healthy native perennial understory, which is the primary objective of both the TAC and LAWG (Bi-State TAC 2018, p. 30). Methods of active restoration of degraded sites can be effective through herbicide or mechanical means but require additional actions such as reseeding with perennial species (Frost and Launchbaugh 2003, pp. 43-44; Jones et al. 2015, p. 17). With regard to pinyon-juniper encroachment, ecologists have developed clear and effective recommendations to target appropriate phases of encroachment (specific age and density structure) to ensure restoration occurs in sagebrush and sage-grouse habitat areas that are most meaningful (e.g , critical brood-rearing habitat, corridors in fragmented areas) (e.g , Bates et al. 2011, pp. 476-479; Davies et al. 2011, pp. 2577-2578). Accordingly, BLM, USFS, and NRCS are strategically targeting phases I and II pinyon-juniper encroachment in the Bi-State area, which is supported by literature as effective with careful planning and execution (e.g , Bates et al. 2011, pp. 476-479; Davies et al. 2011, pp. 2577-2578). As of December 2018, pinyon and juniper removal has taken place on more than 18,700 ha (46,400 ac) within or adjacent to sage-grouse habitat, including minor projects to remove phase I tree encroachment from nesting habitat to more intensive mechanical removal within both phase I and phase II areas to expand available sage-grouse habitat and enhance existing conditions within nesting, brood-rearing, and winter habitats, representing approximately 25 percent of all conifer treatments proposed in the 2012 Action Plan (Bi-State TAC 2018, p. 27.). Furthermore, conifer treatment maintenance has been completed on more than 3,000 ha (7,400 ac). Approximately 8,245 ha (20,373 ac) of additional conifer treatments are currently in progress and have analyses under the National Environmental Policy Act (NEPA) either completed or under development (Bi-State TAC 2018, in litt.). Subsequent to our prior withdrawal of the 2013 proposed listing rule, several studies have been published that demonstrate the effectiveness of pinyon-juniper removal across the range of the greater sage-grouse. These studies have demonstrated that: Sage-grouse readily nest in conifer treatment sites after trees had been removed (Severson et al. 2017, p. 53); woodland treatments increased suitable available breeding habitat and enhanced nest and brood success (Sandford et al. 2017, p. 63); and removal of pinyon-juniper trees encroaching into sagebrush vegetation communities can increase sage-grouse population growth through improving juvenile, yearling, and adult survival as well as improving nest survival (Olsen 2019, pp. 21-22). Additionally, sage-grouse population growth was 11.2 percent higher in treatment versus control sites within 5 years of conifer removal (Olsen 2019, pp. 21-22). Thus, we conclude that pinyon-juniper removal is effective in restoring areas impacted by woodland succession such that they become suitable and productive for sage-grouse, reducing the magnitude of the threat on the species. (4) Infrastructure--Conservation efforts to reduce infrastructure are focused on roads, power lines, fencing, and a landfill. Permanent and seasonal road closures over a minimum of 2,137 miles in the Bodie, Desert Creek-Fales, Mount Grant, South Mono, and Pine Nut PMUs will reduce the likelihood of mortality and improve vital rates for sage-grouse near leks, including nesting and brood-rearing areas. Nearly 22 miles[[Page 18085]]of power line and fencing removal projects have occurred in the Bodie, Pine Nut, and South Mono PMUs, and approximately 141 miles of fencing have been marked or modified across all PMUS. Some of these projects require annual maintenance, such as let-down fences, and three projects that will mark and modify fencing in the Pine Nut, Desert Creek-Fales, or South Mono PMUs are scheduled to be completed in the future. Additionally, a landfill in the Long Valley area of the South Mono PMU is a significant source of predators for one of the two core populations of the Bi-State DPS; Mono County is undergoing the initial stages of relocating this landfill (Bi-State TAC 2014, in litt.; Mono County 2014, in litt.: Mono County 2018, in litt.). Removing or modifying the types of infrastructure described above will be effective at reducing the amount of invasive plants present along or around developed areas (Manier et al. 2014, pp. 167-170), reducing existing habitat fragmentation and potential vectors for invasive plants (Gelbard and Belnap 2003, pp. 424-431); removing some edge effects that can lead to avoidance of nesting in suitable habitat areas (Aldridge and Boyce 2007, pp. 516-523); reducing or removing anthropogenic noise that disturbs normal behavior patterns of sage-grouse (Blickley 2013, pp. 54-65); reducing collision-related mortalities (associated specifically with fencing) (Stevens et al. 2012, pp. 299-302); and making currently undesirable habitat areas (that attract predators) favorable by sage-grouse as nest and brood sites by reducing predator attractants (e.g , power lines, landfill) (Dinkins et al. 2012, pp. 605-608). (5) Wildfire--Fires have consumed some important habitat areas within the range of the Bi-State DPS, primarily within the Pine Nut PMU, but also recently as a result of the Spring Peak fire within the Bodie and Mount Grant PMUs and the Boot Fire in the Desert Creek-Fales PMU (Espinosa 2014, in litt.: Service 2020, p. 26). Site restoration activities are planned to be implemented following wildfires by utilizing the CPT to identify sites that are the best candidates for enhancing or returning sagebrush habitats to conditions that benefit sage-grouse (Espinosa 2014, in litt.). Restoration efforts will be tracked for success, noting that some actions (e.g , seeding) vary in success rate, given variables such as elevation, precipitation, and site-conditions prior to a fire (Espinosa 2014, in litt.). Recovery of functional sagebrush habitats following wildfire and restoration actions can take decades (potentially several sage-grouse generations) to be realized, and requires monitoring to assure conservation objectives are met (such as ensuring appropriate levels of sagebrush and native herbs are established, and reducing nonnative plant dominance) (Arkle et al. 2014, p. 17). Additionally, the Bi-State TAC currently utilizes the CPT and field reconnaissance to maximize the likelihood of enhancing the desired sagebrush community composition post-fuels reduction treatment activities (Espinosa 2014, in litt.). As of December 2018, restoration following wildfire has resulted in fire rehabilitation treatments on more than 7,690 ha (19,000 ac) (Bi-State TAC 2018, in litt.). (6) Small Population Size and Population Structure--The BSAP specifically identifies a strategy (MER7) to address small population size issues in the Bi-State area, by identifying potential sage-grouse population augmentation and reintroduction sites, developing translocation guidelines, and potentially implementing augmentation and reintroduction efforts (Bi-State TAC 2012, p. 93). Specific actions include developing contingency plans for the Parker Meadows and Gaspipe Spring subpopulations in the South Mono PMU, and populations in the Pine Nut PMU; and evaluating the need for augmentation for the Fales population of the Desert Creek-Fales PMU, the Powell Mountain area of the Mount Grant PMU, the McBride Flat/Sagehen Spring area in the Truman Meadows portion of the White Mountains PMU, and Coyote Flat of the South Mono PMU. In 2016, CDFW began implementing a plan to translocate sage-grouse from stable subpopulations in the Bi-State area to the Parker Meadows subpopulation in the South Mono PMU (Bi-State TAC 2014, in litt.; CDFW 2014b, in litt.; Mathews et al. 2018, pp. 14-34). Prior to initiating this effort, members of the Bi-State TAC conducted a site visit to assess habitat condition and conducted removal of conifer trees that had become established in proximity to the lek and brood-rearing meadow. Preliminary results suggest that translocated birds are increasingly remaining in the Parker Meadows area. Additionally, probability of nest initiation and nest success have increased, brood success is on par with the remainder of the DPS, and lek counts have increased over the past two years (Bi-State TAC 2018, pp. 13-14; Mathews et al. 2018, pp. 28-34). Efforts on this current action are directly relevant to future conservation efforts for other unstable subpopulations. It is reasonable to assume future translocations in the Bi-State area have a high likelihood of effectiveness given continued careful consideration to all the variables (including translocation that would occur concurrent with other threat reduction activities, such as conifer removal or predator control), and published literature that also indicates success of translocated sage-grouse when successful translocation methodology is followed (Musil et al. 1993, pp. 89-90; Reese and Connelly 1997, pp. 239-240; Hennefer 2007, pp. 33-37; Baxter et al. 2008, pp. 184-185). For details of additional conservation efforts related to effects associated with climate change, disease, predation, and other threats, please see the full PECE analysis (Service 2019, entire). We will have an ongoing role in monitoring the implementation and effectiveness of the partially completed and future conservation efforts given our regular participation with the Bi-State EOC, TAC, and LAWG, participation in providing updated versions of the BSAP, and by reviewing any monitoring and research reports. We are satisfied that the conservation efforts evaluated will be effective in reducing threats to the Bi-State DPS and its habitat; however, to do so, they do not need to be applied on every acre of suitable and unsuitable sage-grouse habitat. For instance, not all of the native pinyon-juniper vegetation needs to be removed, such as in areas within the range of the Bi-State DPS where pinyon-juniper historically occurred. Rather the effort needs, and is expected, to be implemented in areas that are most likely to support sage-grouse (post-removal) and critical areas that address habitat fragmentation or reduced-connectivity issues. These efforts need to occur at a rate that significantly reduces further habitat losses, which is consistent with the objective to address pinyon-juniper expansion provided in the March 22, 2013, COT Report for conservation of the greater sage-grouse (Service 2013a, pp. 47-48), including the Bi-State DPS. We have determined that the agencies' resource commitments (e.g , staffing and funding, including more than $45 million from 2015 through 2024), and a demonstrated record of implementation will ensure continued conservation of habitat for the Bi-State DPS. The BSAP has sufficient monitoring and reporting requirements to ensure that the proposed future conservation measures are implemented as planned and are effective at removing threats to the DPS and its habitat. The collaboration between the Service, BLM, USFS, NRCS, Mono County, USGS, and[[Page 18086]]the States of Nevada and California requires regular team meetings (Bi-State EOC, TAC, and EOC), and continued involvement of all parties will occur (Bi-State EOC 2014, in litt.) in order to implement the BSAP fully. We find that the future conservation efforts in the BSAP meet the PECE criteria for certainty of implementation and effectiveness, and can be considered as part of the basis for our final listing determination for the Bi-State DPS. In conclusion, we find that the conservation efforts in the BSAP, and as outlined in the agencies' 2014, 2018, and 2019 commitment letters, meet the PECE criteria with regard to certainty of implementation (for those measures not already implemented) and effectiveness and can be considered as part of the basis for our listing determination for the Bi-State DPS. Our full analysis of the 2012 BSAP, and additional materials submitted to the Service as mentioned above, pursuant to PECE can be found at   [*http://www.regulations.gov*](http://www.regulations.gov) under either Docket No. FWS-R8-ES-2018-0106 or Docket No. FWS-R8-ES-2018-0107.Summary of Comments and Recommendations As discussed above in Previous Federal Actions, the Bi-State DPS of the greater sage-grouse has a long and complex listing history. This has included multiple public comment periods since the proposed rules were published on October 28, 2013 (78 FR 64328, 78 FR 64358). In the period 2013-2015, we published five documents announcing to the public new comment periods, extensions to the comment periods, new information that became available, and a 6-month extension of making the final listing determination (78 FR 77087, December 20, 2013; 79 FR 19314, April 8, 2014; 79 FR 26684, May 9, 2014; 79 FR 31901, June 3, 2014; and 79 FR 45420, August 5, 2014). We held one public hearing in Minden, Nevada, on May 28, 2014, and one public hearing held in Bishop, California, on May 29, 2014. Newspaper notices inviting general public comment and advertisement of the information and public hearings was published in The Inyo Register, The Record Courier, and the Reno-Gazette Journal. When we reinstated the proposed listing rule on April 11, 2019, we reopened the comment period for 60 days (84 FR 14909); the comment period opened on April 12, 2019, and closed on June 11, 2019. When we announced the 6-month extension on October 1, 2019 (84 FR 52058), we reopened the public comment period for an additional 30 days; the comment period closed on October 31, 2019. In all comment periods, we also contacted appropriate Federal and State agencies, Tribes, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. We did not receive any requests for further public hearings. Between 2013 and 2015, we received more than 6,400 public comments on the proposed rules. In 2019, we have received more than 2,600 public comments in response to the reinstatement of the proposed rules and the 6-month extension. Submitted comments were both for and against listing the species. All substantive information provided during the comment periods and relevant to this finding has either been incorporated directly into this withdrawal or is addressed below. For additional responses to comments for which there is no updated information since 2015, please see the previous withdrawal of the proposed listing rule published on April 23, 2015 (80 FR 22828). We also received a few comments related to the proposed 4(d) rule, and more than 200 comment letters both in support of and opposition to the proposed critical habitat designation; however, given the decision to withdraw the listing proposal, no further assessment of the proposed 4(d) rule and critical habitat designation is necessary at this time. (1) Comment: Several commenters inquired as to how the BLM RMPs, USFS LRMPs, the BSAP, and the plans developed by the LADWP are used in our evaluation of existing regulatory mechanisms. Commenters also questioned the effectiveness of these plans and of the effectiveness of regulatory mechanisms in general. Other commenters suggested that existing regulatory mechanisms are adequate. Our Response: Existing regulatory mechanisms that could provide some protection for greater sage-grouse in the Bi-State area include: (1) Local land use laws, processes, and ordinances; (2) State laws and regulations; and (3) Federal laws and regulations. Regulatory mechanisms, if they exist, may preclude the need for listing if such mechanisms are judged to adequately address the threats to the species such that listing is not warranted. Conversely, threats on the landscape continue to affect the species and may be exacerbated when not addressed by existing regulatory mechanisms, or when the existing mechanisms are not adequate (or not adequately implemented or enforced). We use an inherently qualitative approach to evaluate existing regulatory mechanisms when conducting a threats analysis for a proposed listing. In general, this means that we assess language in an existing mechanism/plan as well as any pertinent decisions instituted based on that language (track record) and evaluate it against the best available science informing species conservation. For the local land use regulatory mechanisms, the regulations in some counties identify the need for natural resource conservation and in some instances (such as Mono County) attempt to minimize impacts of development through zoning restrictions. To our knowledge, however, none preclude development, nor do they provide for monitoring of the loss of sage-grouse habitats. Similarly, State laws and regulations are general in nature and provide flexibility in implementation, and do not provide specific direction to State wildlife agencies, although they can occasionally afford regulatory authority over habitat preservation (e.g , creation of habitat easements and land acquisitions). With respect to Federal laws, we note that recent LRMP and RMP amendments adopted by the Humboldt-Toiyabe and Inyo National Forests and BLM's Carson City District and Tonopah Field Office in the Bi-State area appear to offer significant improved certainty toward sage-grouse conservation. These changes in conjunction with existing RMPs and LRMPs, with demonstrated track records of effectiveness (such as the BLM Bishop Field Office's RMP), supports a conclusion that currently existing Federal regulations are effective regulatory mechanisms. Federally managed lands account for approximately 89 percent of the Bi-State DPS habitat. Additionally, we note that recent changes to RMPs and LRMPs associated with greater sage-grouse conservation across its range in the western United States do not apply to the Bi-State DPS. For additional detail see the Existing Regulatory Mechanisms section in the 2019 Species Report. Since the proposed rule, we received additional information on Federal regulatory mechanisms. Jointly, the Humboldt-Toiyabe National Forest and the Carson City and Tonopah Offices of the BLM have developed new Land Use Plan Amendments (HTNF 2016, entire; BLM 2016, entire). The amendments more fully address conservation of the Bi-State area by providing specific direction to management of the DPS and its habitat, including (but not limited to) direct effects (such as land disturbance) and indirect effects (such as noise) caused by management of: Recreation, grazing, weeds, wild horses and burros, minerals, fire management, and rights-[[Page 18087]]of-way. Furthermore in 2019, the Inyo National Forest completed a revised Land Management Plan, which also improves management consideration of sage-grouse conservation (USFS 2019, entire). For additional discussion on existing regulatory mechanisms and our conservation efforts analysis, see discussions in Summary of Factors Affecting the Species and the Existing Regulatory Mechanisms and Conservation Efforts sections in the 2019 Species Report (Service 2020, pp. 124-147). Therefore, we conclude that the BLM and USFS Land Use Plan amendments will limit future additional impacts caused by discretionary actions, thus greatly enhancing the conservation afforded to the Bi-State DPS and its habitat. The 2012 BSAP is not a regulatory mechanism. As such, we have evaluated it through our PECE policy, as described in Policy for Evaluation of Conservation Efforts When Making Listing Decisions, above. Since we have concluded that it is sufficiently certain to be both implemented and effective, we have considered how the measures included in the plan are ameliorating the magnitude of threats. The LADWP plans are also not regulatory mechanisms, and we have evaluated them as an existing and ongoing conservation measure. (2) Comment: Several commenters stated that conservation efforts to date have not been adequate, as threats remain on the landscape. Our Response: While considerable effort has been expended over the past several years to address some of the known threats throughout portions or all of the Bi-State DPS's estimated occupied range, threats to the continued viability of the DPS into the future remain. The development of the 2012 BSAP (Bi-State TAC 2012, entire) has highlighted the importance of not only habitat restoration and enhancement but also the role of the States and other partners in reducing many of the known threats to the Bi-State DPS. Cooperative, committed efforts by Federal and State agencies, as well as Mono County will result in full implementation of the 2012 BSAP, including funding and staffing commitments from 2015 through 2024 to address the most significant impacts to the DPS and its habitat (BLM 2014a, in litt.; BLM 2019, in litt.; CDFW 2014b, in litt.; Mono County 2014, in litt.; Mono County 2018, in litt.; NDOW 2014, in litt.; NDOW 2018, in litt.; NRCS 2018, in litt.; USDA 2014, in litt.; USFS 2018, in litt.; USGS 2014a, in litt.). Such plans will help provide the ongoing, targeted implementation of effective conservation actions that are essential for the conservation of the Bi-State DPS and its habitat into the future. We discuss the various conservation efforts occurring currently and into the future within the estimated occupied range of the Bi-State DPS of greater sage-grouse in more detail in the detailed PECE analysis (Service 2019, entire) under Policy for Evaluation of Conservation Efforts When Making Listing Decisions. (3) Comment: A few commenters suggest that the Bi-State DPS is not a genetically unique subspecies or that it does not meet our standard for recognition as a DPS. Our Response: In our 12-month finding on petitions to list three entities of sage-grouse (75 FR 13910, March 23, 2010), we found that the Bi-State population of sage-grouse meets our criteria as a DPS of the greater sage-grouse under Service policy (61 FR 4722, February 7, 1996). This determination was based principally on genetic information, where the DPS was found to be both markedly separated and significant to the remainder of the sage-grouse taxon. The Bi-State DPS defines the far southwestern limit of the species' range along the border of eastern California and western Nevada (Stiver et al. 2006, pp. 1-11). Sage-grouse in the Bi-State area contain a large number of unique genetic haplotypes not found elsewhere within the range of the species (Benedict et al. 2003, p. 306; Oyler-McCance et al. 2005, p. 1300; Oyler-McCance and Quinn 2011, p. 92, Oyler-McCance et al. 2014, p. 7). The genetic diversity present in the Bi-State area population is comparable to other populations, suggesting that the differences are not due to a genetic bottleneck or founder event (Oyler-McCance and Quinn 2011, p. 91; Oyler-McCance et al. 2014, p. 8). These studies provide evidence that the present genetic uniqueness exhibited by Bi-State area sage-grouse developed over thousands and perhaps tens of thousands of years, hence, prior to the Euro-American settlement (Benedict et al. 2003, p. 308; Oyler-McCance et al. 2005, p. 1307; Oyler-McCance et al. 2014, p. 9). The available genetic information demonstrates that the Bi-State sage-grouse are both discrete from other greater sage-grouse populations and are genetically unique. Therefore, we believe the best scientific and commercial ***data*** available continues to clearly demonstrate that the Bi-State sage-grouse meet both the discreteness and significance criteria to be designated as a distinct population segment. (4) Comment: Several commenters stated that the 2013 proposed listing rule dismissed past conservation measures without fairly addressing their breadth, effectiveness, and chance of success. Further, they submit that the Service must evaluate the conservation measures through (at minimum) an analysis consistent with PECE and must fully consider how conservation measures will reduce or remove threats. The commenters believe that a fair evaluation of the past conservation efforts would demonstrate that they are sufficient to protect the Bi-State DPS. Alternatively, several commenters argue that past conservation efforts, while well-intended, have been inadequate to provide sufficient conservation for the DPS. Further, the commenters contend that the 2012 BSAP is voluntary in nature and does not meet the PECE standard, and that populations have continued to decline since the implementation of the BSAP. Our Response: In this finding, we acknowledge and commend the commitment of many partners in implementing numerous conservation actions within the range of the Bi-State DPS. The PECE policy applies to formalized conservation efforts that have not yet been implemented or those that have been implemented but have not yet demonstrated whether they are effective at the time of listing. Our analysis of all conservation efforts currently in place and under development for the future is described in detail above in Policy for Evaluation of Conservation Efforts When Making Listing Decisions. The effect of conservation efforts and regulatory mechanisms on the status of a species is considered under Summary of Biological Status and Threats. In this document, we considered whether formalized conservation efforts such as the BSAP are included as part of the baseline through the analysis of the five listing factors or are appropriate for consideration under our PECE policy. All participating agencies have provided letters affirming their commitment to the plan, as well as funding and implementation schedules (Service 2019, entire). Due to these and other considerations as outlined in our detailed PECE analysis, we concluded that the 2012 BSAP is highly certain to be implemented. We acknowledge that the most recent population studies show that some sage-grouse populations in the Bi-State DPS have declined (Coates et al. 2020, Table 3). However, the Bi-State DPS as a whole is showing a stable, long-term trend. Conservation measures are in place to counter negative population growth (such as the Parker Meadows translocation project). Currently, 53 of[[Page 18088]]the 76 high-priority projects have been initiated representing 68 percent of the projects originally identified (Bi-State TAC 2018, p. 3). Twelve projects (17 percent) were evaluated and determined to lie outside of occupied sage-grouse habitat and were subsequently removed from the list of priorities. Furthermore, 142 of the 159 identified actions in the BSAP have been initiated and are in stages of completion, meaning they are in progress, ongoing, occur annually, or have been evaluated as part of the planning process (Bi-State TAC 2018, p. 45; Service 2019, p. 33). Given that these measures are still ongoing, we do not expect that positive gains from these measures would yet be reflected in population studies. Overall, due to many factors as outlined in our detailed PECE analysis, we concluded that future conservation measures are highly certain to be effective in ameliorating the threats currently impacting the Bi-State DPS. Therefore, we find the Bi-State DPS is not in danger of becoming extinct throughout all or a significant portion of its range, and is not likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range, and we are withdrawing the proposed listing, 4(d), and critical habitat rules for the Bi-State DPS (see Determination of Status for the Bi-State DPS below). (5) Comment: Numerous commenters suggested that predators are a significant threat and that we did not account for this impact accurately. Further, many commenters suggested predator removal programs should be implemented. Alternatively, several commenters suggested that predator control is not sustainable and may have negative and unintended consequences. Our Response: As discussed in Predation, we recognize that predation of sage-grouse is the most commonly identified cause of direct mortality during all life stages. However, we note that sage-grouse have coevolved with a suite of predators (Schroeder et al. 1999, pp. 9-10), yet the species has persisted. Thus, this form of mortality is apparently offset by other aspects of the species life-history under ``normal'' conditions. However, when non-endemic predators are introduced into a system (one with which the prey species did not evolve (e.g , domestic cats and dogs)), or when other factors influence the balance between endemic predator and prey interactions, such that a predator gains a competitive advantage, predation may overwhelm a prey species life-history strategy and ultimately influence population growth and persistence (Braun 1998, pp. 145-146; Holloran 2005, p. 58; Coates 2007, p. 155; Bui 2009, p. 2; Coates and Delehanty 2010, p. 243; Howe et al. 2014, p. 41). Therefore, we agree that increases in sage-grouse predator abundance and predation rates are a concern by potentially negatively affecting population growth. However, we maintain that predation is a proximal cause of mortality and increases in predator abundance and predation rates are ultimately caused by changes in habitat conditions, which positively influence predator occurrence or efficiency. See also the Urbanization and Habitat Conversion, Infrastructure, and Predation sections in the associated Species Report for a detailed analysis on the impacts of predation (Service 2020, pp. 39-60, 110-117). As a point of clarification, we agree that targeted, short-term predator removal programs may be warranted in instances where habitat restoration cannot be achieved in a timely manner. In these instances, predation rates and predator abundance may be artificially high and high sage-grouse mortality may be a concern. However, ***data*** do not appear to suggest that removal programs are sustainable or that they result in consistent increases in sage-grouse numbers (Hagen 2011, pp. 98-99). We intend to explore the potential benefits and negative ramifications caused by predator control through our continued coordination efforts with the Bi-State TAC and LAWG for continued conservation of the Bi-State DPS. In 2018, a research project was initiated to explore the potential benefits gained through predator management. Specifically, this project targeted nesting common ravens in Long Valley associated with the local landfill through egg-oiling to prevent successful egg hatching. While final results will not be known for several years, preliminary results suggest improved nesting success of sage-grouse in Long Valley in the spring of 2019. (6) Comment: Numerous commenters suggested that the degree of impact we assign to specific threat factors is not accurate and suggested revisions. Further, several commenters identified an inconsistency in our proposed listing rule associated with our assignment of significance level to grazing and rangeland management. Our Response: The threats analysis and associated discussion of the degree of impact that is described in the Species Report (2013, 2014, and 2019 versions), our 2013 proposed listing rule, our 2015 proposed withdrawal, and this document are based upon the best available scientific and commercial information. No additional information or assessments were provided by the commenters to support their claim that the analysis and conclusions in our proposed listing rule were inaccurate. However, where applicable in our revised 2019 Species Report and this document, we have updated our threats analyses based on new information received since the proposed listing rule published on October 28, 2013 (78 FR 64358). With regard to potential inconsistencies in the threats analysis in the proposed rule, we made corrections to any inconsistencies identified by commenters and as applicable in both the revised 2019 Species Report and this document. Specifically, our 2013 proposed listing rule identified livestock grazing as a significant threat in the summary of threats section but did not reach this conclusion in the livestock grazing section of the document. We have corrected that error in this finding. (7) Comment: One commenter suggested that the potential threat to sage-grouse posed by fencing can be mitigated. Alternatively, another commenter stated that fencing is a major threat and expressed concern that there are no programs in place to require fencing to be removed. Our Response: We agree that certain practices, such as making fences more visible to sage-grouse through the use of visual markers or employing the use of alternative fence designs, such as let-down fencing, can reduce certain impacts to the Bi-State DPS caused by fencing, specifically collision. However, we do not anticipate that these efforts will completely ameliorate the threat of collision. For example, one study found that marking fences reduced the fence collision rate during the sage-grouse breeding season by 83 percent (Stevens et al. 2012, p. 301). Nevertheless, collisions still occurred at marked fences, especially those in close proximity to spring breeding sites, suggesting marking alone did not completely resolve the concern. Furthermore, while direct mortality through collision may be minimized by these approaches, indirect impacts caused by predation and other forms of habitat degradation may remain (see the discussion of impacts due to fences under Infrastructure above and in the 2019 Species Report (Service 2020, pp. 54-57)). Therefore, a combination of approaches to managing fences and their impacts needs to be applied, which may include removal. These efforts are currently ongoing in the Bi-State area (Bi-State TAC 2018, p. 33). With regard to the comment that fencing may be considered a major threat, we have described the impacts[[Page 18089]]that may occur from fencing based on the best scientific and commercial information available. We found that fencing impacts are widespread but generally minor. In addition, management actions are being undertaken to further ameliorate this threat. For example, approximately 20 km (13 mi) of fencing has been removed or modified in the Bi-State area, and approximately 101 km (63 mi) of fencing has been marked with visual flight diverters. Furthermore, the BLM RMP and USFS LRMP amendments prepared by the Humboldt-Toiyabe and Inyo National Forests, and the Carson City District and Tonopah Field Office of the BLM, specifically identify restrictions on new fence installation and removal or marking of fences already in place within 1.9-3.2 km (1.2-2 mi) of an active lek. The removal of fencing throughout all of the Bi-State area is not feasible. However, consideration of alternative approaches to traditional fencing would help reduce impacts of fencing to sage-grouse (for example, use of let-down fence designs), and we will continue to work with partners to encourage implementation of reduced or alternative approaches to fencing in areas that are most important to the Bi-State DPS. Conservation efforts are under way currently and into the future to reduce fencing impacts in priority areas (e.g , BLM's removal of racetrack fencing in Bodie PMU, marking or modifying fencing in Pine Nut and South Mono PMUs) (Bi-State TAC 2018, entire). (8) Comment: A few commenters suggested woodlands and woodland expansion is natural and should be left alone. Specifically, commenters speculated that forest occurrence is a reestablishment of sites that were harvested during historic mining in the latter part of the 1800s or that woodlands are naturally occurring. Further, the commenters suggested that woodland treatments are not effective at positively influencing sage-grouse population performance. Our Response: Across the Bi-State area, we estimate that approximately 40 percent of the historically available sagebrush habitat has been usurped by woodland succession over the past 150 years (USGS 2012, unpublished ***data***). As described in the 2019 Species Report (Service 2020, pp. 73-79) and in Nonnative Invasive Plants and Native Woodland Succession, the cause of this increase is likely multifaceted but most certainly includes recovery from past disturbances such as mining. However, the support for this single mechanism is not apparent. For example, while there are locations within the Bi-State area where there are stumps from harvested trees attributable to the mining era, most locations do not contain evidence of past tree cutting. Furthermore, genetic evidence suggests that sage-grouse populations contained within the Bi-State area were historically more connected and that these connections began to erode relatively recently (Oyler-McCance et al. 2014, pp. 10-11). This finding suggests that barriers to movement, such as trees, were less restrictive historically as compared to today. No additional information was received by the commenter or others since the proposed listing rule published that would modify our understanding of this threat. Therefore, based on the best available information, we conclude that woodland expansion is a significant threat in the Bi-State area as it has reduced habitat availability and negatively influenced population connectivity. As a result, conservation efforts are under way currently and into the future to reduce potential woodland succession impacts in priority areas (e.g , BLM, USFS, and NRCS treatments of phase I and II pinyon-juniper encroachment in all six PMUs) (phases of pinyon-juniper encroachment are generally defined by percent tree cover and tree age in the affected area) (Miller et al. 2008, p. 5; Bi-State TAC 2018, pp. 26-29). Ultimately, the cause of woodland encroachment becomes less relevant in light of its implications as the response to tree presence by sage-grouse is uniformly negative (Commons et al. 1999, p. 238; Doherty et al. 2008, p. 187; Freese 2009, pp. 84-85, 89-90; Casazza et al. 2011, p. 159; Baruch-Mordo et al. 2013, p. 237; Prochazka et al. 2017, p. 46). Therefore, to reduce this impact on the Bi-State DPS and its habitat, as described in the BSAP, land managers should consider management of pinyon-juniper encroachment in specific areas that would most benefit the Bi-State DPS (e.g , lek sites, migration corridors, and brood-rearing habitat) and that is consistent with our understanding of a specific site's vegetation potential. The removal of trees conveys positive benefits to sage-grouse stemming from increased habitat availability, increased adult and nest survival, and ultimately overall improved population performance (Coates et al. 2017b, pp. 31-33; Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Prochazka et al. 2017, p. 46; Olsen 2019, pp. 21-22). (9) Comment: Several commenters suggest that fire is the most significant threat to the Bi-State DPS and that post-fire restoration is difficult. Alternatively, several other commenters suggest that fire is a natural process and does not constitute a complete loss of habitat for the Bi-State DPS because sage-grouse will use burned areas. Our Response: In the Species Report (Service 2020, pp. 79-86) and in Wildfires and Altered Fire Regime, we address potential habitat changes that may be related to wildland fires and post-fire restoration activities. We agree that fire is a natural process on the landscape within the Bi-State area; however, we also note that we found that the ``too-little'' and ``too-much'' fire scenarios present challenges for the Bi-State DPS. In other words, in some locations, the lack of fire has facilitated the expansion of woodlands, especially into montane shrub communities. In other locations, recent fires have been followed by invasive-weed establishment facilitating a reoccurring fire cycle that restricts sagebrush restoration. These scenarios present challenges for the species. Still, although fires have occurred across the range of the Bi-State DPS historically and recently, we acknowledge that a sufficient amount of suitable habitat remains for sage-grouse use. Some of this remaining suitable habitat is threatened by additional fire because of adjacent invasive annual plants and woodland establishment, which can influence the frequency and intensity of future fire events. Further, impacts to remaining sagebrush habitat may be exacerbated due to interactions with other threats that are acting in the Bi-State area (see Summary of Threats). As a result of these impacts, conservation efforts are under way currently and into the future to reduce impacts associated with nonnative, invasive plants (e.g , multiple BLM and USFS invasive weed management treatments in multiple PMUs), and woodland succession (e.g , BLM, USFS, and NRCS treatments of phase I and II pinyon-juniper encroachment in all six PMUs) (Bi-State TAC 2014, in litt.). Additionally, while short-term (and potentially long-term) impacts from fire events to sage-grouse are known to occur, including but not limited to habitat loss and population declines (Beck et al. 2012, p. 452; Knick et al. 2011, p. 233; Wisdom et al. 2011, p. 469), we agree that some information suggests sage-grouse use of burned habitat. Small fires may maintain a suitable habitat mosaic by reducing shrub encroachment and encouraging understory growth. However, without available nearby sagebrush cover, the broad utility of these sites is questionable (Woodward 2006, p. 65). For example, sage-grouse using burned areas were rarely found more than 60 m[[Page 18090]](200 ft) from the edge of the burn and may preferentially use the burned and unburned edge habitat (Slater 2003, p. 63). We recognize that fire is natural and the primary disturbance mechanism in the sagebrush ecosystem. We also recognize that sage-grouse will selectively utilize portions of burned habitat. However, the challenge that wildfire presents to the sustainability of the system remains, especially given the relatively limited and fragmented suitable sagebrush habitat present in the Bi-State area. Still, land managers within the range of the Bi-State DPS are currently implementing and will continue to implement conservation efforts into the future that are expected to reduce the potential impacts of wildfire as it relates to nonnative, invasive plants and pinyon-juniper encroachment (Bi-State TAC 2018, pp. 22-23). (10) Comment: Several commenters suggested that climate change poses a significant impact to the Bi-State DPS and its habitat, including one commenter that stated we underestimated the impact that climate change and drought may have on the DPS. Our Response: In the Species Report (Service 2020, pp. 86-94) and in Climate, we address potential impacts associated with climate change. We found that projected climate change and its associated consequences have the potential to affect sage-grouse and sagebrush habitat in the Bi-State area. The impacts of climate change interact with other stressors such as disease, invasive species, prey availability, moisture, vegetation community dynamics, disturbance regimes, and other habitat degradations and loss that are already affecting the species (Strzepek et al. 2010, p. 5; Walker and Naugle 2011, entire; Finch 2012, pp. 60, 80; IPCC 2014, p. 60; Ault et al. 2014, p. 7545; Garfin et al. 2014, p. 463; He et al. 2018, pp. 16-17; Reich et al. 2018, p. 21). In the 2015 withdrawal of our proposed rule, we concluded that the overall impact of climate change to the Bi-State DPS at this time is considered moderate. Neither the commenters nor others provided new information related to climate change that would result in a change in our analysis. Our conclusion of moderate impact from climate change may ultimately prove to be conservative, but we believe this is the most supportable conclusion given the inherent uncertainties associated with climate modeling, especially prediction concerning precipitation. Additionally, conservation efforts associated with the 2012 BSAP (such as grazing exclosures, changes to grazing management plans, prescribed fires, invasive plant control, mechanical treatments, and conservation of meadow habitats) are increasing resiliency such that the magnitude of climate changes impacts will be reduced into the foreseeable future. If in the future substantial new information becomes available as to the specific impacts that may be incurred by the Bi-State DPS associated with climate change, we will revisit this assessment. (11) Comment: Several commenters stated that we should have proposed listing the Bi-State DPS of greater sage-grouse as an endangered species as opposed to a threatened species. Our Response: Section 3 of the Act defines an endangered species as any species that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. With regard to the Bi-State DPS, we have identified a series of threats across the range of the Bi-State DPS that are resulting in the present or threatened destruction, modification, or curtailment of its habitat or range, and other natural or manmade threats affecting the DPS's continued existence. We have determined that, assuming current conditions continue into the future, these impacts are such that the DPS is likely to become an endangered species within the foreseeable future (i.e , the definition of a threatened species). Many of these impacts are cumulatively acting upon the Bi-State DPS and increase the risk of extinction, but not to such a degree that the DPS is in danger of extinction today (see Determination of Status for the Bi-State DPS, below). However, after consideration of partially completed projects and future conservation efforts that we have found to be highly certain to be implemented and effective (see Policy for Evaluation of Conservation Efforts When Making Listing Decisions, above), we conclude the Bi-State DPS is not in danger of becoming extinct throughout all or a significant portion of its range, and is not likely to become endangered within the foreseeable future (threatened), throughout all or a significant portion of its range. Therefore, the Bi-State DPS of greater sage-grouse does not meet the definition of a threatened or endangered species, and we are withdrawing the proposed listing, 4(d), and critical habitat rules for the Bi-State DPS. (12) Comment: Some commenters were concerned about the effects of listing on mining and associated activities conducted under the General Mining Law of 1872. One commenter suggested that listing did not take into consideration Federal mining law and recognition of valid existing rights. Another commenter was concerned that there would be no assurances that development of a mining claim will result in the ability to mine it. Our Response: In the proposed listing rule, we identified mining and associated activities to be a threat to the Bi-State DPS; however, today we consider it a less significant impact and one that does not occur across the entire Bi-State area. On federally managed land outside of designated wilderness and wilderness study area (approximately 92 percent of all federal lands (1,629,669 ha or 4,027,000 ac)), new mining may occur pursuant to the Mining Law of 1872 (30 U.S.C 21 et seq.), which was enacted to promote exploration and development of domestic mineral resources, as well as the settlement of the western United States. It permits U.S citizens and businesses to prospect hardrock (locatable) minerals and, if a valuable deposit is found, file a claim giving them the right to use the land for mining activities and sell the minerals extracted. Gold and other minerals are frequently mined as locatable minerals subject to the Mining Law of 1872. Federal agencies with jurisdiction over land where mining occurs will review mining and other actions that they fund, authorize, or carry out to determine if listed species may be affected in accordance with section 7 of the Act. Because we are withdrawing our proposed rule to list the Bi-State DPS and it will not be placed on the list of federally endangered or threatened species, consultations under section 7 of the Act will not be required specific to the Bi-State DPS. As discussed above, potential exists for mining operations to expand both currently and into the future, but the scope of impacts from existing mining expansion is not considered extensive. We concluded that, by itself, mining is not currently considered a significant impact to the Bi-State population, though mining exploration continues, and mining activity could occur at any time in the future. (13) Comment: Several commenters stated that they believe mining is not a threat to the Bi-State DPS. Alternatively, another commenter suggested impacts from mining are significant. Our Response: In the Species Report (Service 2020, pp. 60-63) and in Mining,[[Page 18091]]we address potential impacts associated with mining activities. Sage-grouse could be impacted directly or indirectly from an increase in human presence, land use practices, ground shock, noise, dust, reduced air quality, degradation of water quality and quantity, and changes in vegetation and topography (Moore and Mills 1977, entire; Brown and Clayton 2004, p. 2). However, these effects are theoretical, given that information relating sage-grouse response to mineral developments is not extensive. Neither the commenters nor others provided new information related to this threat. While we maintain that it is reasonable to assume a negative impact from mining on sage-grouse, based on the current extent and location of mineral developments in the Bi-State area, we conclude that mining is not considered a significant impact at this time. Mining is a potential future concern based on its potential to impact important lek complexes and population connectivity. It may also create effects that combine with other threats currently acting on the Bi-State DPS resulting in a higher degree of negative impact in the future, though not to the extent that the species will become endangered in the forseeable future. See the Mining section of the 2019 Species Report for a complete discussion of the potential effects of mining activities on the Bi-State DPS and its habitat. (14) Comment: Numerous commenters suggested that our grazing and rangeland management assessment in the proposed listing rule is not accurate and requires additional clarification. Specifically, they suggested that: (1) Current livestock grazing is compatible with sage-grouse conservation in the Bi-State area, (2) a more clearly defined delineation is needed between past and present grazing impacts, and (3) additional delineation is needed among grazing animals (such as cattle, horses, sheep). Alternatively, several other commenters suggested that grazing and rangeland management are a significant threat to the Bi-State DPS's conservation and that this threat is not adequately controlled by existing management programs. Our Response: In the 2019 Species Report (Service 2020, pp. 65-73) and in Grazing and Rangeland Management, we found that the majority of sage-grouse habitat in the Bi-State area is not significantly impacted by livestock grazing. Specifically, RHAs or their equivalents (the standard used by Federal agencies to assess habitat condition) have been completed on allotments covering approximately 81 percent of suitable sage-grouse habitat in the Bi-State area. Of the allotments with RHAs completed, 81 percent (n=97) are meeting upland vegetation standards, suggesting that approximately 352,249 ha (870,427 ac) out of approximately 563,941 ha (1,393,529 ac) of suitable sage-grouse habitat are known to be in a condition compatible with sagebrush community maintenance. Furthermore, of the allotments with RHAs completed, 45 percent are meeting riparian standards and 27 percent are not, with the remainder being unknown or the allotment not containing riparian habitat. Of those not meeting riparian standards (approximately 15 percent), livestock were a significant or partially significant cause for the allotment failing to meet identified standards while the remainders were attributed to other causes such as past mining activity or road presence. In each instance of an allotment not meeting standards due to livestock, remedial actions have been taken by the representative land managing agency (such as changes in intensity, duration, or season of use by livestock). Furthermore, while we have information on the class of livestock (i.e , sheep, cattle) associated with any given allotment, we did not analyze these allotments independently based on this difference. While it is true that types of livestock will use vegetation communities differently, meaning some animals consume more shrubs and others consume more grasses, RHAs or their equivalents are a measure of the condition of the allotment against a desired condition, which includes among other things fish and wildlife habitat condition. Given that RHAs in the Bi-State area consider suitable sage-grouse habitat condition as part of their evaluation, including shrub and herbaceous cover, we consider RHAs as a unit of measure sufficiently fine-scaled to be informative. Ultimately, based on ***data*** contained within RHAs, we concluded that modern livestock grazing is not a significant impact on sage-grouse habitat. We also note that historical impacts from livestock grazing and impacts caused by feral horses are apparent, but ***data*** to assess these impacts are limited. None of the commenters provided additional ***data*** to assist with this assessment. In total, we believe that historical impacts (past grazing and other land uses) and impacts from feral horse use is apparent in local areas, but we consider current management to be sufficient to address these issues. (15) Comment: Several commenters provided information pertaining to population performance and size across the DPS as a whole as well as for individual Population Management Units. Our Response: While we appreciate these updates, all of these comments and the ***data*** contained within them have been considered in the associated 2019 Species Report as well as within this document. Furthermore, we note that the most recent final results stemming from the IPM (Coates et al. 2020, entire) are similarly incorporated into our 2019 Species Report and this document. The ***data*** provided by commenters have either been updated by incorporating more recent ***data*** into the analysis or by making slight alterations to the modelling approach. Many preliminary research results are presented to the Local Area Working Group during regularly occurring meetings. These results, however, are often prone to change as the research is finalized. Therefore, the numbers presented in the 2019 Species Report and incorporated into this document represent the most up-to-date finalized findings and represent the best scientific and commercial ***data*** available. (16) Comment: At least one commenter questioned the efficacy and rationale for the currently ongoing translocation effort in the Parker Meadows subpopulation. The commenter specifically expressed concern over the potential impact this action may have on the source population and further questioned whether the habitat in the Parker Meadows area is sufficiently suitable for the reintroduction. Our Response: The 2012 Action Plan identified augmentation of the Parker Meadows subpopulation via translocation as a conservation action. This effort was identified as a need based on the small size of the subpopulation, genetic information highlighting relatively low genetic diversity in the subpopulation, and recent monitoring results identifying low hatchability of clutches (females were laying eggs but these eggs were not hatching, suggesting eggs were either going unfertilized or genetic anomalies were inhibiting some aspect of egg development). To restore genetic and demographic health to the subpopulation, birds from outside the subpopulation were captured and moved to the Parker Meadows site. The overarching intent of this action was to conserve and enhance connectivity between PMUs, specifically between the South Mono and Bodie PMUs. Prior to initiating this effort, members of the Bi-State TAC conducted a site visit to assess habitat condition. Habitat[[Page 18092]]was deemed to be of suitable condition but for the occurrence of a limited number of conifer trees that had become established in proximity to the lek and brood-rearing meadow. These trees were removed prior to the augmentation. In addition, the Bi-State TAC evaluated the potential impact the source population may incur, due to the removal of birds, via the IPM. Essentially, the study evaluated how altering adult female and brood survival for the source population impacted population performance. The source population was the Bodie PMU, and the results suggested the removal of birds from this location would not affect overall population growth within this PMU. We evaluated the potential impact from this action in the 2019 Species Report, within the Scientific and Educational Uses section (Service 2020, pp. 101-104). Ultimately, measuring the success of this translocation effort will require additional time. Preliminary results suggest that translocated birds are remaining in the Parker Meadows area at an increasing rate, probability of nest initiation and nest success have increased, brood success is on par with the remainder of the DPS, and lek counts have increased over the past 2 years. (17) Comment: Several commenters expressed concern over the estimated effective population size of the DPS as a whole as well as for specific populations. Our Response: As discussed in Small Population Size and Population Isolation, studies suggest effective population size should exceed 50 to 100 individuals to avoid short-term extinction risk caused by inbreeding depression, and mathematical models suggest that effective population size should exceed 500 individuals to retain evolutionary potential and avoid long-term extinction risk (Franklin 1980, entire; Soule 1980, entire). However, some estimates of an effective population size necessary to retain evolutionary potential are as high as 5,000 individuals, although these estimates are thought to be highly species specific and influenced by many extrinsic factors (Lande 1995, p. 789). The effective population size of the Bi-State DPS in 2018 was between 330 and 661 birds (Table 2; Service 2020, pp. 119-121). We agree that the size of the populations and the relative degree of isolation among populations within the Bi-State area is a concern to species conservation as it can exacerbate the effects of genetic issues, stochastic events, and other threats to the DPS. However, as discussed above, the current genetic diversity present in the Bi-State area population is comparable to other populations, suggesting that the differences are not due to a genetic bottleneck or founder event (Oyler-McCance and Quinn 2011, p. 91; Oyler-McCance et al. 2014, p. 8). The available genetic information demonstrates that the Bi-State sage-grouse are both discrete from other greater sage-grouse populations and are genetically unique. Further, a significant impetus of the 2012 Action Plan was to facilitate connectivity among populations across the DPS. While we remain concerned regarding isolation of these populations, we believe that effective implementation of the 2012 Action Plan will help alleviate concerns over loss of genetic diversity or the accumulation of deleterious alleles. (18) Comment: Several commenters identified new potential threats to the DPS, which were not apparent at the time of our proposed listing in 2013. Specifically, these include a potential change to how LADWP manages their lands in Long Valley, the potential for additional development within the designated West-wide Energy Corridor, a potential new hydro-pump storage energy development in the White Mountains PMU, and the development of a Programmatic Environmental Impact Statement pertaining to fuel break development in the Great Basin (PEIS). Our Response: We appreciate these updates on potential threats and note that each of these identified new threats has been considered in the associated 2019 Species Report as well as in this document. The Record of Decision on the West-wide Energy Corridor was signed in 2009 by the Secretaries of the Interior and ***Agriculture***. This action was challenged in court the same year, and a settlement was reached in 2012. One aspect of the settlement was a reevaluation of the corridors identified in 2009, and the public scoping for this assessment was reopened in the past year. Thus, we have been aware of this potential activity for nearly a decade but recognize the renewed interest in its potential impact to the Bi-State DPS. A section of these designated corridors passes through the Mount Grant PMU. This corridor section currently has a high-voltage transmission line in place, but additional development may take place assuming the completion of this NEPA action. While we recognize that additional development may occur and may cause impacts to this population, we do not have any knowledge of, nor did the commenters provide, additional ***data*** informing the likelihood of future development. The reevaluation of these corridors is currently ongoing per the 2012 settlement. This reevaluation may, in fact, result in revisions to the 2009 corridor proposals. We do not have sufficient certainty at this time of what the potential impacts of this action may have on the Mount Grant PMU. The LADWP is currently evaluating alterations to the amount of water it has traditionally provided for ***agricultural*** use in Long Valley. This water allocation has most commonly been used to irrigate portions of Long Valley to benefit forage production for local ranching operations. An ancillary benefit of this practice has been the enhancement of sage-grouse brood-rearing habitat. Thus, changes to this practice could influence the sage-grouse population in Long Valley by negatively impacting chick survival. To address these type of concerns, in June of 2019, LADWP sent a letter to the Service reaffirming their commitment to their 2013 Conservation Strategy (implemented by a memorandum of understanding with FWS), through which LADWP supports sage-grouse conservation by, in part, utilizing its water resources to maintain and improve important habitat for sage-grouse on their lands; and to continue using a collaborative, science-based, and adaptive management approach to achieve the best habitat results. Therefore, we recognize the potential impacts that alteration to water supplies in Long Valley may have on the local sage-grouse population, but we consider this to be a manageable stressor, in light of LADWP's continuing commitment toward Bi-State DPS conservation. In 2019, an application was submitted to the Federal Energy Regulatory Commission to build and maintain a new hydro-pump storage facility within the White Mountains PMU, representing a potentially new threat to the DPS. However, this application was subsequently withdrawn. Therefore, the Service does not consider this formerly proposed facility to be an active threat to the Bi-State DPS. In 2017, the BLM published a notice of intent to prepare the development of a Great-Basin-Wide Fuel Break PEIS. The purpose of this document is to expedite the development, enhancement, maintenance, and utilization of fuel breaks to prevent or minimize the likelihood of large-scale wildfire events, which are becoming more prevalent in the Great Basin. This would be accomplished by establishing strategic fuel breaks wherein fire fighters could stage and anchor suppression activities to increase[[Page 18093]]quicker suppression response times. We recognize that Bi-State DPS habitat is included within the scope of the PEIS. Further, we recognize that fragmentation of habitats through the establishment of fuel breaks may negatively impact some wildlife species including greater sage-grouse (Shinneman et al. 2019, pp. 4-7). There are trade-offs between the effects of habitat lost to fire and habitat lost or degraded by the establishment of a fuel break. Because the plan has not yet been prepared, it is difficult to fully assess its impacts on sagebrush habitat. Still, we anticipated that, after the PEIS is complete, site-specific NEPA analysis (or possibly categorical exclusion or determinations of NEPA adequacy analyses) will still be developed, as the PEIS does not detail the specific locations where these fuel breaks will be established. Given current direction provided by Land Use Plans in the Bi-State area, identified ``Best Management Practices'' outlined in the PEIS, and the existing collaboration among the EOC, TAC, and LAWG, we contend that future discussions pertaining to the potential establishment of fuel breaks in the Bi-State area will be robust and afford substantial deference to sage-grouse as well as the integrity of the entire sagebrush ecosystem. Therefore, we do not consider the PEIS to negatively impact the species, and thus do not consider it in our threats analysis. (19) Comment: One commenter questioned the feasibility of ongoing financial commitments provided by the Bi-State EOC toward the implementation of the 2012 BSAP. Our Response: The BSAP identifies threats to the conservation of sage-grouse in the Bi-State area and delineates specific conservation actions to alleviate those threats. In 2014, the Bi-State EOC pledged to fund these actions at a value in excess of 45 million dollars over a 10-year timeframe. We recognize that funding commitments provided by Federal agencies over a 10-year time horizon may appear speculative, given these agencies typically work with annual funding cycles driven by the U.S Congress appropriations process; however, agency managers still retain substantial discretion to forecast and plan how to utilize appropriations in a longer term strategy. From 2014 through 2018, approximately 26 million dollars have already been allocated, representing approximately 57 percent of pledged funds (Bi-State TAC 2018, p. 35). Furthermore, agency partners in the EOC recently updated their respective letters of commitment to continue funding for the next 5 years. Given the robust collaborative effort in the Bi-State area in combination with the realized funding track record over the past 5 years and recent reiterations of commitments for future funding, we consider the likelihood of future commitments to be high. (20) Comment: One commenter suggested we should assess human population density on a county-by-county basis to determine how it compares to the four people per 1 km\2\ threshold established by Aldridge et al. (2008). Our Response: In 2008, Aldridge et al. (2008) published a peer-reviewed scientific article, which evaluated a number of predictive variables to compare locations of extant versus extirpated sage-grouse populations. We note that this correlative study does not imply causation but is a frequently used approach in wildlife studies and that this type of approach can be highly informative. As discussed in Urbanization and Habitat Conversion, in modeling several measures of human population on greater sage-grouse persistence, including current population density, historical population density, and human population growth, the best predictor of sage-grouse extirpation was human population density in 1950 (Aldridge et al. 2008, p. 985). This finding suggests that human development has had long-term impacts on habitat suitability and sage-grouse persistence. Extirpation was more likely in areas having a moderate human population density of at least four people per 1 km\2\ (10 people per 1 mi\2\). Furthermore, increase in human populations from this moderate level did not infer a greater likelihood of extirpation, likely because much of the additional growth occurred in areas no longer suitable for sage-grouse (Aldridge et al. 2008, pp. 991-992). In the 2019 Species Report, we examined the potential likelihood of population changes that may influence urbanization and habitat conversion in the future, by reviewing the most recent U.S Census Bureau ***data*** (U.S Census Bureau 2018). We found five of eight counties in the Bi-State area have documented declines in the estimated number of people present between 2010 and 2017: Alpine, Mono, and Inyo Counties in California, and Mineral and Carson City Counties in Nevada. In addition, all of these counties except Carson City, Nevada, support substantially fewer than four people per 1 km\2\ (10 people per 1 mi\2\). The remaining three counties in the Bi-State area have seen human population increases over the past decade, ranging from 2.8 percent for Douglas County, Nevada, and 4.1 percent for Lyon County, Nevada, to 8.4 percent for Esmerelda County, Nevada (U.S Census Bureau 2018). While Esmerelda County still contains substantially fewer than four people per km\2\ (four people per 0.4 mi\2\), both Lyon and Douglas Counties, Nevada, have from two to six times that population density. Although we do not have specific information on possible future developments from each of these counties with documented human population increases, we are aware that recent development levels are reduced as compared to the past. Obviously, this metric can be informative but potentially misleading or unsatisfying. Frequently, counties have high- and low-density areas such as cities and towns or more rural developments. Evaluating the number of people per area does not capture the true distribution of people across the landscape. So, while it is reasonable to use the Aldridge et al. (2008) study to explore similarities or differences among locations, two counties with the same density of people can have differing levels of effects to sage-grouse based on the pattern of development. (21) Comment: One commenter suggested we should invite and interview Native American tribal partners to share their knowledge of historical and pre-historical occurrence of sage-grouse in the Bi-State area. Our Response: We agree that our Native American partners have a rich oral and written history in the Bi-State area, and we have been working with them since 2014 to incorporate their knowledge into the Bi-State collaboration. The first milestone of this endeavor occurred in 2016 in the form of a Traditional Ecological Knowledge Summit intended to engage and learn from the local and more broadly dispersed Native American Tribes in the Great Basin on sage-grouse history and conservation and the cultural significance of pinyon pine trees. This well-attended event presented an opportunity for the dissemination of traditional knowledge and subsequently led to the establishment of the Bi-State Traditional Natural Resources Committee. The intent of this committee is simple, to expand the breadth of the Bi-State collaboration such that decisions and actions are informed by and take into consideration Native American concerns and insights. We are pleased to further expand the Bi-State collaborative through the participation of Native American tribes and agree that inclusion of traditional knowledge is an[[Page 18094]]imperative. With respect to this listing decision process specifically, we extended an invitation to Tribal partners to review and comment on our 2019 Species Report prior to its completion, but we did not receive any responses. (22) Comment: One commenter stated that we must consider the best available science on impacts to sage-grouse wintering habitats and map Bi-State sage-grouse wintering habitat to assess threats to it. Further, they stated this is of critical importance because wintering habitats may be found outside habitats designated on the basis of breeding and nesting habitats. Our Response: We concur that an understanding of wintering habitats is important to conservation and management of the Bi-State DPS. We further agree that mapping of wintering habitat would be useful to assess threats. However, we are required to make our determination based on the best scientific and commercial ***data*** available at the time of our rulemaking, and information on wintering habitats as well as maps of wintering habitat are not currently available. In preparing this document, we considered the best scientific and commercial ***data*** available regarding the Bi-State DPS to evaluate their potential status under the Act. We solicited peer review of our evaluation of the available ***data***, and our peer reviewers supported our analysis. Science is a cumulative process, and the body of knowledge is ever-growing. In light of this, the Service will always take new research into consideration into future analyses of the Bi-State DPS, but we are required to publish a final decision on the Bi-State DPS in the Federal Register by April 1, 2020. If plausible new research supports amendment or revision of this withdrawal document in the future, the Service will consider the new information consistent with the Act and our established work priorities at that time. (23) Comment: One commenter suggested we should present up-to-date acreage for private lands covered by conservation easements and provide descriptions of projects funded by the NRCS. Our Response: We estimate that, since 2003, approximately 10,415 ha (25,737 ac) of private land, which may provide suitable habitat for sage-grouse in the Bi-State DPS, are currently enrolled in various easement programs. The easements are targeted primarily at development and water rights and vary in length from 30 years to in perpetuity. The majority of these easement lands are located in the Bodie PMU, with the remainder of easements occurring in the Desert Creek-Fales, South Mono, Pine Nut, and White Mountains PMUs. In addition, we estimate that approximately 9,737 ha (24,060 ac) of previously private land within the Bi-State DPS has been acquired by State and Federal agencies over this same timeframe. In total, approximately 20,153 ha (49,800 ac) of land, either through conservation easements or acquisitions, has been substantially protected from urbanization challenges. These acres represent approximately 31 percent of total private lands containing mapped sage-grouse habitat across the Bi-State. Furthermore, 12,243 ha (30,254 ac) of the total 20,153 ha (49,800 ac) of easements and acquisitions completed since 2003 have been accomplished since the adoption of the BSAP in 2012. Further, we note that approximately 7,284 ha (18,000 ac) of private lands have funding obligated for conservation easements, but these transactions are still in progress. An effort to acquire approximately 5,870 ha (14,500 ac) of lands in the Pine Nut PMU by the Carson City BLM has been approved and is anticipated to finalize in spring of 2020. The NRCS, via the Farm Bill, can fund restoration actions on private and public lands across the Bi-State DPS. The suite of actions they can fund is broad, but based on a Conference Report with the Service in 2010, there are three main types of conservation practice standards employed: management, vegetative, and structural. Examples of practices that fall under these three main categories include (but are not limited to): (1) Prescribed grazing assistance, upland and meadow management, access management; (2) forest slash management, cover crop, weed control, seeding; and (3) infrastructure, fish and wildlife structure, obstruction removal. While a variety of these practices have been employed in the Bi-State area, in general the preponderance of NRCS's efforts in the Bi-State area have focused on securing conservation easements and conifer removal. Since 2010, NRCS has placed into easement approximately 8,741 ha (21,600 ac) of private lands. In addition, over this same timeframe, NRCS has funded the removal of approximately 4,649 ha (11,488 ac) of conifer trees for the benefit of the species across multiple PMUs. (24) Comment: Several commenters expressed concern over population performance in some subpopulations and how this may result in range contraction of the DPS. Further one commenter submitted that we evaluate lek count ***data*** ***collected*** by the States and incorporate it into population trend analysis. Our Response: We agree that some of the smaller peripheral populations experiencing population declines may result in range contractions in the Bi-State DPS as a whole. A recent analysis considering ***data*** from the past 24 years on four populations found that some populations in the Bi-State DPS are contracting their habitat use, with contractions most apparent in the Fales, Long Valley, and Sagehen populations (Coates et al. 2020, p. 44). Over this same time, distributional area in the Bodie Hills has increased (Coates et al. 2020, p. 44). Across the entire Bi-State area, these results suggest a median net loss of 858 ha (2,120 ac) annually. Additionally, recent changes in distribution (past 11 years) suggests a pattern similar to those described for the long-term spatial trend analysis. This short-term analysis also considered additional populations (Coates et al. 2020, p. 51). These results suggest contractions of total area for the Desert Creek, Long Valley, Mount Grant, Pine Nut, Sagehen, and White Mountains populations and expansion in the Bodie Hills, Fales, and Parker Meadows populations. Similar to the long-term analysis, the net effect over the 11 years was a loss of total area occupied over time, which corresponds to a median loss of 2,312 ha (5,713 ac) annually since 2008 (Coates et al. 2020, p. 51). These apparent declines in certain populations and habitat use over the shorter time period was likely influenced by the fact that the DPS is in the downward portion of their cyclic population growth. We also note that a significant drought affected this DPS from 2011 to 2015, and based on our understanding of the drivers behind sage-grouse population cycles, this drought condition has very likely affected recent population performance. We will continue to monitor the condition of these smaller, peripheral populations while working with our partners to implement beneficial actions from the BSAP. As part of our assessments of the Bi-State DPS, we request and review lek count ***data*** from NDOW and CDFW. We recognize that this ***data*** can be informative but further acknowledge that these ***data*** have limitations. For example, sage-grouse are known to forgo breeding activity during years of poor conditions, such as drought. Therefore, an individual animal may still be present in the population but does not attend the lek and therefore is not counted. While the ***data*** in this instance may suggest decline, it is misleading. There is support, however, that over a longer timeframe (8-10 years), lek counts act as a reasonable index to[[Page 18095]]population performance. Modeling these ***data*** helps alleviate concerns over the inherent errors associated with lek counts. Further, integrating the observations with additional ***data*** such as that ***collected*** via telemetry studies makes for a much more robust approach to understanding population dynamics. Ultimately, we do not dismiss lek count information, but we contend that incorporating this information into a more holistic approach--such as the Integrated Population Model for the Bi-State DPS--is a more informative approach to understanding population abundance and trend. (25) Comment: One commenter suggested we review Smith and Beck (2017) and contends that sagebrush treatments do not benefit greater sage-grouse and further that pinyon-juniper treatments also disturb sagebrush habitat, implying pinyon-juniper treatments do not benefit sage-grouse. Our Response: We appreciate this information. We agree with the findings in this report and submit that these results have been supported by others investigating habitat selection by greater sage-grouse. While the removal of sagebrush to benefit herbaceous understory development was a relatively frequent activity in the 1940s to the 1970s (Knick et al. 2011, p. 220), this form of action has been greatly curtailed in the past two decades. There may still be benefits to this type of action, and it is still conducted sporadically, but recent treatment methodology has been to open small gaps in the shrub canopy to alter the mosaic of the landscape in hopes of improving brood-rearing habitat. The validity of this treatment approach remains uncertain, and our understanding of the appropriate sage-grouse habitat mosaic remains untested. The intent of pinyon-juniper removal projects is to facilitate sagebrush community conservation and improve the suitability of a location for sage-grouse. Sage-grouse avoid tree communities, and their fitness is impacted by exposure to it. Furthermore, left unmanaged, trees will ultimately out-compete understory species (shrubs and herbaceous), resulting in a homogenous forested vegetation condition. Restoration of the shrub community at this point becomes extremely challenging. Targeted pinyon-juniper treatments in the Bi-State area are focused on, what is termed, phase I and phase II encroachment conditions. Phase I refers generally to conditions where trees are small (shrub high) with less than 10 percent canopy cover and the shrub community remains intact. Phase II occurs as the tree canopy cover increase (10-30 percent), trees increase in size, and the shrub community begins to decrease in dominance. Treatments of phase I communities is typically accomplished with garden pruners and pedestrian locomotion. This type of treatment would have negligible impact on the shrub community due to disturbance. As trees begin to increase in size, chainsaws and machinery are employed. In these instances, disturbance to the shrub community may occur but specific prescriptions and best management practices are followed to alleviate this exact concern. Shrub community disturbance in these instances do not equate to the treatments described by Smith and Beck (2017), where shrubs were specifically targeted for removal across large acreages. Finally, the potential short-term and restricted impact to the shrub community caused by tree removal treatments are outweighed by the long-term benefit gained through increasing and improving sage-grouse habitats. (26) Comment: Several commenters expressed concern that economic development will be negatively impacted by listing and suggested that it is necessary for the Service to conduct an analysis of the impacts that listing a species may have on local economies prior to issuance of a final rule. Alternatively, one commenter submitted that the local economy will be positively benefited. Our Response: Under the Act, the Secretary shall make determinations whether any species is an endangered species or a threatened species solely on the basis of the best scientific and commercial ***data*** available. Thus, the Service is not allowed to consider the economic impact of listing when making determinations whether a species is an endangered species or a threatened species.Determination of Status for the Bi-State DPS Section 4 of the Act (16 U.S.C 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of ``endangered species'' or ``threatened species.'' The Act defines an ``endangered species'' as a species that is ``in danger of extinction throughout all or a significant portion of its range,'' and a ``threatened species'' as a species that is ``likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether a species meets the definition of ``endangered species'' or ``threatened species'' because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence. For a more detailed discussion on the factors considered when determining whether a species meets the definition of ``endangered species'' or ``threatened species'' and our analysis on how we determine the foreseeable future in making these decisions, see Regulatory Framework, above.Status Throughout All of Its Range In this document, we reviewed the biological condition of the Bi-State DPS and its resources, and the influence of those resources on the species' overall viability and the risks to that viability. We presented summary evaluations of 11 threats analyzed in the Species Report: urbanization and habitat conversion (Factor A); infrastructure (Factor A); mining (Factor A); grazing and rangeland management (Factor A); nonnative invasive plants and native woodland succession (Factor A); wildfires and altered fire regime (Factor A); climate change, including drought (Factor A); recreation (Factor E); disease (Factor C); predation (Factor C); and small population size and population isolation (Factor E). We also evaluate the adequacy of existing regulatory mechanisms (Factor D) in ameliorating the magnitude and effect of threats. Please see the Species Report (Service 2020, pp. 39-136) for a more detailed discussion of each threat. In the Species Report, we also presented our evaluation of four additional threats: Renewable energy (Factor A), commercial and recreational hunting (Factor B); scientific and educational uses (Factor B); and contaminants (including pesticides) (Factor E). In the species report, we concluded that, although these threats are currently having some impact on individual sage-grouse and their habitat, their overall effect now and into the future is expected to be minimal. We did not present summary analyses of those threats in this document but, did consider them in Summary of Threats and consider them now as a part of our determination of status. When we issued a proposed rule to list the Bi-State DPS in 2013 (78 FR 64358, October 28, 2013), we found that the species was likely to become endangered in the foreseeable future[[Page 18096]]throughout all of its range due to threats associated with native woodland succession, the wildfire-invasive plant cycle, effects associated with small population size, and increased fragmentation of sagebrush habitat in the Bi-State area. Many of these threats remain on the landscape today. Pinyon-juniper encroachment (Factor A) continues to alter sagebrush habitat in the Bi-State area. Effects due to wildfire (Factor A) and nonnative invasive plants (cheatgrass) (Factor A) also continue to alter and degrade sagebrush habitat. The effects of drought (Factor A) are exacerbating impacts of wildfire, invasive plants, and altered wildfire regimes across the Bi-State area. In the future, climate change (Factor A) will result in warmer temperatures, altered precipitation regimes, and more frequent droughts. These changes will likely result in a greater intensity of these other threats into the foreseeable future. Drought in particular appears to have a strong influence on population dynamics and population cycling in the Bi-State DPS (Coates et al. 2020, pp. 27, 29). Areas across the Bi-State DPS are experiencing combined impacts of threats from wildfire, invasive species, urbanization (Factor A), infrastructure effects (Factor A), and recreation (Factor E); these effects may be exacerbated by population isolation and discontinuous population structure (Factor E). Regulatory mechanisms (Factor D), particularly RMPs and land management plans, are helping to ameliorate some threats across the Bi-State DPS. These plans provide specific direction for management of the DPS and its habitat, including decreasing habitat disturbance (direct effects) and noise and other impacts (indirect effects), through provisions addressing recreation, grazing, weeds, wild horses, minerals, and fire management. Impacts associated with Factor B (commercial and recreational hunting, and scientific and educational uses) are having very minor effects the Bi-State DPS now, and they are not expected to substantially increase within the foreseeable future. Predation (Factor C), particularly by ravens, is impacting the DPS, but not at a magnitude where resiliency is significantly affected. However, as habitat degradation and fragmentation continue to increase, the magnitude of the threat of predation could increase into the future. The key distinction between now and the 2013 proposed listing rule is the implementation of the 2012 BSAP, which began implementation in 2014 with the publication of the 2014 EOC report and the letters of commitment from partner agencies. Ongoing and future conservation efforts associated with the BSAP are likely to increase habitat quantity, quality, and connectivity, and enhance resiliency, redundancy, and representation. Efforts associated with the BSAP will: (1) Protect and restore critical brood-rearing habitat (reduces impacts from development/habitat conversion, grazing and rangeland management, and effects resulting from climate change). (2) Restore habitat impacted by nonnative, invasive species (e.g , cheatgrass) and pinyon-juniper encroachment (reduces impacts from nonnative, invasive and certain native plants, wildfire, predation, and effects resulting from climate change). (3) Improve our understanding of sage-grouse populations, structure, etc., to: (a) Prioritize management actions related to synergistic impacts on already fragmented habitat (reduced impacts such as infrastructure, urbanization, and recreation), such that management efforts occur in locations that benefit the DPS the most; and (b) develop and implement sage-grouse translocations from stable subpopulations to other small subpopulations that may be experiencing a high risk of extirpation (reduces impacts from small population size and population structure). These measures will likely increase the number of sage-grouse and resiliency of populations throughout the Bi-State DPS. These efforts to stop and reverse habitat loss and fragmentation will make small populations of Bi-State sage-grouse less susceptible to the effects of habitat loss, degradation, and fragmentation. They will expand the amount of protected habitat in critical brood-rearing habitat areas as well as restore currently unsuitable habitat in areas utilized for dispersal and colonization. As a whole, conservation efforts associated with the BSAP are expected to increase species redundancy and the Bi-State's ability to withstand future random, stochastic events. Additionally, in recent years, we have gained increased certainty of the effectiveness of pinyon-juniper removal on restoring sagebrush habitat and the use of restored areas by sage-grouse (Sandford et al. 2017, p. 63; Severson et al. 2017, p. 53; Olsen 2019, pp. 21-22). Further, sage-grouse using restored areas had significantly increased survival and brood success in treated versus control areas, with population growth was 11.2 percent higher in treatment than in control sites within 5 years of conifer removal (Olsen 2019, pp. 21-22). Recent trend analyses have given us a stronger understanding of the population dynamics of the Bi-State DPS. The Bi-State DPS appears to be undergoing population cycling, which is typical of sage-grouse populations rangewide. The most recent study concluded that the DPS, as a whole, experiences stable trends over all three time periods studied, and that in the period 1995-2018, the DPS increased by 2 percent a year (95 percent CRI = 0.74-1.42) (Coates et al. 2020, p. 25). Although the Bi-State DPS experienced periods of decline, these declines were offset by later periods of population growth (Coates et al. 2020, p. 25). Overall, the modelled probability of extirpation of the Bi-State DPS over the next 10 years is very low (1.1 percent; Coates et al. 2020, Table 1). It is important to note that individual population trends of some populations within PMUs have declined, and areas such as Sagehen and Parker Meadows (both in the South Mono PMU) have high probabilities of extirpation over the next 10 years, though the extirpation probability of the South Mono PMU is only 3.8 percent (Coates et al. 2020, Table 1). Longer-term extirpation probabilities are not available for all PMUs, but the 30-year probabilities of declining below 50 males for the North Mono Lake area (the Desert-Creek Fales, Bodie, and Mount Grant PMUs) and for the South Mono PMU were both 8 percent (Garton et al 2015, p. 14). Conservation efforts are in place to help offset declining populations such as the translocation of broods to Parker Meadows, which has shown some early signs of success. Conservation measures in other areas, including post-fire restoration, wild horse gathers, fuel reduction treatment, and pinyon-juniper removal, are further reducing the magnitude of threats. Many of the conservation efforts associated with the BSAP have only been completed in recent years or are in the process of being completed. As discussed in more detail in our full PECE analysis, 142 of the 159 identified actions in the BSAP have been initiated and are in stages of completion, meaning they are in progress, ongoing, occur annually, or have been evaluated as part of the planning process (Bi-State TAC 2018, p. 45), but have not necessarily been completed. Thus, the full benefits of the conservation actions may not yet be achieved or apparent in sage-grouse population growth rates or in probabilities of extirpation, which are calculated by projecting past trends into the future. Some positive results are already apparent. For example, the translocation effort in Parker Meadows began in 2018 and has shown some[[Page 18097]]early signs of success in improved reproductive success and recruitment. Overall, as described in our PECE analysis (Service 2019, entire), based on studies showing the effectiveness of other conservation actions (such as pinyon-juniper removal) and on detailed implementation schedules provided by agencies participating in the BSAP, we have sufficient certainty that conservation efforts outlined in the BSAP will be implemented and effective, and will increase the viability of the species into the future. The BSAP does not remove or eliminate all threats to the species, and we expect impacts from cheatgrass, pinyon-juniper encroachment, altered wildfire regime, and climate change to continue to act on the species into the foreseeable future. Overall, however, we find that the BSAP and existing regulatory mechanisms are reducing the level of threats and increasing population resiliency across the Bi-State DPS. After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we conclude that, due to the effects of conservation actions as analyzed under our PECE policy, the threats impacting the Bi-State DPS of the greater-sage grouse have been greatly reduced. Thus, after assessing the best available information, we conclude that the Bi-State DPS is not in danger of extinction throughout all of its range. We, therefore, proceed with determining whether the Bi-State DPS is likely to become so within the foreseeable future. Threats such as wildfire and altered fire regimes, climate change, nonnative invasive plants and native woodland succession, recreation, and others are expected to continue or increase into the future. Within the foreseeable future, we expect the individual and combined impacts of these threats to continue to increase. In particular, effects associated with climate change, such as drought, will continue to degrade habitat supporting the Bi-State DPS. However, as noted above, actions associated with the BSAP are expected to increase resiliency, redundancy, and representation of the Bi-State DPS, increasing the overall viability of the DPS such that they will be able to withstand the increased magnitude of threats into the foreseeable future. Thus, after assessing the best available information, we conclude that the Bi-State DPS is not likely to become in danger of extinction within the foreseeable future throughout all of its range.Status Throughout a Significant Portion of Its Range Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. Having determined that the Bi-State DPS is not in danger of extinction or likely to become so in the foreseeable future throughout all of its range, we now consider whether it may be in danger of extinction or likely to become so within the foreseeable future in a significant portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways, so we first screen the potential portions of the species' range to determine if there are any portions that warrant further consideration. To do the ``screening'' analysis, we ask whether there are portions of the species' range for which there is substantial information indicating that: (1) The portion may be significant; and, (2) the species may be, in that portion, either in danger of extinction or likely to become so in the foreseeable future. For a particular portion, if we cannot answer both questions in the affirmative, then that portion does not warrant further consideration and the species does not warrant listing because of its status in that portion of its range. Conversely, we emphasize that answering both of these questions in the affirmative is not a determination that the species is in danger of extinction or likely to become so within the foreseeable future throughout a significant portion of its range--rather, it is a threshold step to determine whether a more-detailed analysis of the issue is required. If we answer these questions in the affirmative, we then conduct a more thorough analysis to determine whether the portion does indeed meet both of the ``significant portion of the range'' prongs: (1) The portion is significant and (2) the species is, in that portion, either in danger of extinction or likely to become so in the foreseeable future. Confirmation that a portion does indeed meet one of these prongs does not create a presumption, prejudgment, or other determination as to whether the species is an endangered species or threatened species. Rather, we must then undertake a more detailed analysis of the other prong to make that determination. Only if the portion does indeed meet both prongs would the species warrant listing because of its status in a significant portion of its range. At both stages in this process--the stage of screening potential portions to identify any that warrant further consideration, and the stage of undertaking the more detailed analysis of any portions that do warrant further consideration--it might be more efficient for us to address the ``significance'' question or the ``status'' question first. Our selection of which question to address first for a particular portion depends on the biology of the species, its range, and the threats it faces. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the second question for that portion of the species' range. For the Bi-State DPS, we chose to address the status question (i.e , identifying portions where the Bi-State DPS may be in danger of extinction or likely to become so in the foreseeable future) first. To conduct this screening, we considered whether any of the threats acting on the DPS are geographically concentrated in any portion of the range at a biologically meaningful scale. We examined the following threats throughout the range of the DPS: Urbanization and habitat conversion (Factor A); infrastructure (Factor A); mining (Factor A); grazing and rangeland management (Factor A); nonnative invasive plants and native woodland succession (Factor A); wildfires and altered fire regime (Factor A); climate change, including drought (Factor A); recreation (Factor E); disease (Factor C); predation (Factor C); renewable energy (Factor A), commercial and recreational hunting (Factor B); scientific and educational uses (Factor B); pesticides and other contaminants (Factor E), as well as the potential for effects from small population size (Factor E). We identified one portion of the Bi-State DPS, essentially the Pine Nut PMU, that is experiencing a concentration of the following threats: Urbanization, infrastructure, wildfire (and associated isolation and fragmentation of populations), cheatgrass, livestock and feral horses, nonnative woodland succession, and recreation. Although these threats are not unique to this PMU area, they are acting at a greater intensity here (e.g , higher risks from cheatgrass invasion created by more frequent wildfires), either individually or in combination, than elsewhere in the range. In addition, the PMU's small population size (usually less than 100 birds), coupled with the information suggesting this unit has a high projected probability of extirpation over the next 10 years (69.7 percent; Coates et al. 2020, Table 1), leads us to find that this portion meets[[Page 18098]]the screening criteria of whether substantial information exists indicating the population occurring here may be threatened or endangered. We then proceeded to the significance screening question, asking whether there is substantial information indicating that this portion of the range (i.e , the Pine Nut PMU) may be significant. As an initial note, the Service's most recent definition of ``significant'' within agency policy guidance has been invalidated by court order (see Desert Survivors v. Dep't of the Interior, No. 16-cv-01165 (N.D Cal. Aug. 24, 2018). Therefore, for purposes of this analysis the Service is screening for significant portions of the range by applying any reasonable definition of ``significant.'' Biological importance/significance is often considered in terms of resiliency, redundancy, or representation. We evaluated the available information about the portion of the DPS that occupies the Pine Nut PMU in this context, assessing its significance in terms of these conservation concepts, and determined the information did not substantially indicate it may be significant. Sage-grouse in this PMU exhibit similar habitat use and behaviors to sage-grouse in the remainder of the Bi-State DPS; thus, there is no unique observable environmental usage or behavioral characteristics attributable to just this area's population. While unique genetic characteristics have been documented in the PMU's birds, including haplotypes not present elsewhere in the DPS, particularly in the northern portion (Oyler-McCance et al. 2014, pp. 1303, 1308), we note that each of the five other populations in the DPS also exhibit unique genetic characteristics and haplotypes. So although there is genetic differentiation between the Pine Nut PMU and other PMUs, we found no information indicating that the Pine Nut PMU's genetic characteristics represent a unique or significant adaptive capacity compared to the remainder of the DPS. In addition, the Pine Nut PMU has the smallest number of birds compared to the other PMUs in the DPS, making up approximately 5% of the total population (see Table 1 above), and there is very limited movement of these birds into occupied areas of other PMUs. For the northern portion of this PMU, which has very few birds and little to no lek attendance reported in recent years (see the description of the Pine Nut PMU in Range and Population Estimates above), there has been no detected movement of birds to other PMUs. There is some movement of birds between the southern portion of Pine Nut PMU and the Desert Creek-Fales PMU and the Bodie PMU to the south, but this has involved only very few birds. Overall, we found no substantial information that would indicate the Pine Nut PMU may be significant. While the Pine Nut PMU provides some contribution to the DPS's overall ability to withstand catastrophic or stochastic events (redundancy and resiliency, respectively), and to adapt to changing environmental conditions (representation), the best scientific and commercial information available indicates that this contribution is very limited in scope due to its small population size and isolation from other populations. Therefore, because we could not answer both screening questions in the affirmative, we conclude that the Pine Nut PMU portion of the range does not warrant further consideration as a significant portion of the range. In addition to the Pine Nut PMU, we identified another portion of the DPS, the White Mountains PMU, where the information regarding projections of extirpation probability suggests the population may be experiencing a disproportionate response to threats. While the magnitude of most threats acting in this PMU (e.g , threats associated with cheatgrass, infrastructure, recreation, grazing, predation, and drought) are generally lower than the remainder of the range, it also has a projected high probability of extirpation (75.1 percent; Coates et al. 2020, Table 1). These projections were calculated from limited ***data***, as completing surveys was difficult given the area's remoteness and being at the highest elevation for the Bi-State DPS, and as a result, the authors note that some leks needed to be omitted from the analysis due to ***data*** quality issues, leks could have been missed, and the model may underrepresent abundance for that PMU (Coates et al. 2020, p. 36). (Coates et al. 2020, pp. 9, 36). However, though the model may underrepresent abundance (and thus over represent the probability of extirpation to some degree), out of an abundance of caution, we proceeded under the premise that this portion of the range meets the screening criteria of whether substantial information exists indicating the population occurring here may be threatened or endangered. Subsequently, as with the Pine Nut PMU, we then proceeded to the significance screening question, asking whether there is substantial information indicating that this portion of the range (i.e , the White Mountains PMU) may be significant. As in the Pine Nut PMU, sage-grouse in the White Mountains PMU exhibit similar habitat use and behaviors to sage-grouse in the remainder of the Bi-State DPS; thus, there is no unique observable environmental usage or behavioral characteristics attributable to just this area's population. In the White Mountains PMU, unique genetic characteristics have been documented in the PMU's birds, including haplotypes not present elsewhere in the DPS (Oyler-McCance et al. 2014, pp. 1304, 1308). However, although there is genetic differentiation between the White Mountains PMU and other PMUs, we found no information indicating that the White Mountains PMU's genetic characteristics represent a unique or significant adaptive capacity compared to the remainder of the DPS. Additionally, the White Mountains PMU has relatively few birds compared to most other PMUs in the DPS. Though exact counts are not available due to the isolated nature of this PMU, recent surveys have found only two leks, with between zero and nine males documented per lek per year (NDOW 2018, unpublished ***data***). Historical evidence suggests bird densities in this area have always been low (Bi-State Local Planning Group 2004, p. 108); Service 2020, pp. 31-32). Additionally, there has been no recent recorded movement of birds into occupied areas of other PMUs. Though a potential connectivity corridor exists between populations in the South Mono and White Mountains PMUs, the vegetation within this corridor has apparently changed due to woodland succession, and an aerial survey suggests that current vegetation is not suitable sage-grouse habitat (Bi-State Lek Surveillance Program 2012, p. 36; Service 2020, pp. 29-30). Overall, we found no substantial information that would indicate the White Mountains PMU may be significant. While the White Mountains PMU provides some contribution to the DPS's overall ability to withstand catastrophic or stochastic events (redundancy and resiliency, respectively), and to adapt to changing environmental conditions (representation), the best scientific and commercial information available indicates that this contribution is very limited in scope due to its small population size and isolation from other populations. Therefore, because we could not answer both screening questions in the affirmative, we conclude that the White Mountains PMU portion of the range does not warrant further consideration as a significant portion of the range.[[Page 18099]] Because we did not identify any portions of the Bi-State DPS entity where: (1) It may be in danger of extinction or likely to become so in the foreseeable future; and (2) it may be significant, a more thorough significant portion of the range analysis is not required. Therefore, we conclude, based on this screening analysis, that no portions warrant further consideration through a more detailed analysis, and the Bi-State DPS is not in danger of extinction or likely to become so within the foreseeable future within a significant portion of its range. Our approach to analyzing significant portion of the species' range in this determination is consistent with the courts' holdings in Desert Survivors v. Department of the Interior, No. 16-cv-01165-JCS, 2018 WL 4053447 (N.D Cal. Aug. 24, 2018); Center for Biological Diversity v. Jewell, 248 F. Supp. 3d, 946, 959 (D. Ariz. 2017); and Center for Biological Diversity v. Everson, 2020 WL 437289 (D.D.C Jan. 28, 2020).Determination of Status Our review of the best scientific and commercial ***data*** available indicates that the Bi-State DPS of greater sage-grouse no longer meets the definition of a threatened species. Therefore, we are withdrawing our proposed rule to list the DPS as threatened. Consequently, we are also withdrawing the associated proposed 4(d) and critical habitat rules.References Cited A complete list of references cited in this rulemaking is available on the internet at   [*http://www.regulations.gov*](http://www.regulations.gov) and upon request from the Reno Fish and Wildlife Office (see FOR FURTHER INFORMATION CONTACT).Authors The primary authors of this document are the staff members of the U.S Fish and Wildlife Service's Species Assessment Team and the Reno Fish and Wildlife Office.Authority The authority for this action is the Endangered Species Act of 1973, as amended (16 U.S.C 1531 et seq.).Aurelia Skipwith,Director, U.S Fish and Wildlife Service.[FR Doc. 2020-06384 Filed 3-30-20; 8:45 am] BILLING CODE 4333-15-P

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**Body**

Zagreb,Hrvatska14 December 2020 (Hina) - Capak: Twofold increase in new infections recorded last week ZAGREB, Dec 14 (Hina) - Croatian Public Health Institute (HZJZ)headKrunoslav Capak said on Monday that Croatia last week registered a twofold increase in new COVID-19 cases and that the country'sepidemiological situation was the worst in the European Union. According to Capak, from December 7 to 13, Croatia registered a 7.5% increase in the number of new infections compared to a 3.7% increase in the week before that. The incidence rate in the entire Croatia is high, but the differences between counties are considerable, with Medjimurje County reporting the highest and Dubrovnik-Neretva County the lowest incidence rate. We are in the last place in the EU when it comes to the number of new cases per 100,000 inhabitants in the last 14 days, Capak said. As for the mortality rate, we are in the 16th place of the 27 EU countries, with 628.5 deaths per onemillion inhabitants.

Capak also said that today people in self-isolation account for 40% of the new infections. "This shows that the system of searching for contacts has not fallen apart despite operating with difficulties due to thelarge number of new infections," he added. Vaccination programme by end of week Asked about the number of health workers who want to be vaccinated, Capak confirmed the unofficial ***data*** that slightly more than 50% of health workers want to, adding that they are still ***collecting*** ***data***. He stressed that the vaccination campaign had already started, and by the end of the week the government would adopt a vaccination programme although it was not yet known when the vaccines would arrive and be distributed. In the coming days, scientific conferences on vaccination will be organised, and there will also be a media campaign. Asked about people who will not be able to get vaccinated, the head of Zagreb's Dr Fran Mihaljevic hospital for infectious diseases, Alemka Markotic, said that those were peopleallergic to a vaccine ingredient. She added that they expected there would be very few such cases and that people should get informed on their own about their allergic reactions to medicines. Croatia reports 1,472 new coronavirus cases, 65 deaths in last 24 hours Croatia has registered 1,472 new coronavirus cases and 65 infection-related deaths in the last 24 hours, the national coronavirus response team reported on Monday morning. A total of 2,857 infected people are receiving hospital treatment for COVID-19 and 284 of them are on ventilators. Currently, there are 22,769 active cases and 54,042 people are in self-isolation. Since February 25, when the first case was confirmed, 177,358 people have been infected with the novel virus, 2,705 of them have died and 151,884 have recovered, including 3,673 in the last 24 hours.A total of 888,080 people have been tested to date, including 5,798 in the last 24 hours. Beros: Seven fewer hospitalised COVID patients from Sunday ZAGREB, Dec 14 (Hina) - Health Minister Vili Beros said on Monday that there were seven fewer COVID-19 patients in hospitals than on Sunday, and expressed hope that this trend would continue. Beros said that three quarters ofbed capacityallocated for COVID-19 patients wasoccupied. Currently, the hospital occupancy rate for COVID-19 patients is at 76.58%, while the occupancy rate of ventilators is 57.32%, he said. "In Osijek, there are currently 197hospitalised COVID-19 patients, and 41 of them are on ventilators. In Varazdin, there are 268 hospitalised patients, including 20 on ventilators," he said. Zagreb's hospital for infectious diseases has been occupied almost completely for months, catering currently for 116 patients, including 21 on ventilators. The KB Dubrava hospital is caring for 472 COVID-19 patients, including 71 on ventilators. In Cakovec, there are 143 hospitalised patients, including 14 on ventilators. In Rijeka, there are 144 patients, of whom 21 are on ventilators, in Sisak there are 82 COVID-19 patients, including 10 on ventilators, and in Koprivnica 90, including 12 on ventilators. The minister said that the high numbers posed a burden on the healthcare system. Minister says hospital increasing capacity to admit COVID-19 patients ZAGREB, Dec 14 (Hina) - Health Minister Vili Beros said on Monday that his ministry had sent the KBC Zagreb hospital, the KB Dubrava hospital and the Hospital for Lung Diseases, also in Zagreb, an instruction to urgently take steps to increase their accommodation capacity for COVID-19 patients. Beros said the instruction was sent in light of the current epidemiological situation and that the three hospitals would also secure additional staff and equipment. He added that activities related to the reassignment of medical workers and equipment were ongoing, underlining the deployment of additional doctors and nurses to the hospitals in Varazdin and Cakovec. "At the meeting with epidemiologists on December 11 we analysed the strategy for fast antigen testing in order to put hotpots under control. Today's meeting of the expert group of the COVID-19 response team discussed the need toincrease the accommodation capacity of medical institutions and other current problems so as to determine steps to be taken in the coming weeks," Beros said. He added that the distribution of 100,000 rapid antigen tests from commodity reserves to county institutes of public health had begun and that so far a total of 250,000 had been distributed. Beros stressed that the number of COVID-19 patients who were being admitted to hospitals had grown mildly compared to last week, as had the number of new patients on ventilators. "Even though it is resilient and sustainable in terms of organisation, the health system must be protected from maximum strain. Our main goal is to maintain, as long as possible, the centralised treatment of COVID-19 patients, that way we are reducing the possibility of the virus entering more hospitals, which will makeit possible to continue providing regular medical care," said the minister. He reported that the number of coronavirus infections worldwide had exceeded 72,655,000 and that the number of related fatalities was above 1,619,999. In Croatia, there are 1,430 active cases among medical workers while 807 are in self-isolation. Government decides to procure ventilators and Remdesivir medication ZAGREB, Dec 14 (Hina) - The government on Monday gaveits consent to the Croatian Institute ofPublic Health (HZJZ) to procureinvasive ventilators for COVID-19 and also tothe Zagreb-based Infectious Diseases Hospital to obtain Veklury (Remdesivir) medication for the first three months of next year. The price of one ventilator is €24,000 without VAT (HRK 180,000) and based on the situation, it was decided to procure 169 ventilators for a total price of €5.056 million (HRK 38.02 million), said Health Minister Vili Beros. The government authorised the public health institute's director, KrunoslavCapak, to sign acontract with GE Medical Systems Information Technologies, in Germany, for the procurement of the ventilators. The government also decided to endorsethe procurement of Veklury (Remdesivir),a broad-spectrum antiviral medication,for the treatment of COVID-19 patients who require additional oxygen, hence a separate contract will besigned withGilead Sciences, in Ireland, to procure the medicine for the period from 1 January to 31 March next year. An estimated5,000 doses are required a month or 15,000 doses for that period, based on estimates by health institutions. The price of one dose is HRK 2,625 (without VAT), or a total of HRK 41.3 millionincluding VAT, and the director of the Fran Mihaljevic Infectious Diseases Hospital has been authorised to sign that procurement contract. Deadline for introducing refundable milk bottles shifted to1 July The government amended a waste management decision extending the deadline to introduce refundable milk bottles from 1 January to 1 July 2021. The reason to defer the introduction of refundable bottles is to relieve the economic impact the coronavirus has had on the national dairy industry and to preserve national cattle production, particularly for milk production. The government sent a request to the parliament for an extraordinary sitting so lawmakers can, among other things, discuss a decision to declare Croatia's Exclusive Economic Zone in the Adriatic Sea. PM says additional restrictions possible unless situation improves ZAGREB, Dec14 (Hina) - Prime Minister Andrej Plenkovic said on Monday that it was evident that the current counter-COVID measures, which expire on21 December, would be extended if the current high numbers of new infections were not reduced. Additional restrictions are also on the table, Plenkovic said while chairing today's government session via video linkfrom his home. Commenting on the unfavourable epidemiological situation, Plenkovic underscored that in the last seven days, a total of 25,119 new cases of the infection hadbeen registered, or 5.6% more than in the week before. Figures about coronavirus-related deaths have also been on the rise. Unless we manage to reduce the current high coronavirus numbers, the existing measures will be prolonged beyond 21 December, said the premier, who is in isolation after he was diagnosed with the coronavirus infection in late November. The premiercalled on citizens to be aware of the demanding circumstances, noting that the measures adopted by the government and the COVID-19 crisis management team had to be complied with. "It is clear that this year, Christmaswill differ from Christmas festivities in the past. I appeal for avoidance of any bigger family gatherings, since the virus spreads most easily in such situations," he added. New framework of anti-COVID measures to be specified this week ZAGREB, Dec14(Hina) - Interior Minister Davor Bozinovic, who is at the helm of Croatia's national coronaviruscrisis management team, said on Monday that the team would hammer out a new framework of anti-COVID measures this week. "Intensive talks are underway, consideration is given to everything," the minister told a news conference in Zagreb. This week some concrete answers will be givento the question of what can be done to make sure that coronavirus numbers start declining, Bozinovic said while answering the question if travel passes could be expected. He said that he could understand that everyone wanted predictability of moves. I must underscore that some countries have announced the easing of restrictions in this period only to make them stricter. Some countries have announced tougher restrictions but have eventually eased them, he said in acomment on predictability. Jandrokovic: People not adhering to measures responsible for pandemic spreading ZAGREB, Dec 14 (Hina) - Parliament Speaker Gordan Jandrokovic said on Monday that people who do not adhere to epidemiological restrictions are to blame for the COVID-19 pandemic spreading and he once again called forresponsible behaviour. "I consider that people who do not adhere to the restrictions that are essential to reduce the number of people dying and being infected are to blame," Jandrokovic told reporters in parliament. He specified that this was not a criticism of citizens a vast majority of whom were adhering to restrictions but of those who were not and who, with their behaviour, were causing the disease to spread. "That can be ordinary people, politicians, reporters, writers, workers and anyone who does not adhere to the measures," Jandrokovic said, stressing that compliance with restrictions was essential for reducing the number of new infections. He said that the police should sanction anyone who does not adhere to epidemiological measures. "With their behaviour they jeopardise those who are complying with the restrictions," he said and recalled that COVID-19 is a disease that one or two people can pass on to dozens and hundreds of others and the lack of discipline by one person can cause the death of dozens of other people. Demanding political responsibility at this moment is irresponsible Jandrokovic also noted that demanding political responsibility at the moment is irresponsible. "Germans, too,could demand Angela Merkel's responsibility, Austrians their chancellor's orHungarians their prime minister's responsibility... This is not just a Croatian problem and phenomenon, yet the level of intolerance is unbelievable as are attempts to create chaos and attack those who are working. I think it's time to say 'enough!', said Jandrokovic. He went on to say that it hadbecome quite popular in Croatia to accuse those who work,make difficult decisions and invest effort to achieve the best results possible for citizens. "At the same time you have criticswho are demanding responsibility, who have not shed any sweat and who in these difficult times want to debate about responsibility and bring down the system andremove those who, with their hard work achieved brilliant results in the first wave of the epidemic and are now struggling, as is all of Europe, with the second wave," said Jandrokovic. Parl. speaker: More than one-third of MPs are, were infected with coronavirus ZAGREB, Dec 14(Hina) - Parliament Speaker Gordan Jandrokovic said on Monday that more than one-third of members of parliament had recovered from COVID-19,were currently infected orhad been in self-isolation. According to official ***statistics***, 29 MPs have recovered from COVID-19 or are still infected, and another 25 were in self-isolation, which makes a total of 54 deputies or more than one-third, Jandrokovic said in an interview with Croatian Radio, noting that the infection rate was evidently higher in the parliament than in the general population. He called again for compliance with epidemiological restrictions and thanked everyone who over the past months had complied with them. Decision on passes not made yet Jandrokovic said that a decision on the introduction of passes enabling travel had not been made yet and that he hoped the number of new infections and deaths would go down, which would make thatmove unnecessary. "But we also have to be ready, in case the numbers go up, for additional restrictions." He dismissed criticism from the Opposition that the government alone was responsible for the consequences of the epidemic because it had not accepted any of its suggestions. Responsibility for the spread of the infectionrests with those who do not comply with restrictions, and raising the issue of responsibility at the moment will not help change the situation for the better, Jandrokovic said, commending the work of the national COVID-19 response team. New parliament - lot of noise, aggression, little substance Jandrokovic said that he was satisfied with the work of the parliament this year, adding that he was not impressed by the new parliament. "It started very well, it seemed more serious, more substantial but as the time passes, I have the impression that the Opposition is resorting to the mode of work of the previous Opposition, with a lot of noise, aggression and debates bordering on incident and very little substance and concrete proposals," Jandrokovic said, adding that it seemed there was also a considerable lack of political experience and political and human wisdom. National COVID-19 response team says measures will be analysed when pandemic ends ZAGREB, Dec 14 (Hina) - Members of the national COVID-19 response team said on Monday that they were managing the crisis the best they could, and that once the pandemic finishedthe government and the team would conduct an analysis of the adoptedcounter-COVIDmeasures. "In the past 14 days we have had a bad incidence rate, but the whole epidemic must be evaluated, from February 25, when Croatia registered its first case of the infection," epidemiologist Krunoslav Capak said in response to the opposition calling for the government's political accountability due to a large number of new COVID-19 infections and deaths. Members of the national COVID-19 response team told the press conference that the measures in the whole world were similar and that their adoption in Croatia had depended on economic, social and psychological aspects. "It will be decided eventually whether a particular measurewas adopted on time," Capak said. He said that at one moment Croatia was the best, but for the past two weeks it had been the worst in Europe according to some criteria. "We will draw a line under this at the end of the pandemic," he said. Health Minister Vili Beros said that it was not a problem for him to pay the price of "all of this", adding that he would like to see which relevant scientific sources supported accusations that the measures had been adopted too late. "I am doing the best I can at this moment, and at one moment the Croatian people will assess my role and it is not a problem to bear the consequences if I did something wrong," he said. Asked about the political responsibility of the national COVID-19 response team, Interior Minister Davor Bozinovic said that the team "has been fully focused for ten months on thinking daily about how to reduce the numbers". The head of Zagreb's Dr Fran Mihaljevic hospital for infectious diseases, Alemka Markotic, said that she was working responsibly and that extensive expert analyses would be conducted to see which measures had been adequate. All secondary schools online as of today, says minister ZAGREB, Dec 14 (Hina) - Science and Education Minister Radovan Fuchs said on Monday that as of today all secondary schools in Croatia have gone online, which should contribute to the general measures adopted to curb the spread of coronavirus in public transport. He assessed that the situation in schools is very stable, as evidenced by the latest figures. There have been no sudden hikes in the number of positive cases that we had about a month ago, he said. He added that Grades 5 to 8 in primary schools would, in addition to those in Varazdin County, which are already online, join online classes in Primorje-Gorski Kotar, Medjimurje and Istria counties. Asked whether virtual classes were planned for the next semester, Fuchs said that he hoped there would not be any need for that. He recalledthat the entire time lessons were planned two weeks ahead so that if the situation demanded, anyone could use that material. Returning back to classrooms and teaching in personwill depend on the epidemiological situation. I hope that it will improve significantly by then and that students will be able to return to their classrooms as there is no alternative to face-to-face learning, he underlined. The start of the next semester has been recently shifted to 18 January. Croatia and Italy to declare exclusive economic zone in January ZAGREB, Dec 14 (Hina) - Croatia's government on Monday adopted the decision on declaring an exclusive economic zone (EEZ), which will happen formally in January after a trilateral ministerial meeting with Slovenia and Italy. The government adopted a draft proposal of the decision on the declaration of an exclusive economic zone in the Adriatic Sea, and the parliament willput it to the vote at an extraordinary sitting on Thursday, Prime Minister Andrej Plenkovic said. Foreign and European Affairs Minister Gordan Grlic Radman said that "an understanding has been reached" in discussion with his Slovenian and Italian counterparts that Croatia and Italy would declare an EEZ after a trilateral meeting in January 2021. Grlic Radman added that they would also discuss strengthening cooperation in the Adriatic area, with the aim of its environmental protection and blue economy management. Earlier, the minister had announced the declaration of the EEZ to the Council of Ministers of the European Union and neighbouring countries, and he spoke about it at the Mediterranean Dialogue videoconference. He underscored that the EEZ was being declared in line with the Maritime Code, the UN Convention on the Law of the Sea and EU legislation, and that the zone would remain a maritime area where all countries would enjoy freedom and rights guaranteed by international law, without prejudice to the sovereign rights and jurisdiction of Croatia. ***Agriculture*** Minister Marija Vuckovic said that the EEZ would further improve an already "deep, lately even excellent cooperation with Italy" on the issues of fishing fleets and resource management. Prime Minister Plenkovic earlier said that the EEZ would, compared with the existing Ecological and Fisheries Protection Zone (ZERP) declared in 2003, bring two new rights - the construction of artificial islands and the use of the power of the sea, wind and currents. The Ministry of Foreign and European Affairs last week said that the declaration of the EEZ was the result of implementation of thecommon fisheries policy byCroatia and Italy, as well as of cooperation in the field of environmental protection. FM: Exclusive Economic Zone better than EFPZ ZAGREB, Dec 14 (Hina) - Croatia's Foreign and European Affairs Minister Gordan Grlic Radman said on Monday that an Exclusive Economic Zone is a better variant of the Ecological and Fisheries Protection Zone (EFPZ) and that it constitutes a "better approach regulating relations between coastal countries." Compared to the existing EFPZ, declared in 2003, the Exclusive Economic Zone brings two new rights - building artificial islands and using sea and wind energy and the energy of currents. "I would say that this is a form of upgrading. The UN Convention on the Law of the Sea encourages that. 120 countries in the world have declared Exclusive Economic Zones. That is in fact a more orderly approach to regulating relations between coastal countries," Grlic Radman said at a press conference in Government House. It was announced that Croatia and Italy would declare their exclusive economic zones in January. "The Exclusive Economic Zone is a better variant of the EFPZ," said Grlic Radman. He stressed that The Exclusive Economic Zone was being declared in accordance with the Law of the Sea, the UN Convention and EU legislation and that it would remain a marine area where all countries would enjoy rights and freedoms guaranteed by international law "without encroaching on Croatia's sovereign rights and jurisdiction." He added that the issue was not new and had been considered for some time. "When there are two neighbouring countries that share common interests and want to protect the Adriatic as that is their common sea, then it is understandable that they wish to act together," said Grlic Radman. A state secretary at the ministry, Andreja Metelko-Zgombic, said that in 2003 countries did not have exclusive economic zones in the Mediterranean. She recalled that France then had an ecological zone, Spain had a fisheries zone and Croatia eventually declared an EFPZ. "As we were aware then that we were heading towards the EU, we wished in fact to just copy the practice by other member states in the Mediterranean," said Metelko-Zgombic. She underscored that now the "objective and idea is to truly protect the Adriatic and at the moment the Adriatic on the Italian side is not protected." "That part still falls under the regime of the high seas and fishing boats also from third countries can come from that side and fish," she explained. SDP will support EEZ but it won't make any difference, says Grbin ZAGREB, Dec 14 (Hina) - Social Democratic Party (SDP) leader Pedja Grbin said on Monday that the party would support the declaration of an Exclusive Economic Zone (EEZ) saying, however, that that will not change anything when it comes to fisheries. "SDP will support the declaration ofan Exclusive Economic Zone because that was agreed to with our partners in the European Union, but why we are going in that direction is something that the government needs to be asked," Grbin said in parliament. He recalled that theEcological and Fisheries Protection Zone(EFPZ)was declared during the late prime minister Ivica Racan's term and that it containedthe most important aspects of an exclusive economic zone. The only difference is the possibility of building artificial islands and exploiting sea energy, he said. "If we know that Croatia has for years had a regulated and continental shelf with Italy then it is clear that there will not be any drastic difference between what we had before and what we will have after the exclusive economic zone is declared," said Grbin. "We support that, especially since it has been agreed to with our partners in the European Union. I won't go into why the government has only now decided to declare the EEZ. The thing that is crucialfor me isthat it is in agreement with our partners in the EU and all those saying anything with reference to sovereignty need to know that there is theCommon EU Fisheries Policyand that all exclusive economic zones for member states are incorporated in that commonpolicy. That means that the EEZ will not change anything with regard to fisheries," said Grbin. OECD membership continues to be one of Croatia's priorities, says Plenkovic ZAGREB, Dec 14 (Hina) - The coronavirus crisis has once again shown the importance of Croatia's membership in the Organisation for Economic Cooperation and Development (OECD), which continues to be one of the government's priorities, PM Andrej Plenkovic said on Monday on the occasion of the 60th anniversary of the OECD. In a video address on the occasion of the 60th anniversary of the OECD Convention being signed, Plenkovic underlined its objectives. The visionary commitment of the Convention's signatories to building an organisation that promotes high living standards, sustainable growth and employment while maintaining financial stability, has significantly contributed to developing the global economy, said Plenkovic. I believe that today, when the world is faced with the biggest health crisis in the past 100 years and the most serious economic crisis since Word War II, the OECD's commitment to creating better policies for a better life is now needed more than ever, Plenkovic said. The fight against the pandemic provides an opportunity to jointly transform our societies by increasing the resilience of their economies through digital transformation and transition to new and green technologies, he said. Membership of the OECD remains a priority for the Croatian government. The current crisis has once again shown the importance of Croatia's membership in the OECD. We are prepared to launch negotiations on admission, he underscored. Plenkovic recalled that even though Croatia is not a member of the OECD, it actively cooperates with the organisation. Our experts participate in the work or many OECD bodies, adopting the best OECD practices, he added. OECD expertise is highly valued in EU-funded structural reforms in Croatia, he added. We are committed to the policies of investment and regulatory committees and are continuing with reform projects for other public policies, he said. Plenkovic congratulated OECD Secretary-General Angel Gurria, the member states and the secretariat on making the OECD a united, diverse and highly relevant organisation. As a strong supporter of multilateralism and new EU member, Croatia remains committed to contributing to the future activities of the organisation, he concluded. The Croatian government sent a formal membership request to the OECD in January 2017 and since then it has had candidate status. The decision on accepting it as a member has to be unanimously adopted by the OECD Council after which the accession process begins. Parl. to debate decision on system of own resources of EU ZAGREB, Dec14 (Hina) - The government on Monday forwarded to the parliament a motion to ratify the Council of the EUdecision on the system of own resources of the European Union whereby the upper ceiling forcontributions bythe member-states will be raised for the purpose of financing the recovery instrument. The Croatianparliament will discuss the motion on Wednesday. The system of own resources is decided by the Council on the basis of unanimity, having regard to the opinion of the European Parliament, and it needs to be ratified by the Member States. On 28 May 2020, the Commission proposed to borrow up to EUR 750 billion by issuing bonds on international markets on behalf of the EU with maturities of 3 to 30 years, in order to finance a revamped Multiannual Financial Framework and recovery and resilience plan (grants and loans to EU countries). Finance Minister Zdravko Maric said today that Wednesday's parliamentary discussion would be a good opportunity to inform the public about the EU system of own resources. The EU revenue composition includes: traditional own resources, the VAT-based own resource, the GNI-based own resource,other revenue and the balance carried over from the previous year, and correction mechanisms. Maric said that two key changes refer tonew own resources and to the additional increase in the upper ceiling. The change refers toraisingthe ceiling on annual calls for own resources from the current level of 1.20% of the EU's GNI (Gross National Income)to 1.29%. Croatia has not yet passed the threshold of one percent, and this year the planned contribution from the Croatian budget is set at HRK 4.23 billion, according to Maric. The proposal is about raising the upper ceiling from 1.4% to 2% of Gross National Income. The0.6 percentage points are connected with the EU decision that during the COVID-19 pandemic the European Commission could be authorised to take out a loan of EUR 750 billion on international financial markets in the context ofeconomic and healthcare needs,the minister said. New own resources will be based on non-recycled plastic packaging waste. Ministry sends EC statement of outlay for approval of HRK 980m ZAGREB, Dec 14 (Hina) - Croatia's Regional Development and EU Funds Ministry said on Monday it had sent a statement of outlay to the European Commission to authorise the expenditure of HRK 980 million. The statement refers to the funds from Priority Axis I which includes thestrengthening of the economythrough promoting research and innovation and Priority Axis 3 pertaining to the enhancing of business competitiveness. The authorisation of HRK 980 million, that is €130 million, will lead to the accomplishment of97% of the target for 2020, which amounts to €2.4 billion, says the ministry. To date, €2.3 billion has been authorised within the Competitiveness and Cohesion operational programme, says the ministry. Value of fiscal receipts drops by HRK 27 bn since start of crisis y-o-y ZAGREB, Dec14 (Hina) - Since the start of the coronavirus epidemic onFebruary 24until December 13, the value of fiscal receipts was HRK 27.1 billion lower than in the same period of 2019, show ***data*** made public by the Tax Administration on Monday. The number of fiscal receipts in the said period dropped by 24% and their value by 16% compared to the corresponding period of 2019. This year, 1.5 billion fiscal receipts were issued in the period from February 24 to December 13, and their value stood at HRK 138.2 billion while in the same period of 2019 two billion fiscal receipts were issued, worth HRK 165.3 billion. The value of fiscal receipts in the period from the start of the coronavirus crisis to December 13 thus dropped by 27.1% from the same period of 2019. Last week, in the period from December 7 to 13, in all activities covered by the fiscalisation system there were 30 millionreceipts, a29% drop from the corresponding week of 2019, while their value dropped by 11% or HRK 387 million to HRK 3.14 billion. Compared to the previous week, that is, the period from November 30 to December 6, the number of fiscal receipts last week was 1% up and their value was 3% higher. Government issues state guarantee to HAC to refinance loan ZAGREB, Dec 14 (Hina) - The government on Mondaygave the state-owned motorways operator HAC consent to take out a €45.5 million loan from a domestic bank syndicate in orderto reschedule a long-term loan taken from the Deutsche Bank, and a state guarantee was issued for the loan. HAC thus obtained the consent and state guarantee to take out a loan from Erste&Steiermaerkische Bank, OTP Bank and the state-owned Croatian postal bank HPB in the amount of €45.5 million in order to refinance a long-term loan with Deutsche Bank AG, contracted in 2015 in the amount of €100 million. The consent and state guarantee have been given because of the business and financial restructuring of the road sector, as well as that sector's impact on public finance, Transport and Infrastructure Minister Butkovic said. According to the ***data*** presented, from 2017 to 2019 HAC carried out most of the financial and operational business restructuring, and the remaining loan was taken out five years ago from Deutsche Bank. The offer for refinancing the existing loan has much more favourable terms than the existing ones, Butkovic underscored. The new loan is repayable over 10 years, with semi-annual payments, at an interest rate of six-month Euribor plus a spread of 1.5%, and only five percent of the used principal is paid in the first three years. Butkovic said that in addition to closing the existing €36.3 million loan, the new €45.5 million loan will be used to refinance the loan installment that had been settled from HAC's funds in early November this year in the amount of €9 million. MPs: Completion of Corridor Vc motorway important for east Croatia ZAGREB, Dec 14 (Hina) - Members of parliament on Monday backed a loan for the completion of the motorway to the border with Hungary within the pan-European Corridor Vc, stressing that this is an important project for the development of eastern Croatia. The parliament is expected to ratifythe state guarantee agreement between Croatia and the European Bank for Reconstruction and Development for financing a portion of the project for the completion of the said motorway. That is a priority project important for the development and progress of Slavonia and Baranja, and it is also important for the port of Ploce which will become an EU port of entry, HDZ MPs Branko Bacic and Ivan Radic said during the discussion. SDP MP Domagoj Hajdukovic agreed with them, underscoring that the port of Ploce would gain in importance and be connected with Budapest and the rest of Europe. The €55 million loan will be used to complete the construction of a 17.5-km-long section between Halasica Bridge and Beli Manastir and a 5-km-long stretch between Beli Manastir and the Hungarian border. The loan agreement is repayable over 15 years, including a 3-year grace period, at a variable interest rate of six-month Euribor plus a spread of 1%. HRK 600 mn allocated to bail out Croatia Airlines ZAGREB, Dec 14 (Hina) - Thegovernment on Monday approved state aid for the national flag carrier, Croatia Airlines amounting to HRK 600 million, HRK 350 million of which refers to investing fresh capital in the company and HRK 250 million as an equity loan. The decision was made in line withthe European Commission's temporary framework allowing member states to provide additional support to the business sector due to the COVID-19 pandemic. Thus, CA has been given supportin an effort to resolve its liquidity problems and to boost its capital. Transport and Infrastructure Minister Oleg Butkovicsaid that the pandemic has had and still has a destructive impact on the global airline industry, which is faced with the most difficult crisis ever. Croatia Airlines is not an exception, said Butkovic, explaining that other airlines have recorded a decrease in traffic of 65% to 90% compared to 2019. The national flag carrier has a strategic role in Croatia's transport infrastructure, which is evident in these times of crisis, he said. The government's decision resolves the company's urgentproblems, he said, adding that money for this was ensured in this year's budget revision. Finance Minister Zdravko Maric said that this model of injecting fresh capital and providing an equity loan will financially stabilise the airline. The government authorised Minister Butkovic to increase the airline's stock capital at a meeting of the shareholders' general assembly. An extraordinary general assembly was convened today for shareholders to decide on increasing the company's stock capital by HRK 350 million by issuing shares and that the state would participate in that. That would increase the airline's equityfrom HRK 277.88 million to HRK 627.88 million by releasing 35 million new ordinary shares at a nominal price of HRK 10. The equity loan of HRK 250 million should stabilise the airline's business operations and prevent negative consequences to the population and economy, which will be felt directly by the airline and tourism sectors and indirectly by other economic branches, the government said. CA general assembly decides to increase stock capital by HRK 350 mn ZAGREB, Dec 14 (Hina) -An extraordinary Croatia Airlines (CA) general assembly on Monday decided to increase the national flag carrier's stockcapital by HRK 350 million through a money deposit and issuance of new shares as state support due to the situation caused by the COVID-19 pandemic, CA has said. The shareholders decided to increase the stock capital by HRK 277.88 million to HRK 627.88 million through the issuance of 35 million ordinaryshares with a nominal value of HRK 10. The increase in equity is being conducted pursuant to an agreement between the state and CA. Existing shareholders do not have the pre-emptive right. The purpose of increasing the stock capital is to reinstate the airlines equity and provisions to the level prior to the crisis caused by the COVID-19 pandemic as at 31 December 2019, which isone of applicable state aid measures based on theEuropean Commission document "Temporary Framework to support the economy in the context of the coronavirus outbreak". Thisgives us additional strength necessary in the months to come in which we will continue to be a support for our citizens and economy, endeavouring to enable the transport of passengers and goods at any given time, which is currentlybeing made difficult in this economic situation and to justify the trust of our owners and all Croatian citizens, CA president of the board Jasmin Bajic said. Earlier in the day, the government approved a total of HRK 600 million in state aid for Croatia Airlines, HRK 350 million of which will be used to inject fresh capital into the company and HRK 250 as an equity loan to ensure the company's liquidity for regular business operations. Parliament: Vessel safety has no alternative ZAGREB, Dec 14 (Hina) - The parliamentary groups of the ruling Croatian Democratic Union (HDZ) and the opposition Homeland Movement (DP) said on Monday that Croatia should ratify the international conventionfor the safe recycling of ships and the agreement on the safety of fishing vessels. "The safety of people navigating the Adriatic and the seas of the world has no alternative," DP MP Davor Dretar said, calling for the ratification of the 2012 Cape Town Agreement on fishing vessel safety. Josip Bilaver, State Secretary at the Ministry of the Sea, said that the agreement includesmandatory safety measures for vessels24 metres in length or longerfishing the high seas, with provisions on stability, seaworthiness,machinery and electrical installations, and life-saving appliances. Before entering into force, the agreement must be ratified by 22 countries, which together havea total of 3,600 fishing vessels,and so far it has been adopted by 14 countries. The two political parties also endorsed a proposal to ratify the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships. The convention lays down the conditions that must be met by ship recycling yards, HDZ MP Branko Bacic said, adding that the steel that ships are made of will not end up as waste but will be used as raw material for new products. The convention does not apply to warships, vessels below 500 gross tonnes, and ships operating only in waters subject to the sovereignty or jurisdiction of the state whose flag they fly. Bacic said it was important that maritime transport was safe and ships were of good quality. He said that the average age of ships with a carrying capacity of 500 tonnes and more was about 21 years. He noted that in 2018 alone there had been over a thousand accidents at sea in the world in which 46 vessels had sunk. HRK 881m grant agreement inked for water supply, sewerage in Dubrovnik area ZAGREB, Dec 14(Hina) - An agreement on a HRK 881.2 million grant for the development of the water supply and utilities infrastructure in the agglomeration of Dubrovnik was signed in that city on Monday. The EU-funded project is the biggest project for the upgrade of water supply and sewerage systems in Dubrovnik and its environs. Speaking at the agreement-signing ceremony in that southernmost Croatian city, Economy and Sustainable Development Minister Tomislav Coric said that the project would solve problems related to water management and sewerage on thatpart of the coast. He recalled that the agglomeration inDubrovnik-Neretva County had to date signed contracts worthHRK 1.58 billion for the improvement of the quality of life.In the next four years, Croatia can expect the implementation of works valued at HRK 25 billion, and this will have an effect on the contribution of the construction sector to the country's GDP and to its economic recover, Coric said. The grant agreement signed today also envisages the construction of a new water purification plant at Petka Hill and the extension of the sewerage and water supply networkin the Dubrovnik agglomeration. A month ago, the project was greenlighted by the staff of JASPERS, a partnership between the European Commission (Directorate General for Regional Policy), the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD) and Kreditanstalt fuerWiederaufbau (KfW). It is a technical assistance facility whichtargets assistance on major infrastructure projects supported by the EU funds, such as roads, rail, water, waste, energy and urban transport projects. JGL pharmaceutical company employs 85 new workers despite coronavirus crisis ZAGREB, Dec 14 (Hina) - Despite a decrease in consumer buying power caused by the coronavirus pandemic, the Jadran Galenski Laboratorij (JGL) pharmaceutical company has employed85 new workers and ensuredan investmentof HRK 373 million, JGL saidon Monday. JGL executive director Mislav Vucic has said that he is proud of the results achieved in the current challenging times thanks to a quality strategy, operational flexibility and enormous enthusiasm and commitment by JGL employees in Croatia and other markets. He added that maintaining the system's stability enabled solidarity towards the local and broader social community throughout the entire year. Vucic underscored that the company would continue with its strategic projects in 2021, investing in its brands, markets andtechnology. Recently JLG signed a contract with the Croatian Bank for Reconstruction and Development (HBOR) for the Integra 2020 project, valued at HRK 373 million, which will enable it to step out onto the international market. The company plans to invest in sterile pharmaceutical production, R&D, a new pilot plant and a robotised logistics-distribution centre. The projectis expected to increase capacities for the production of sterilepharmaceutical solutions by 60% and integrate the research and quality processat a single location inRijeka. The project will enable JGL to continue producing thesterile ophtalmic preparations of its strategic partner from Poland inCroatia and continue exporting medicines produced in Croatia to Poland and other markets. This way, the company is strengthening its and the national pharmaceutical industry's export capacities. Vucic said that the crisis caused bythe pandemic would certainly have a major impact on the economy but it hadalso once again pointed out the significance of having a strong industry based on highly sophisticated technology. "That is why we consider Integra 2020 to be a capital project that will position us even more strongly on the global pharmaceutical map and enable us to produce an additional 41 million sterile sprays, eye drops andBoV (Bag on Valve) products, intendedprimarily for export. Thanks to this investment, we are significantly raising the company's development-technological competencies and its global competitiveness," said Vucic. Construction of Hilton Hotel in Rijeka nearing completion ZAGREB, Dec 14 (Hina) - Works on a new hotel complex - Hilton Rijeka Costabella Beach Resort & Spa,an €80 million investment, is nearing completion and 95% of the project is finished for the resort to be opened next spring, the investor, JTH Costabella, and executives from the Hilton chain, said on Monday. During an inspection of the construction site, the head of construction Lukas Jaros said that the rooms were finished and now kitchen and common facilities were being completed. Indoor and outdoor pools have been built as have a spa centre with massage parlours andsaunas, a beauty and hairdressing salon, and a dental office. All basement premises have been completed as have works to the beach in front of the resort and now other utilities on the waterfront are being worked on. The Hilton Rijeka Costabella Beach Resort & Spa has been built on 18,000 square metres and consists of 10 floors with a total area of 25,000 square metres. In addition to hotel rooms, guests can book villa units that are part of the resort. Prosperus Growth Fund starts operating in Croatia ZAGREB, Dec14(Hina) - The venture capital fund "Prosperus Growth", which has so far raised €51 million from investors, has started operatingand plans to increase its capital to 70 million overthe next month, the Prosperus-Investcompany formanagement of open private equity investment funds said on Monday. The new fund will facilitate access to capital for small and medium-sized enterprises (SMEs) and mid-cap companies and provide an alternative source of funding and more flexible transaction structures. This is one of the three funds which have been supported by the European Investment Fund (EIF) and the Croatian Bank for Reconstruction and Development (HBOR). These banks are expected to invest more than €70 million in Adriatic Structured Equity Fund,Croatian Mezzanine Debt Fundand Prosperus Growth Fund, and thesource of joint investment is the €80 million Croatian Growth Investment Programme (CROGIP), jointly launched by the EIF and HBOR in 2019. Considering Prosperus Growth, the EIF and the HBOR have provided 49.99% for the fund's capital within the CROGIP scheme. Propserus Growth sees opportunities for investing in companies in the sectors of tourism, renewables, pharmaceutical industry, healthcare, consumer goods and business process management. Atlantic Grupa issues 5-year HRK 300m bond ZAGREB, Dec 14 (Hina) - The Atlantic Grupa food production and distribution group has issued a five-year HRK 300 million bond at a fixed annual interest rate of 0.875% to refinance the existing bonds and finance its working capital requirements, the group announced on Monday. The bond, maturing on 11 December 2025, was issued on the domestic capital market. It islisted on the Zagreb Stock Exchange (ZSE) and includedin depository services and inclearing and settlement servicesof the Central Depository and Clearing Company. It will start trading on the ZSE on Tuesday, 15 December. The joint agents and underwriters of the bond are Erste&Steiermaerkische Bank, OTP Banka, Privredna Banka Zagreb, Raiffeisenbank Austria and Zagrebacka Banka. The bond will be legally represented by the Savoric & Partneri law firm. By issuing the bond, Atlantic Grupa has continued its practice of encouragingthe development of the domestic capital market and improving its own sources of financing, the company said. Atlantic said earlier that investors had subscribed for slightly over HRK 407 million worth of bonds. Croatia among EU countries with highest annual increases in industrial production ZAGREB, Dec 14 (Hina) - Industrial production in the European Union and the euro area fell in October 2020 compared with October 2019, while Croatia was among the memberstates that recorded the largest annual increases in industrial output, according to ***data*** released on Monday by the EU's statistical office ***Eurostat***. Annual comparison Compared with October 2019, industrial production fell by 3.1%in the EU and by 3.8% in the euro area. Production of capital goods dropped the most in both zones, by 7.1% in the EU and by 8.2% in the euro area. The best results in both zones were recorded in the production of durable consumer goods, which rose by 2.3% in the EU and by 0.3% in the euro area. By far the largest annual decrease in industrial production was recorded in Ireland (-15.5%), followed by Denmark (-9.2%) and France (-4.3%). The largest increases were observed in Belgium (+5.4%),Poland (+3.4%) and Croatia (+2.8). In September, Croatia's industrial production shrank by 1.1% year on year. Monthly comparison In October 2020, compared with September 2020, industrial production increased by 1.9% in the EU and by 2.1% in the euro area. Production of capital goods rose the most in both zones, by 2.6% respectively. Production of non-durable consumer goods decreased the most in the EU, by 0.4%, while remaining unchanged in the euro area. The largest monthly increases were observed in Belgium (+6.9%), Germany (+3.4%) and Slovenia (+3.1%), while the largest decreases were recorded in Denmark (-5.8%), Greece (-3.0%) and Lithuania (-1.7%). In Croatia, seasonally adjusted industrial production in October 2020 rose by 2.9% from the previous month. In September, it went up by 1.7%. Number of deputy local leaders to be reduced by 568 instead of 618 ZAGREB, Dec14(Hina) - The number of deputy heads of local government units will not be reduced by 618 but by 568 after the government on Monday adopted amendments to two bills regulating that issue. The government gave its consent to its representative to accept amendments by other sponsors to the final bill on local and regional government and the bill on local elections, under which the number of deputy heads of those units willbe reduced by 568. Justice and Public Administration Minister Ivan Malenica told reporters before the government session that the agreement on downsizingthe number of deputy heads of local government units had been reached following talks with representatives of associations of municipalities and towns and counties. The number of deputy heads will be slashed by 568, he said, recalling that the original plan was toreduce their number by 618. Malenica explained that the amendments also referred to technical detailsregarding the appointment of thetemporary deputy headin local government units which will nolonger have deputy heads, who will be appointed from among members of the local representative body by itspresident at the start of their term to makeit possible for the local government unitto continue functioning normally if the head of the local government unit is prevented from performing their duties for alonger period of time. Reducing number of local officials, functional connectivity a priority Malenica said that the down-sizingenvisaged bythe bills on local government primarily referred to the reduction of the number of local officials and members of local lawmaking councils and to caps on allowances for membership inrepresentative bodies. He said rationalisation would help save 100-115 million kuna, noting that this was an estimate as one could not know what decisions local government units would adopt on the amount of theallowance. Malenicaadded that the biggest savings were expected to be made in the work of representative bodies. "This is the first step in the further reform of local government. Since local elections will be held next year we wanted to introduce the changes as soon as possible but we will continue working onfunctional connectivity between local government units," he said. The minister noted that it was good news that the EUbudget for the period from 2021 to 2027 had been adopted, with €24 billion intended for Croatia, and he believes that local government units willuse the money to be saved through cost-cutting for their development. Croatia holds local elections on the third Sunday in May every four years. Aladrovic: Application for national pension allowance as of tomorrow ZAGREB, Dec 14 (Hina) - The Croatian Pension Insurance Fund (HZMO) will start accepting applications by elderly persons for the right to a national pension as of tomorrow, and about 20,000 beneficiaries who will receive HRK 800 per month are expected next year, Minister Josip Aladrovic said on Monday. The law on a national allowance for the elderly, which enters into force on 1 January 2021, provides for an income for Croatian citizens over the age of 65 who have not secured an old age income and are not entitled to a pension. The allowance will be paid by the HZMOthrough commercial banks, and the first payments will be made in February 2021 for January 2021. The national allowance for the elderly will cover the most vulnerable part of the population, Labour, Pension System, Family and Social Policy Minister Josip Aladrovic told reporters ahead of a government session. The estimated cost in the state budget is HRK 132 million, and we have ensured that much for 2021, he said. It will be possible to submit an application for the national allowance in person at a regional HZMO office, by mail or online through the e-Citizen system. Aladrovic said that the target group were elderly citizens who did not have enough years of insurance and who were not covered by the social welfare system for some reason. Those are citizens who have more than 20 years of uninterrupted residence in the Republic of Croatia, fewer than 15 years of pensionable service and who are over 65 years of age, he said. Coric: I don't comment on disparaging remarks ZAGREB, Dec 14 (Hina) - Minister of Economy and Sustainable Development Tomislav Coric said on Monday in Dubrovnik that he hadbeen communicating very well with a large number of entrepreneurs, local government and associations over the past four years. "My thoughts on economic issues, which I have expressed on several occasions in front of entrepreneurs, including representatives of the Voice of Entrepreneurs association,are a reflection of how the taxation and economic systems in the country function." "I am open to any discussion, butI will no longer comment on disparaging statements by certain individuals. I do not think that a ministerial position requires previousexperience in the private sector, it requires knowledge ofmacroeconomic circumstances and what certain economic policies mean for Croatia," Coric said in a commenton criticism by the association. President, PM agreed it is necessary to continue protecting BiH Croats ZAGREB, Dec14 (Hina) - President Zoran Milanovic and Prime Minister Andrej Plenkovic agreed on Monday that it was necessary to respect the fact that Croats are one of the three constituent peoples in Bosnia and Herzegovina (BiH) and that it was necessary to continue working to ensure protection for their rights. The Office of the President issued a statement saying that President Milanovic and PM Plenkovic today discussed the status of the Croats in Bosnia and Herzegovina and the implementation of the Dayton peace agreement, which wasreached at Wright-Patterson Air Force Base near Dayton in November 1995, and signed in Paris on 14 December that year. The Dayton Accords put an end to the war in that country. "President Milanovic and Prime Minister Plenkovic share the view that it is necessary to respect the fact that Croats are one of the three constituent peoples in Bosnia and Herzegovina and that Croatia has an obligation to insist on the protection of their status and rights," said the statement, issued onthe occasion of the 25th anniversary of the signing of the accords. The two officials agreed that Plenkovic would present Croatia's position on the matter at an international conference on the 25th anniversary of the Dayton peace agreement,to be organisedby the Croatian Academy of Sciences and Arts (HAZU) and the Ministry of Foreign and European Affairs in Zagreb on Tuesday. US President-elect says it's time for functional, stable Bosnia and Herzegovina ZAGREB, Dec 14 (Hina) - US President-elect Joe Biden on Monday joined messages of congratulation to Bosnia and Herzegovina (BiH) citizens on the occasion of the 25th anniversary of the Dayton peace agreement, but warned that BiH citizens and the international community had not completed their job in the country. In a special statement published on the Biden-Harris official transition website on the day when 25 years ago the agreement that put an end to the war in Bosnia and Herzegovina was signed in Paris, the US President-elect, who is very familiar with the situation in the Balkans and Bosnia and Herzegovina, said that the document ended the worst conflict on the European continent since World War II. "On this day, we celebrate the efforts of the peacemakers, even as we mourn the loss of approximately 100,000 lives and the displacement of millions more. "The Dayton Accords brought peace to Bosnia and Herzegovina and reaffirmed its sovereignty, territorial integrity, and independence. Yet, a quarter century later, it is clear that the work to promote justice, reconciliation, and a functional, multi-ethnic Bosnia and Herzegovina remains incomplete. Too often, we have seen nationalism win out over national interest and the enrichment of a few coming before reforms to benefit the many. This anniversary is an occasion for all the parties to reflect on the possibility of a brighter future and to recommit to the difficult but necessary steps to build a fully-functioning Bosnia and Herzegovina for all its citizens," Biden says in his statement. He adds that as president, he looks forward to working with the international community and the people of Bosnia and Herzegovina to finally achieve the promise contained in the Dayton Accords - a prosperous, just, and democratic Bosnia and Herzegovina in the heart of a Europe whole, free, and at peace. Coronavirus numbers declining in Bosnia ZAGREB, De 14 (Hina) -Bosnia and Herzegovina on Monday reported 344 new cases of coronavirus and 46 related fatalities and the epidemic seems to be subsiding in some areas of the country. Despite a relatively large number of deaths, the epidemiological situation in the country is better than in neighbouring countries and in some areas the number of new cases is gradually but steadily falling. Improvement is evident in Sarajevo now too. A member of the Sarajevo Canton's response team, Kemal Beganovic, said on Monday that available ***data*** indicatedthat the epidemic was ebbing away. "A month ago, on November 14 we had 6,111 active cases and today there are 2,393," said Beganovic, adding that it is particularly encouraging to see that for days now the number of recoveries is higher than the number of new cases. Lavrov: Russia against the West's engagement in Bosnia, wants to preserve Dayton ZAGREB, Dec 14 (Hina) - Russia's Foreign Minister Sergei Lavrov confirmed on Monday that his country was opposed to changes to the Dayton peace agreement and any engagement by the international community in Bosnia and Herzegovina, as well as that it was against the country's drawing closer to NATO. Lavrov arrived in Bosnia and Herzegovina (BiH) on Monday evening for a two-day official visit and immediately upon arriving, he met in East Sarajevo with the Serb member and chairman of the country's tripartite presidency, Milorad Dodik, who also invited officials from the Serb entity of Republika Srpska (RS) to the meeting. After the meeting, Lavrov told the media that RS was a good and close partner to Russia which also wanted a stable BiH and that there was no alternative to internal dialogue to resolve the country's problems. "Our joint stance is that the Dayton (agreement) is the basis for BiH to function and that it is necessary to respect the equality of the three constituent peoples and the two entities," Lavrov said, adding that Russia called on everyone to respect the fundamental elements of the Dayton agreement and that all problems should be resolved through internal dialogue and without interference in Bosnia and Herzegovina's internal affairs. Lavrov believes that the Office of the High Representative (OHR) should be shut down as an "anachronism that discredits the West," claiming that BiH does not need international protectorate. "Any attempt to destroy the Dayton agreement can have very serious repercussions," Lavrov said, adding that it was difficult to build the fragile balance on which the Dayton agreement was based. Asked by reporters how he sees the current status of Croats in BiH, Lavrov said that the Croat people must have rights that are guaranteed by the Dayton agreement and that that also refers to persons representing it on the BiH presidency. Amendments to the election law should also be a matter of internal agreement, he said. Lavrov used his visit to BiH to send a message that Moscow supports RS's stance on "military neutrality" and accused NATO of undermining international stability with its engagement. Dodik underlined that it was important that Russia's foreign minister was visiting BiH on the day when the Dayton agreement was signed in Paris in 1995, adding that Russia's support had always been important for Serbs. He condemned the international community's engagement in reforms in BiH and accused the OHR of deceit. He said that he had informed Lavrov that RS would refuse BiH's integration into NATO and once again indirectly announced the continuation of his separatist project. "Since one part of BiH wants to abolish RS, we will not remain in that BiH," Dodik threatened, adding that "today Lavrov is visiting RS and tomorrow he will be visiting BiH." After meeting with Dodik, Lavrov went to Sarajevo where he was to meet with the president of the Croat HDZ BiH party, Dragan Covic. On Tuesday Lavrov will meet with all three members of the country's ***collective*** presidency and hold talks with his counterpart, BiH Foreign Minister Bisera Turkovic. Exclusive Economic Zone will have no impact on BiH, says diplomat ZAGREB, Dec 14 (Hina) - Croatia's Ambassador to Bosnia and Herzegovina (BiH) Ivan Sabolic on Monday informed BiH Prime Minister Zoran Tegeltija that Croatia's plan to declare an Exclusive Economic Zone in the Adriatic would not affect relations between the two countries. "Croatia's plan to declare an Exclusive Economic Zone will not lead to any changes in relations with Bosnia and Herzegovina because the zone will be declared in the same area that is now considered to be the Ecological and Fisheries Protection Zone (EFPZ), which now already applies to BiH," said a press release issued after Sabolic met with Tegeltija. The Croatian ambassador explained that Croatia's activities regarding the adoption of a draft decision declaring an exclusive economic zone in the Adriatic were in line with the UN Convention on the Law of the Sea. Sabolic and Tegeltija also discussed other political and economic issues, describing the cooperation between the two countries as good and noting that it could be further improved to the mutual benefit. Aluminij and Glencore sign five-year contract ZAGREB, Dec 14(Hina) - The Mostar-based Aluminij and the Baar-based Glencore,an Anglo-Swiss multinational commodity trading and mining company, have signed a five-year contract on the delivery of aluminium logs, the Aluminij management reported on Monday. The management said that cooperation between Aluminij and Glencore was important for both companies.The press release issued today did not specify the amount of the logs which should be delivered in the next five years. The Aluminij foundry in Mostar, Bosnia and Herzegovina, relaunched production in early November after a16-month-long closure. Croatia holds a 12% ownership share in the Mostar-based factory. Slovenia logs 413 new coronavirus infections, 44 COVID-related deaths ZAGREB, Dec 14 (Hina) - In the last 24 hours, of 1,679 tests performed for coronavirus, 24.6%, that is 413, have returned positive, and there have been another 44 COVID-related deaths, Slovenia's government stated on Monday morning. Currently, 1,320 COVID patients are receiving hospital treatment, and of them 208 are in intensive care wards. Slovenia's COVID-19 death toll now stands at 2,107. Since the outbreak of the infection, 96,745 people have caught the novel virus in Slovenia. There are now 20,878 active cases. From Tuesday until 23 December some of the restrictions in the country will be eased, and therefore some of public transportation will be restored. Only shops selling essential goods are still allowed to work. Also the authorities allow car wash facilities, car dealers, floristshops, hairdressers andnail salons to reopen in the said period. Budget funds for STA news agency not disbursed yet ZAGREB, Dec14 (Hina) - The budget allocation which the Slovenian news agency STA is entitled tohas not yet been disbursed despiteinterventions from international associations, while local reporters believe that the latest developments are theresult of the Prime Minister Janez Jansa's attempt to put STA under his control. In the meantime, the Council of Europe Human Rights Commissioner Dunja Mijatovic has sent a letter to Jansa urging him to restore funding for the STAand expressing her concern that the suspension of public funding could put the new agency’s future at risk. "I trust you would agree that well-funded and robust public service media are an essential element of a democratic society. I am therefore kindly asking you to use your authority as Prime Minister to ensure that the decision to suspend public funding for the STA is promptly reversed," Mijatovic wrote in her letter to Jansa. TheCoE commissioner expressed concern "the suspension of public funding may seriously hamper the STA's work, possibly even jeopardising its continued operation." Mijatovic has received a response from the head of the GovernmentCommunication Office (UKOM), Uros Urbanija, reminding her that a precondition for the disbursement of the budget allocation to the STA has not been met and laying the blame on the STA leadership. In accordance with the Slovenian Press Agency Act, the Government is obliged to ensure appropriate financing for the STA. This area has been regulated from the very beginning by the UKOMon behalf of the Government. The umbrella contract, signed by current STA Director Bojan Veselinovic and former UKOM Director Kristina Plavsak Kranjc in December 2019, stipulates that the UKOM pays approximately EUR 165,000 to the STA for the provision of the public service, whilethe SPA provides the UKOM with all the necessary documents, including the documents regarding financial and legal matters, as well as the content,Urbanija said. It is only possible to establish the meaning of "appropriate financing" as stipulated by law on the basis of a comprehensive review of the STA's financial operation, he added, accusing STA Director Veselinovic of failing to hand over the complete documentationconcerning the agency's financial operation. Veselinovic insists that the government's demands have no grounds in the law, noting that assessments that one should define "appropriate financing" are only "a tawdry excuse". If it does not receive the budget allocation before the end of this year, the STA will see its planned revenues decline by a half million euros. The current modest reserves and the revenues earned on the market will not suffice to ensure salaries forabout 70 employees ina few months' time. European news agencies urge Jansa to reinstate STA's funding ZAGREB, Dec 14 (Hina) - The European Alliance of News Agencies (EANA) wrote an open letter to Slovenian Prime Minister Janez Jansa urging him to reverse his "unjustified" decision to suspend the financing of the Slovenian Press Agency (STA). Slovenia's Government Communication Office (UKOM) has suspended the financing of the agency until STA submits its commercial contracts to it. STA has said that such a request isunlawful and is a blow to the agency's autonomy. Half of STA's revenue is earned in the market, and half of it is received from the state based on the public information obligation. EANA sentthe open letter to Jansa on Thursday, and it was published on Monday, still with no response from the authorities. The letter says that the suspension of financing for the Slovenian Press Agency was "clearly unjustified" and thatit "could only be explained as a form of pressure on the independence of the STA", which is "unacceptable" and "goes against the basicprinciples of democratic societies". EANA, an organisation that brings together 32 European news agencies, urged Jansa to reinstate the financing for the Slovenian agency, stressing the importance of the freedom of media from political influence. EANA thus joined the letter sent to the Slovenian prime minister by Council of Europe Human Rights Commissioner Dunja Mijatovic, in which she expressed concern that the suspension of public financing could jeopardise STA's operation. The government finances the Slovenian news agency, which employs about 70 people, with €2 million a year, which is half of its annual income, while the unpaid monthly installment for October is €165,000. UKOM, headed by Uros Urbanija, who was an editor at STA during Jansa's 2004-2008 term, has justifiedthe suspension of financing with accusations against the agency's management, saying that it should submit its commercial contracts to the office, after which its financing would be reinstated. Serbia registers 49 coronavirus fatalities, 4,932 new cases ZAGREB, Dec 14 (Hina) - Serbia's health authorities on Monday reported 49 fatalities as a consequence of COVID-19 and 4,392 new cases of the infection, with the national response team expected to propose new measures. According to official ***data*** released on the health ministry's web site, there are currently 8,842 patients in hospital treatment, including334 on ventilators. A total of 15,765 tests were conducted in the past 24 hours and a total of 2,046,456 since the outbreak of the epidemic, confirming 271,364 positive cases. A total of 2,380 people have died since the outbreak of the epidemic, which is a fatality rate of 0.88%. The capital Belgrade is still a hotspot for coronavirus, accounting for one-quarter of the country's cases, or 1,167 of the 4,932 registered on Monday. The national response team is expected to introduce new restrictions and it is believed that PCR tests no older than 48 hours will be mandatory to enter the country as well as that new restrictions could be introduced forthe Christmas and New Year holidays. Passengers travelling to Serbia have to show negative PCR test as of Dec 20 ZAGREB, Dec 14 (Hina) - As of December 20, passengers travelling to Serbia will have to show a negative PCR test to enter the country and this regime could last until January 10, depending on how the epidemiological situation develops, the country's COVID-19 crisis management team said on Monday. Darija Kisic Tepavcevic, who is a member of the team and serves as Labour and Welfare Minister, said that Serbian nationals arriving at the border without a negative PCR test would be allowed to enter the country but would have to go into compulsory 10-day quarantine, which can be shorter if in the meantime they take a test and test negative. The current epidemiological restrictions will be in force until December 18, when the national crisis management team will again hold a session and decide on possible changes to the restrictions, said Kisic Tepavcevic. She said that the measures taken so far, such as a ban on the work of restaurants and services businesses as well as a ban on the work of shopping centres after 5 pm, which does not refer to pharmacies, food shops and petrol stations, had helped reduce the number of new infections. In other news: Bridge's Zvonimir Troskot to run in Zagreb mayoral election ZAGREB, Dec 14 (Hina) - MP Zvonimir Troskot of the opposition Bridge party will be the party's candidate for Mayor of Zagreb in local elections in May next year, Bridge announced on its Facebook page on Sunday. Troskot has been a financial manager and auditor for large foreign companies and has led one of the biggest referendum initiatives in Croatia. He is well respected in his party as a person full of empathy and understanding for others. He has demonstrated remarkable leadership qualities and seeks to restore the citizens' trust in politics and politicians, Bridge said. ZSE indices down amid meagre turnover ZAGREB, Dec 14 (Hina) - The main Zagreb Stock Exchange indices slid slightly on Monday, the Crobex by 0.35% to 1,737 points and the Crobex10 by 0.48% to 1,082 points, while turnover was meagre. Of the sector indices, the construction index saw the biggest decline, of 1.25%, while the tourism index increased the most, by 0.38%. Regular turnover amounted to HRK 5.2 million, about HRK 1.8 million less than on Friday. An additional HRK 2.1 million was generated through block trading in HT telecommunications shares at the price of HRK 180. The only stock to pass the turnover mark of one million kuna was the stock of the HT telecommunications company, with a turnover of slightly over a million kuna. Its price dropped by 1.64% to HRK 180 per share. The Podravka food company's stock turned over HRK 554,000, its price rising by 0.42% to HRK 477 per share. Thirty-eight stock traded on the ZSE today, with 17 of them registering share price increases, 14 recording price decreases and seven remaining stable in price. (€1 = HRK 7.542016) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2115HRS MONDAY. (Hina) ms rml Masthead Brief News Bulletin is published by the Croatian News Agency HINA Marulićev trg 1610 000 ZagrebCroatia web:[*www.hina.hr*](http://www.hina.hr) mail: [*hina@hina.hr*](mailto:hina@hina.hr) phone: (+385 1) 48 08 660; fax (+385 1) 48 08 822 Publisher: Branka Gabriela Valentić, DirectorEditor in Chief: Serđo Obratov Bulletin Editor: Marija Šestan

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**Body**

Zagreb,Hrvatska09 June 2020 (Hina) - Croatia sends letters to EU member states and EC regarding ERM II entry ZAGREB,June 9 (Hina) - Prime Minister Andrej Plenkovic has sent letters to the EU member states' leaders and the European Commission asking for their support to Croatia's efforts to join the Exchange Rate Mechanism (ERM II) and the Banking Union as early as July, the government stated on Tuesday. "All benchmarks and obligations have been entirely met in early May, before the set deadline, and an additional confirmation of Croatia's readiness to enter the ERM II and the Banking Union was the report the European Central Bank issued last week saying that top five Croatian banks passed the bank's comprehensive assessment and do not face any capital shortfalls," the government said in the press release. In early July 2019, Croatia received Eurogroup's official confirmation that its Letter of Intent to enter the EMR II and the Banking Union was accepted, as was its action plan with reform measures. ERM II was set up on 1 January 1999 as a successor to ERM to ensure that exchange rate fluctuations between the euro and other EU currencies do not disrupt economic stability within the single market, and to help non euro-area countries prepare themselves for participation in the euro area. The convergence criterion on exchange rate stability requires participation in ERM II.

The Banking Union in the European Union is the transfer of responsibility for banking policy from the national to the EU level in several countries of the European Union, initiated in 2012 as a response to the euro area crisis. The government recalls that so far Croatia has fulfilled in a committed manner all the requirements on its journey to the ERM II and the euro area. Croatia's efforts have been recognised by leading credit rating agencies -- Fitch and S&P - that maintained Croatia's rating at an investment level in the recent months despite the impact of the coronavirus pandemic and the expected strong economic downturn, the government says. Plenkovic's letter to the presidents of the European Council, the European Commission and the European Central Bank underscores that "joining the euro area is a strategic goal of the Croatian government." Plenkovic: Austrian govt to lift restrictions on arrivals from Croatia ZAGREB, June 9 (Hina) - The Austrian government will lift restrictions on arrivals from Croatia as of mid-June, Prime Minister AndrejPlenkovic announced on Tuesday after speaking with his Austrian counterpart. "We agreed that tomorrow the Austrian government will adopt a decision on lifting restrictions on movement for people between Croatia and Austria as of mid-June," Plenkovic tweeted after speaking with Chancellor Sebastian Kurz. Anyone travelling from Croatia to Austria cannot enter Austria without restrictions whereas Croatia has opened its borders to 10 EU countries, including Austria. Passengers from Croatia can now enter Austria upon presenting a negative test to coronavirus no older than four days which needs to be issued in either German or English. Croats, resident in Austria, can also enter that country but are required to self-isolate for 14 days. Austria to lift quarantine rules for travellers from Croatia and some other EU states ZAGREB, June 9 (Hina) - Austria will reopen its borders to Italy and lift a quarantine requirement for travellers from over 20 other European countries, including Croatia next week, Reuters reported on Tuesday. Austria will reopen its borders to Italy and lift a quarantine requirement for travellers from over 20 other European countries next week, officials were quoted by Reuters as saying on Tuesday. This is the direction in a further easing of restrictions imposed to contain the coronavirus. "The decision should in particular ease tensions with Italy after Austria singled out its southern neighbour for continued coronavirus-related checks given Italy's high number of COVID-19 infections and deaths," Reuters says. Austria, which borders eight countries, had lifted coronavirus-induced border restrictions last week for all of them except Italy, which prompted Rome to say such "individualist" solutions risked damaging the image of the 27-nation European Union. As of June 16 Austria will lift controls on travel from more than two dozen countries including popular holiday destinations Greece and Croatia, the officials said on condition of anonymity, meaning arrivals from those countries would neither have to go into a two-week quarantine nor show a negative test. The Foreign Ministry and Chancellor Sebastian Kurz's office declined to comment., according to Reuters Slovakia to allow travel to and from 16 more countries including Croatia ZAGREB, June 9 (Hina) -Slovakia will as of 10 June enable free travel to and from 16 European countries, including Croatia and there will not be any need to wear face masks, Slovakia's Prime Minister Igor Matovic informed on Tuesday. Apart from the restrictions being lifted for Croatia, visitors from Germany, Lichtenstein, Switzerland, Slovenia, Bulgaria, Greece, Cyprus, Malta, Estonia, Latvia, Lithuania, Finland, Norway, Denmark and Iceland will be free to travel to and from Slovakia, the Reuters news agency reported. Last week Slovakia reopened its borders to the Czech Republic, Austria and Hungary. Slovakia had introduce relatively stringent restrictions including shutting the border before it even recorded any cases of the novel coronavirus and cautiously approached reopening its borders. Matovic was quoted by Reuters as saying that compulsory quarantine upon arrival from abroad will be dropped for countries on the safe list, and people will not have to activate "smart quarantine" on their mobile devices. Slovaks returning from countries outside the safe list should still quarantine themselves and take a coronavirus test. Slovakia which has a population of 5.5 million people recorded 1,531 cases of Covid-19 and 28 deaths. Minister expects 30% of last year's tourism result ZAGREB, June 9 (Hina) - Tourism Minister Gari Cappelli stated on Tuesday that he expected Croatia to realise 30% of last years' tourism result in the upcoming tourist season, because Croatia had proven itself in the fight against the coronavirus and that fact was recognised on the market. "I am not being an optimist, I am realistic," Cappelli said in Opatija, where he signed a grant agreement for launching a Regional Competence Centre at the Opatija Hospitality High School. The minister said that the early activity in Croatia's tourism, concurrent with the relaxation of measures based on expert recommendations, had resulted in a high level of interest for coming to Croatia. "Where else do people line up to enter a country, in three or four lanes," Cappelli asked. He emphasised that some tourism accommodation establishments even at this moment were obliged to reject bookings in August as they had already filled their capacities. We need patience waiting for countries from where visitors come to open their borders. I understand my ministerial counterparts who are worried on the one hand, and are protecting their economy on the other hand, Cappelli said. However, he emphasised that after June 15 practically all borders within the EU would be open, and that Croatia was considering bilaterally opening borders to Bosnia and Herzegovina and Israel. The minister announced that the government would discuss the Cro Card at its Wednesday session, and that the card would be approved for use. Cappelli said that it would be in circulation as of July 1. When asked to evaluate his work as a minister, Cappelli noted that during his time in office, investments in Croatia's tourism had increased by 55%, 20,000 new workers had been employed in the hospitality and tourism industries, 60 million tourists were brought to Croatia in three seasons, and three best season to date were realised. "After such results I can peacefully retire from tourism," the minister said. As for the question if he would still want to be the tourism minister, Cappelli said that it was the prime minister's decision, andthat his knowledge and experience were at the disposal of the Croatian Democratic Union (HDZ). Ryanair to fly to Zadar again as of July 1 ZAGREB, June 9 (Hina) - Ryanair has announced that it will reintroduce flights to Zadar as of July 1 with ten flights as part of its summer flight timetable. Announcing the reintroduction of flights to Zadar, Ryanair said that Croatia had restored international air traffic and motivated tourists to plan their summer vacation. Ryanair is happy to announce the reintroduction of ten flights to Zadar and is pleased to bring tourists and help develop the regional economy on which thousands of jobs are dependent, the head of sales and marketing for Southeast Europe, Olga Pawlonka said. That is an opportunity for passengers who had to cancel their spring flights due to restrictions on movement and to use Ryanair's vouchers announcing that flights to Zadar will be on special during July to 'celebrate' the reintroduction of flights to that airport. Zadar Airport director Josip Klismanictoo expressed satisfaction that Ryanair, which is one of the airport's major carriers, was returning to Zadaradding that this year that companywill connect Zadar with 10 destinations. No new COVID-19 case, two more fatalities, 11 Croats still infected ZAGREB, June 9 (Hina) - In the last 24 hours there has been no new confirmed case of the infection withcoronavirus, while two more patients who have caught the infections have died, bringing the total number of fatalities to 106, according to the ***data*** released by the national COVID-19 crisis response team on Tuesday. Since 25 February when the first case of the infection with the novel virus was confirmed in Croatia, a total of 2,247 citizens have been diagnosed with the infection and of them, 2,130 have recovered to date. Of the 11 active cases, six are being treated in hospitals. The last two fatalities have been women, both born in 1941, who were placed on ventilators. The national COVID-19 crisis response team said today that as of 15 June, spectators will be allowed to attend sports events in the country. Army always prepared to provide assistance to civil institutions, says army chief ZAGREB, June 9 (Hina) -Croatian Armed Forces Chief-of-Staff Vice Admiral Robert Hranj on Tuesday said in the northern coastal city of Pula that the Croatian Army was always readyto provide assistance to civil institutionsif the need should arise as was the case with the crisis caused by the coronavirus. "Congratulations to everyone for an exceptionally well done job. It is good to learn from those who are good and in this case,Istria showed how to successfully act in time of crisis," said Hranj after holding talks with acting county prefect Fabrizio Radin. Assessing that the system in Istriawas under strainover the past two months but well organised and that it showed its preparedness in extraordinary circumstances, Radin said that all services in the county functioned well during the pandemic which he considers isthe "result of the efforts by experts but also because of cooperation that exists in the county at all levels." PulaMayorBoris Miletic underlined that it is professionals who are the force of 'all-Istrian unity' which showed that it knows how to face the most difficult situations when it come to health and the lives of our citizens. "The experts did an excellent job. We have excellent cooperation with people in the defence ministry which can be seen in the operations to clear mines inthe area of the former Valelunga barracks in Pula. We are aware that that area that was once used for the army is no longer as needed and we would like to put former military zones into the service of the economy and development," said Miletic. State-secretary in the Defence MinistryTomislav Iviccommended everyone for the excellent job in managing the coronavirus crisis, stressing that the county and national response teams functioned perfectly and that that is in fact why "Croatia fared so well compared to other countries in the neighbourhood." Commander praises firefighters for engagement during epidemic, after quake Chief firefighter commander, Slavko Tucakovic, said in Pula on Tuesday that during the coronavirus epidemic, firefighting forces had been engaged in more than 31,000 actions, commending them fortheir participation in efforts to curb the epidemic. In that period, 72,290 firefighters were engaged in combating 5,330 fires outdoors, he added. Tucakovic said that on 22 March, when a strong quake hit Zagreb and its environs, firefighters were called to combat blazes 711 times and were engaged in more than 6,000 interventions in the wake of the disaster. Chimneys of nearly 5,000 buildings in Zagreb damaged in 22 March quake The head of the City of Zagreb's department for physical planning,Ivica Rovis, reported on Tuesday that chimney damagewas registered in 4,943 buildings as consequence of the earthquake that hit Zagreb and its environs on March 22. Considering the fact that some buildings have one, and others up to ten chimneys, the number of damaged chimneysis very large, Rovis added. The City Housing and Municipal Services Company (GSKG) performed 1,951 emergency interventions, of which 1,050 were interventions on chimneys. As for buildings not managed by the GSKG, private owners removed the chimneys themselves or via certified managers. Rovis stated that firefighters had removed 4,500 chimneys at 2,800 different addresses, and that equipment and workers trained for working at heights had performed emergency interventions on 1,200 chimneys. He added that 4,299 households in Zagreb had not yet been reconnected to the city's gas supply system. EU civil protection officials discussing ' lessons learned' from pandemic ZAGREB, June 9 (Hina) - The European Union, countries of the European Economic Area, EU candidate countries and representatives of the European Commissionand the Council on Tuesday held avideo conferenceon the lessons learned from the health crisis and on ways ofstrengthening the rescEU initiative, Assistant Interior Minister Damir Trut said. The video conference was organisedas part of Croatia's presidency of the Council of the EU with 86 delegates from national bodies and civil protection organisations participating to discuss "what they did to prevent the spread of the epidemic intheir respective countries and how they assisted each other," Trut underlined. One of the priorities discussed is the further development of capacities to protect citizens, preventing and reducing the risk of disaster, as well as developing the rescEU programme which is part of the EU's civil protection mechanism," he added. The Commission is recommending €2 billion more for the rescEU programme in the new European budget which would create a stockof reserve equipment for emergency health situations, wildfires, chemical, biological, radiological or nuclear threats and other emergency situations. According to the proposal, the total budget for the EU civil protection mechanism would be €3.1 billion. Trutrecalled that as part of this programme Croatia assists in putting out wildfires with twoaircraft when requested either by the Commission or any EU member state and beyond if required. EU ministers: New WTO director-general should be appointed ASAP ZAGREB, June 9 (Hina) - The EU member states' ministers agree that it is necessary to select a new head of the World Trade Organisation as soon as possible, after Roberto Azevedo announced that he would leave the position a year before the end of this term, the Croatian Foreign Affairs Minister, Goran Grlic Radman, said on Tuesday. Minister Grlic Radman chaired on Tuesday the last EU Foreign Affairs Council session in trade configuration under the Croatian Presidency. The EU ministers agree that a new head of the WHO "should be elected as soon as possible, to avert leaving the organisation without leadership in a critical moment," the Croatian minister said. Roberto Azevedo announced that he would resign from the office of the WTO Director-General, a year before the official end of his term. He has been the head of the WTO since 2013, and he is leaving in challenging times. As of December last year, the WTO is no longer able to reach final decisions in trade disputes as the USA had blocked the appointing judges to the Appellate Body. The Office of the US President, Donald Trump, calls for extensive reforms of the WTO, but does not specify what they should look like and does not supportcompromise proposals endorsed by the majority of the 164 WTO members. "We agree that what we need is a strong political person who will know how to articulate the WTO interests," Grlic Radman said, adding that Croatia was committed to free trade and to strengthening the role of the WTO. The minister also said that no names were mentioned at the video conference. The health crisis has revealed weak points in global trade, the EU ministers agree, and Grlic Radman emphasised that global trade in particular should remain the major growth driver and that it was the key to recovery. Croatian PM says has received assurances from Orban on no territorial claims ZAGREB, June 9 (Hina) - Prime Minister Andrej Plenkovic said on Tuesday that he had received assurances from his Hungarian counterpart Viktor Orban that he had no territorial claims to Croatia. Plenkovic explained that earlier on Tuesday he had talked with Orban on the phone and that Hungarian Prime Minister said that the latest developments had been provoked by mistranslation. A few days ago, Hungary's Prime Minister Orban unveiled a plaque with a historical map on the occasion of the centenary of the Treat of Trianon and the map includes some of the parts of neighbouring countries, including Rijeka. That map is about Great Hungary which encompassed parts of modern day Croatia, Serbia, Slovenia, Slovakia, Austria, Romania and Ukraine which were part of the then Hungary in the Austro-Hungarian Empire even though most of these areas were never inhabited by Hungarians. Media reports over the weekend claimed that the inscription on the plaque says "Rijeka - The Hungarian Sea." The Hungarian Embassy in Croatia sent an explanation on Monday saying that the inscription was mistranslated. The proper translation, the Hungarian Embassy claimed, should read "Rijeka - To the Sea, Hungarians," which is a citation from a newspaper article from 1846 written by poet and politician Lajos Kossuth to motivate the construction of a railway and in which he described the beauty of the sea and coastline. Croatia's foreign ministry, which handed a protest to the Hungarian ambassador, said in its press release on Monday that Croatia and Hungary are two neighbouring countries connected by centuries of common history and that the City of Rijeka geographically and in state terms belongs to Croatia, which "cannot be brought into question." "We condemn actions that cause problems and unrest in good neighbourly relations instead of strengthening cooperation with a look to the future. In that regard, the Hungarian ambassador in Zagreb was summoned for talks in the Ministry of Foreign and European Affairs," the ministry's press release said. Plenkovic told NOVA TV commercial broadcaster that Orban had dismissed any interpretations about his territorial claims to Croatia. However, Plenkovic, underlined, that he had made it clear to Orban that such interpretations "create difficulties in Croatia and in bilateral relations." "Trianon was a difficult event in their (Hungarian) past," added the Croatian premier. FM says Croatia condemns any act of provocation that hurts ties with Hungary ZAGREB, June 9 (Hina) - Croatia's Foreign and European Affairs Minister Gordan Grlic Radman reiterated on Tuesday that Croatia condemnedany act of provocation that hurtits bilateral relations with Hungary. "We have had our say. I'llrepeat it once again on this occasion. We condemn inappropriate inscriptions and provocations that hurt neighbourly relations between Croatia and Hungary. We condemn any actions that stir up problems and turbulence in good-neighbourly relations, instead of strengthening them and enabling a future-looking approach," Grlic Radman said in Zagreb on Tuesday, reminding the press of a statement by his ministry on this topic on Monday. Grlic Radman was asked by the press about this topic after his Hungarian counterpartPeter Szijjarto on Monday criticised the Croatian web portal Index over the misinterpretation of an inscription on a monument unveiled recently by Prime Minister Viktor Orban. Both Szijjarto and his state secretaryTamas Menczer accused media outlets of spreading fake news about the monument and the inscription. The Croatian foreign minister responded that he did not read such news on social networks. Official accuses Croatian politicians of disrespect for Hungary ZAGREB, June 9 (Hina) - State-secretary in the Hungarian ForeignMinistryTamas Menczeron Tuesday said that he expected more respect from Croatian politicians who have recently criticised Prime Minister Viktor Orban and spread fake news. Menczerclaimed that his country had made a great contribution to Croatia's economy because last year, 644,000 Hungarians visited Croatia and generated 3.2 million bed nights, the Hungarian MTI news agency has reported. He underscored thatHungarian oil and gas company MOL is "involved in the largest investment in Croatia" and the Hungarian Electricity Works MVM is "about to buy 6.75 billion cubic metres of gas from the LNG terminal on Krk Island." Considering the above, we expect more respect from Croatian politicians voicing baseless criticism and spreading fake news about Hungary," said Menczer as carried by MTI and added that that conduct is"especially difficult to understand at a time when consultations are under way about opening borders, an extremely important move for the Croatian tourism season." This is the second case ofaccusations made against Croatia's politiciansby officials fromBudapest in two days. On Monday,Hungary's Foreign MinisterPeter Szijjartoaccused some media outlets in Croatia of tendentiously spreading an incorrect translation of an inscription on a monument unveiled in Hungary on Sunday and of accusingHungary of allegedlylaying claims to Rijeka. DIP receives first candidacy for parliamentary election ZAGREB, June 9 (Hina) - The Electoral Commission (DIP) on Tuesday received the first candidacy for the July 5 parliamentary election, that of Veljko Kajtazi, the candidate of the Kali Sara association of the Roma community in Croatia. Kajtazi will try to win a seat for 12 ethnic minorities - Austrians, Bulgarians, Germans, Jews, Poles, Roma, Romanians, Russians, Ruthenians, Turks, Ukranians andVlachs. His candidacy was submitted by the head of the Kali Sara association, Suzana Krcmar, who expressed her confidence that Kajtazi would be re-elected. "In the past nine years he has demonstrated his commitment to the Roma community and other minorities that he represents. He will certainly win and be an MP again," Krcmar said, praising the current government for its treatment of the Roma minority. "From the point of view of the Roma minority, we have achieved the most with this government. More can always be done, of course, but we are pleased with everything that has been accomplished," she said. Explaining why Kajtazi did not submit his candidacy himself, Krcmar said that practice is such that a candidate never submits their own candidacy but that it is done by a representative of the Roma association. Hodzic: Bosniaks unhappy with Prljaskaj's term in parliament ZAGREB, June 9 (Hina) - Independent candidate Armin Hodzic on Tuesday submitted his candidacy to the State Electoral Commission (DIP) for the coming election, sayingthat the Bosniak minority isnot satisfied with MP Ermina Lekaj Prljaskaj's term in parliament, who represented five national minorities in the last parliament. "I amthe candidate for the Bosniak national minority. I am optimistic because we managed to ***collect*** a huge number of signatures in a short time and becauseover the past four years we have worked on improving the status of the Bosniak minority in Croatia," Hodzic said after presenting his candidacy. If elected, he would represent the Albanian, Bosniak, Montenegrin, Macedonian and Slovenian minorities in the next parliament. Hodzicsaid that the Bosniak minority isnot satisfied with how they were represented by their MP Lekaj Prljaskaj in the last parliament. "We believe that in the past two parliaments, we won't say that she did not do anything, but did not do enough to win the trust of voters again, not just Bosniaks but other minorities she represents either," said Hodzic. He said that he wanted to awakenthe interest of the Bosniak minority in the July 5 election so that they vote for the candidate that will best represent their interests and the interests of other minorities in Croatia. Lekaj Prljaskaj, of the Union of Albanians in Croatia, was elected in the last parliamentary election in 2016 among eight candidates who ran for five minority seats. HDZ unveils its election platform "Safe Croatia" ZAGREB, June 9 (Hina) - The ruling Croatian Democratic Union (HDZ) on Tuesday presented its five-chapter platform for the 5 July parliamentary elections, with an emphasisput on higher wages, creation of 100,000 more jobs, downsizinng ministries and reducing taxes. Unveiling the five-chapter document, Prime Minister and HDZ leader Andrej Plenkovic said that "the message of a safe Croatia means a safe future". "If we win trust of or citizens for the next four years, as a sort ofsecond half, it will means a safe Croatia in the sense of safe jobs," Plenkovic said. He recalled positive achievements of his cabinet in the past three and a half years including an increase ofthe minimum wage by net 754 kuna (approximately by 100 euros) and an increase of the average wage by HRK 1,150 kuna, as well as higher pensions by 12%. The five planks of the 100-page document are aboutsocial security, a promising future, economic sovereignty, strengthened statehood, and Croatia's global recognisability. More investments in healthcare system The social security chapter envisages an investment of three billion kuna in the public healthcare system, the digitisation of that sector and shorter waiting lists for medical examinations, the construction of a national children's university hospital centre, the revitalisation of the Institute of Immunology in Zagreb and national plans for the fights against cancers. The document envisages the creation of conditions forincreasing the average monthly wage to HRK 7,600 (approximately 1,000 euros) and minimum wage by 1,000 kuna to HRK 4,250 (€560). The HDZ promises investing 10 billion kuna in job creation measures, which is expected to result in the creation of 100,000 new jobs. The party promises a 10% increase in pensions, and aplanto raise the accommodation capacities for 1,500 more beneficiaries in senior homes run by the state. Monthly allowances for those in need should be risen from the current 800 kuna to 1,500. The income tax is to be reduced from 36% to 30% in one bracket and from 24% to 20%. The promising future chapter envisages a rise of investmentin R&D from the current 1% of GDP to 1.4% andto 2.5% until the end of the next four-year term. Also, 2-percent tax on profit will be reduced to 10% for 93% of businesses. The HDZenvisages the allocation of the 130,000 kuna for youth self-employment. The document includes plans for a balanced development of Croatian regions, notably in the hilly and mountainous regions andislands. Economic sovereignty The HDZ has made plans for raising the ***agricultural*** production by 30%, and encouraging young people to be employed in the farm sector.Also, about a score of fishing ports are to be built. Strengthened statehood The HDZ promises further digistisation as well as the further empowerment of the agencies engaged in countering corruption and organised crime. A functional merger and better connectivity of municipalities, downsizing the ministries and the enhancement of the work of the national parliament are foreseen in the document. Plenkovic pledged more funds for the post-quake reconstruction of Zagreb and its environs. Croatia's global recognisability Some of the targets cited in the document are Croatia's entry into the Schengen Area, membership of the euro area and providing the Croatian armed forces and police with modern equipment. "This is the platform of the team that has gained the experience in managing Croatia," the premier said. at the presentation of the document. Bernardic: Restart Coalition with IDS only force for change ZAGREB, June 9 (Hina) -Social Democratic Party (SDP) and Restart Coalition leader, Davor Bernardic, stated on Tuesday, after signing an agreement with the IDS and the PGS to run the parliamentary election together, that the Restart Coalition with its new partners was the only alternative and force for change. The Restart Coalition welcomed new partners on Tuesday, when they signed an agreement with the Istrian Democratic Assembly (IDS) and the Primorje-Gorski Kotar Union (PGS) to run together in the parliamentary election. "We carry a great responsibility to achieve changein Croatia, our goal is the country's decentralisation and devolution, which we will implement during our term of office, while Istria will, of course, retain its distinctiveness," Bernardic stated on the occasion. Claiming that Croatia took the last place in the EU in using EU funds, as it had absorbedonly 30% of the allocated funds, Bernardic emphasised that one of the most important levers for development was putting disused state properties in the function of developing the economy, that is tourism, the health care system, education system, culture, and sports. Declaring Istria to be the most developed and the most progressive Croatian region, IDS leader Boris Miletic claimed that the progressive block stooda real chance to form a government after the election, and build a modern, open, and progressive Croatia. At the moment we have a government which had not implemented any reforms, but is only shutting down the industry. We have a government that allows Ustasha performances and stays quiet while their friend Viktor Orban demonstrates open territorial claims to Rijeka and tries to prevent our dear friends Hungarians from coming to our seaside," the IDS leader stated. Last Friday, the IDS leadership decided to join the Restart opposition coalition led by the SDPin the upcoming parliamentary elections which Croatia will hold on 5 July. The IDS leadership said that the decision was made after a series of negotiations with the SDP which accepted all the conditions set by this regional party. One of the conditions was that any future territorial reorganisation of Croatia would preserve the autonomous status of Istria as a county. Also, the IDS insisted on having its four candidates on the Restart slate for constituency No. 8. In the last parliament, the IDS club had four lawmakers: three of whom were IDS members plus independent deputy Furio Radin as the representative of the Italian minority. Ex-SDP member Tomislav Mikulin released from police custody ZAGREB, June 9 (Hina) -Tomislav Mikulin,charged with assault andbattery against the leader of the Social Democratic Party's Osijek -Baranja county branch, MP Domagoj Hajdukovic, was on Tuesday released on bail, andthe county state attorney's office is continuing its investigation in this case. The police arrested Mikulin on Monday on charges of bodily harm and domestic violence. Withoutnoting the identity of the perpetrator the state attorney informed that after he was questioned, Mikulinwas released on bail as there are nogrounds to detain him. An investigation isunderway to determine the facts and once that is completed the relevant information will be released to the public, the state attorney's office said. Hajdukovicphonedthe police on Sunday toreportthat he had been verbally and physically attacked in the street by a man he knew and then requested medical attention in Osijek hospital where doctors ascertained light injuries. Mikulin was later arrested and taken into police custody. After the news broke about this incident involving its two members, the SDP leadership immediately expelledMikulin from the party and sacked him from a job in the party.Mikulin was a senior adviser in the office of the SDP leader Davor Bernardic. Rijeka 2020 company director relieved from duty at her own request ZAGREB, June 9 (Hina) - Emina Visnic, the director of the Rijeka 2020 company tasked with the implementation of the project of Rijeka the European Capital of Culture in 2020, was relieved from the duty at her own request and the city authorities reported on Tuesday that Irena Kregar Segota would be the new director. A press release reads that Visnic explained her request for being relieved from the duty with the assessment that after the completion of the "demanding process of redefining the programme and the outlays" in the new circumstances in which the project has found itself, it will be necessary for her to be more intensively engaged in the tasks "of operational management of programmes". Visnic continues to be an employee in the company and is now charged with managing the programmes in the pipeline, according to the press release. Visnic'sresignation came against the backdrop of news about irregularities which the State Audit Office established in connection with thisthe Rijeka - European Capital of Culture 2020 project. State Audit Officedeterminesirregularities in connection with Rijeka 2020 project The City of Rijeka culture committee convened in late May to discuss findings of the State Audit Office for this northern Croatian city in 2018, which point out a series of irregularitiespertaining to the implementation of the project. For instance, 13.7 million kuna was designated to this Rijeka 2020 project without necessary documentationwhich should have been provided forthis allocation. The local authorities also failed to inform the ministries of culture and tourism of how they spent the funds in the amount of 32.8 million during 2017 and 2018. Also some of the unused funds remain andthe city authorities were supposedto control their spending in the period to come. Furthermore, the local authorities were supposed to establish aa non-profit-making organisation for the implementation of the project, however instead of that, they founded a company which employed seven people more than planned. In late May, the police pressed charges against six members of the Rijeka 2020 company's expert task force for having favoured a bidder during public procurement procedures for the Rijeka - European Capital of Culture 2020 project. Rally held in Zagreb in support of Black Lives Matter movement ZAGREB, June 9 (Hina) - The Initiative against police violence and racism held a protest in Zagreb on Tuesday to express solidarity with the Black Lives Matter movement and protests across the United States, following the death of unarmed African American George Floyd. "We refuse to participate in the policy of the destruction of lives. We want to be part of the policy of solidarity, the fight for freedom and economic equality and a society that condemns all forms of violence and racist supremacy," the initiative said. Approximately 400 people gathered for the protest in Zagreb. On May 25, 2020, George Floyd, a 46-year-old black man, was killed in Minneapolis, Minnesota during an arrest for allegedly using a counterfeit bill. White police officer Derek Chauvin knelt on Floyd's neck for almost nine minutes while Floyd was handcuffed and lying face down in the street, begging for his life and repeatedly saying "I can't breathe." HRK 2.5m in grants for projects for Croats abroad ZAGREB, June 9 (Hina) - The Central State Office for Croats Abroad has granted atotal of HRK 2.5 million for 153 projects by non-profit organisations of Croats abroad after receiving as many as 585 applications, the office said on Tuesday. Grants rangedfrom HRK 5,000 to HRK 60,000 and one applicant could have submitted two projectproposals at the most. None of the projects was grantedthe maximum amount of HRK 80,000. The single largest amount, of HRK 60,000, was granted to the Croatian National Council from Subotica, Serbia. The Croatian self-governing authorityin Budapest, Hungary and the Alliance of Croatian Associations in Lendava, Slovenia each received HRK 42,000 for their projects. Four projects received HRK 38,000 each. These were submitted by the Croatian National Council in Tivat, Montenegro, the Croatian Printing Society from Eisenstadt, Austria and two associations from Subotica in Serbia. Nine other projects received HRK 30,000 each, including a pilot project providing legal assistance by the Orahova humanitarian cultural association from Kotor Varos in Bosnia and Herzegovina. The only organisation to receive grants for two projects was the Croatian World Congress from Zagreb, receiving a total of HRK 45,000. These grants are issued every year for Croatian associations and individuals outside Croatia. Croats living outside Croatia who are poor, ill or vulnerable members of the community can also be recommended for assistance. This year 24 people were granted assistance ranging from HRK 2,000 to HRK 6,000, mostly from Bosnia and Herzegovina. Milanovic's envoy pays tribute to Partisans killed at Sutjeska in 1943 ZAGREB, June 9 (Hina) - The Croatian president's chief of staff, Orsat Miljenic, visited Tjentiste, Bosnia and Herzegovina on Tuesday to commemorate thousands of Croatian Partisanresistance fighters killed there in battle against the Nazis in 1943. Miljenic came as President Zoran Milanovic'spersonal envoy and laid a wreath at the monument erectedin the Valley of the Heroes in 1971 where the remains of3,301 Partisans killed in battle are buried. He also laid a wreath at the monument in Gornje Bare, where the Second Dalmatian Brigade fought heavy battles in June 1943 to secure the withdrawal of the bulk of the resistance forces, the Supreme Staff and Tito from the encirclement. "An enormous number of our citizens were killed here while fighting for freedom, and it is quite appropriate to pay them tribute," Miljenic told the press. Commenting on the Croatian Parliament's refusal to sponsor the ceremony marking the 75th anniversary of the battle of Sutjeska, Miljenic said that Parliament was independent in decision making, while President Milanovic showed his attitude towards the anti-fascist struggle with his own gestures. "By sending his envoy, the President has made it clear what he thinks about this," Miljenic said. "Our visit shows what we think about historical revisionism," he said, adding that the people of Dalmatia knew well what had happened here during the Second World War. In May and June 1943, about 127,000 occupying and Quisling forces surrounded over 20,000 Partisans near theRiver Sutjeska, southeastern Bosnia and Herzegovina with intent to destroy the bulk of the National Liberation Army forces and capture Tito. More than 7,500 Partisans were killed in the fighting, including over 4,000 Croats, mostly from Dalmatia. The Croatian delegation included Franjo Habulin, the head of the Alliance of Antifascist Fighters and Antifascists (SABA). Speaking to Hina, he said that President Milanovic had felt it his duty to commemorate the battle of Sutjeska, recalling that Prime Minister Andrej Plenkovic had done the same last year by sending his personal envoy to lay a wreath. MICT: Trials for Mladic, Stanisic, Simatovic to be wrapped up in first half of 2021 ZAGREB, June 9 (Hina) - The two remaining trials for war crimes committed in the former Yugoslavia in the 1990s will be concluded in the first half of 2021, the president of theInternational Residual Mechanism for Criminal Tribunals (MICT), the legal successor to the International Criminal Tribunal for the former Yugoslavia (ICTY), said on Monday. The cases in question are those of Bosnian Serb wartime military commander Ratko Mladic and former Serbian State Security Service chiefs Jovica Stanisic and Franko Simatovic, President Carmel Agius told the UN Security Council in a report by video conference from The Hague. Mladic was sentenced to life in prison in 2017 for war crimes and genocide committed in Bosnia and Herzegovina in the first half of the 1990s. His appeal case was scheduled for March this year but was postponed because of his health problems. Stanisic and Simatovic stand accused of the persecution, murder, forcible relocation and deportation of Croats and Muslims in Croatia and Bosnia and Herzegovina. They were acquitted by an ICTY trial chamber, but the ICTY appeals chamber ordered a retrial because of misinterpretation of several aspects of the law. Judge Agius said that MICT has remained operational and delivered results despite the challenges arising from the COVID-19 pandemic. Recalling last year’s 25th commemoration of the genocide against the Tutsi in Rwanda and the upcoming 25th commemoration of the genocide in Srebrenica in July 2020, Agius highlighted the dangers of endemic hatred, division, and denial. He called for a united approach against those who favour impunity over justice. "Though we know that not every pathogen causes a pandemic, we see every day that these destructive forces are becoming more virulent, and that the purveyors of hate feel emboldened. We must combat their version of events and offer our solidarity and support to all those who have suffered, and continue to suffer," he said, urging all member states to join MICT in commemorating the genocide in Srebrenica next month. Bosnia: Suspended state prosecutor sentenced to five years ZAGREB, June 9 (Hina) - Bosnia and Herzegovina's former state prosecutor Bozo Mihajlovic was sentenced to five years in prison for misconduct on Tuesday. Before his suspension in 2017, Mihajlovic headed the department for organised crime, economic crime and corruption at the State Prosecutor's Office. He had held this post for more than 11 years. The State Court found him guilty of failing to oversee the work of a typist in his department who abused her position to appropriate a portion of money seized during criminal investigations. An investigation found that the typist Sadina Beridan Zukic had stolen over 225,000 convertible marks (112,000 euro). Mihajlovic's lawyer Vlado Adamovic said they would appeal the ruling, saying that it was "illogical and henceuntenable." Tunnels used by migrants discovered under fence on Hungarian-Serbian border ZAGREB, June 9 (Hina) - Hungarian police discovered a tunnel under the wire fence on the border with Serbia at the weekend and prevented more than 300 migrants from illegally crossing the border, the Serbian public broadcaster RTS said on Monday. A 24-metre-long tunnel was discovered in cooperation with the military near the spa town of Morahalom. It was believed to be used by migrants to illegally cross the border and carry on their journey to western Europe. It was the third underground passage under the wire fence discovered in this region in the past year, RTS said. Hungarian border police arrested 54 people while attempting to jump over or cut through the border fence while 258 migrants were found in the border area without documents. Most of them identified themselves as Syrians, but there were also Iraqis, Iranians, Afghans and Palestinians. Since the end of May, Hungary has seen a large increase in the number of migrants trying to enter the country illegally, with nearly 900 such attempts reported last week alone. Hungarian officials have repeatedly said that Hungary will not remove the wire fencing from the border, but will increase the defence of the Schengen area to prevent migrants from entering the European Union illegally, RTS said. Attempts to cross the border illegally have also been reported in areas near the Serbian border with Croatia. Special police forces were deployed in the Sid area last month to protect the local population from migrants, RTS said. In other news: EU-27 GDP down by 3.2% in Q1 2020 q-o-q ZAGREB, June 9 (Hina) - The seasonally adjusted GDP in the EU-27 decreased in the first quarter of 2020 by 3.2% compared to the previous quarter, according to latest estimates published by the EU statistical office ***Eurostat*** on Tuesday. Thus, the ***Eurostat*** amended its initial estimate from mid May, when it assessed that the EU economy had decreased by 3.3% in the first three months of 2020. In the euro area, the seasonally adjusted GDP decreased by 3.6% in the first quarter of 2020 compared to the previous quarter. Those are the sharpest declines observed in both areas since time series started in 1995, the report reads. According to provisional ***data***, in the first quarter of 2020 Croatia's GDP decreased by 1.2% compared to the previous quarter. Compared with the same quarter in 2019, the seasonally adjusted GDP decreased by 2.6% in the EU27, and by 3.1% in the euro area. Those are the sharpest declines y-o-y since the third quarter of 2009, the Eurostart reports. According to provisional ***data***, in the first quarter of 2020 Croatia's GDP increased by 0.3% when compared with the same quarter in 2019. The Eurostart also reported that the number of persons employed in the EU27 slipped by 0.1% in the first quarter of 2020 compared to the previous quarter. This is the first decline observed since the first quarter of 2013, the Eurostart notes. The number of persons employed in the euro area decreased by 0.2%, which is the sharpest decline since the second quarter of 2013. Year on year, the number of persons employed increased in both areas by 0.4%. Croatia's Jan-April exports fall by 5.1%, imports by 10.2% ZAGREB, June 9 (Hina) - The value of Croatia's commodities exports in the first four months of 2020 amounted to HRK 34.3 billion, which is 5.1% less than inthe same period last year, while imports fell by 10.2% to HRK 56 billion, the State Bureau of ***Statistics*** (DZS) said on Tuesday. The January to April trade deficit amounted to HRK 21.7 billionwhile coverage of imports by exports was 61.3%. Exports to EU member states amounted to HRK 24.2 billion or 2.4% less year on year, while exports to non-EU countries fell by 11.1% to HRK 10.1 billion. Imports from EUmember states dropped by 11.2% to HRK 45.3 billion and those from non-EU countries declined by 5.8% to HRK 10.7 billion. Expressed in euros, exports totalled €4.6 billion, down by 6%, while imports fell by 11% to €7.5 billion. The trade deficit was €2.9 billion. Rail cargo transport on rise, passenger transport on decline in Q1 2020 ZAGREB, June 9 Hina) - In the first three months of 2020 in Croatia rail cargotransport registered a 7.8% increase compared to the same period in 2019, however rail passenger transport continued to fall, going down 7.7% in the Q1 2020, the HAKOM regulator reported on Tuesday. According to the Croatian Regulatory Authority for Network Industries (HAKOM), in the first quarter of 2020, passenger transport by rail decreased by 7.7% compared to the same period in 2019. On the other hand, there was a 7.2% increase in cargotrain kilometres compared with the same quarter of the previous year. The largest share of train kilometres in cargo transportation, of 53.4%, was recorded by the HZ Cargo. The total number of tonne-kilometres in the first quarter of 2020 increased by 5% compared with the same period in 2019. The largest increase (28.7%) was recorded by new cargocarriers, while the HZ Cargo recorded a decrease of 11.6%. The new cargo carriers participate with 50.4% of the tonnage in the first quarter, achieving an increase of 9.3% compared with the same period last year, the HAKOM reported. Electricity transmission operator invests HRK 45m in Network Centre in Osijek ZAGREB, June 9 (Hina) - The Croatian Transmission System Operator (HOPS) is investing HRK 45 million in a new Network Centre building in Osijek which should be completed in two years, it was said on Monday during an agreement-signing ceremony. The head of the HOPS management, Tomislav Plavsic, signed the agreement with executives from the contractor, the Kamgrad construction company. The Osijek Network Centre is currently located at the Ernestinovo substation, which is not suitable for such an important centre, and a new building at a more appropriate location has been planned for a while, Plavsic explained. All five Slavonian counties are covered by the Osijek Network Centre and the Osijek transmission area. In case of contingency, the Osijek Network Centre can take over the function of the national dispatchingcentre in Zagreb, as well as the functions of all other regional centres strategically distributed throughout Croatia. That means that the complete Croatian electrical power system can be operated from the HOPS Osijek Network Centre, Plavsic said. The new Network Centre will be constructed as part of a larger new building. The centre will span 370 square metres inside a three-storey building, and a warehouse with a garage for cargo vehicles will also be constructed. The total area of the new compounds will be 2,600 square metres. The construction is expected to be completed within two years from the start, and the investment is worth HRK 45 million. The HOPS has invested HRK 300 million into Slavonia in the last three years. Opatija School of Hospitality receives HRK 58.8 m for competence centre ZAGREB, June 9 (Hina) - Tourism Minister Gari Cappelli on Tuesday signed a HRK 58.7 milion grantagreement for a Regional Competence Centreat the Opatija Hospitality High School. A total of HRK 388 million will be invested in six regional competencecentres with 85% being covered from the European Social Fund andthe remainder to be financed by the Tourism Ministry. The headmaster of the Opatija Hospitality School Sibila Roth said that the funds would make it possible for secondary school students to receive education courses in hospitality and tourism. ZSE indices decrease ZAGREB, June 9, 2020 (Hina) - The main Zagreb Stock Exchange (ZSE) indices decreased slightly on Tuesday, the Crobex by 0.17% to 1,658.32 points, and the Crobex10 by 0.13% to 1,032.61 points. Regular turnover was HRK 7.25 million, which is around HRK 2.7 million more than on the previous day. The largest turnover, of HRK 2.2 million, was generated by the Valamar Riviera hotel company share. Its price increased by 0.35% to HRK 28.60 per share. The HT telecommunications operator turned over HRK 1.1 million, and its price decreased by 0.29% to HRK 171 per share. No other share reached the million kuna mark. Of the 36 shares traded today, 15 registered a decrease in price, 11 an increase, and the prices of 10 remained the same. (€1 = HRK 7.569360) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2100 HOURS TUESDAY. 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**Body**

Zagreb,Hrvatska24 November 2020 (Hina) - Croatia logs 2,323 new COVID-19 cases, 47 deaths, 2,390 recoveries ZAGREB, Nov 24 (Hina) - In the past 24 hours Croatia has registered 2,323 new cases of coronavirus while 47 people have died as a consequence of the infection, the national COVID-19 response team saidon Tuesday. There are now 19,161 active cases in the country, including 2,093 hospitalised patients, of whom244 are on ventilators. Forty-sevenpeople have died. Since 25 February, when the first case of coronavirus was identified in Croatia, a total of 108,014 people have been infected with the virus and 1,445 have died. A total of 87,408 have recovered, of whom 2,390 within the last 24 hours.

There are currently 40,762 people in self-isolation. To date a total of 692,048 tests for the virus have been conducted, including 8,944 in the past 24 hours. 127residents of aged care facility in Lika-Senj County infected Of 154 residents in an aged care facility for people with mental disorders in the central town of Otocac, Lika-Senj County, 127 are positive for coronavirus, the local COVID-19 response team said. Seven have been hospitalised but none are in critical condition. Fourteen employees of the home had previously testedpositive for coronavirus. Currently, there are 355 active cases of the infection in Lika-Senj County. Since the outbreak of the epidemic in thatcounty, 1,225 people have contracted the disease, 836 have recovered and 34 have died. Tents outside Varazdin hospital start receiving first patients The tents set up by the army outside the Varazdin Hospital received first COVID-19 patients on Tuesday evening, the hospital management said. According to the hospital head, Nenad Kudelic, patients who will be transferred to the healthcare institutions in Novi Marof and Klenovnik are being accommodated in those tents before their transport to those two towns. There are three tents and each of them is with 30 beds. More information will be given at a news conference, scheduled for 08.30 hrs Wednesday. In the last 24 hours, there have been 242 new infections with coronavirus out of 534 tests in Varazdin County. Currently, there are 201 COVID patients with serious symptoms in the Varazdin hospital, and 70 of them are at the infectious diseases ward, and 16 are in the intensive care ward. Split hospital provided with two devices for high flow oxygen therapy ZAGREB, Nov 24 (Hina) - Two devices for high flow oxygen therapy (HFT) were presented to the University Hospital Centre in Split on Tuesday. The appliances, worth HRK 93,000, were donated by Split-Dalmatia County. High flow oxygen therapy is commonly used on patients with acute respiratory failure (i.e. hypoxemic respiratory failure) in the hospital system and this can help them to avoid more difficult treatment by ventilators. Patients say it is very comfortable and allows them to communicate. During the ceremony, the hospital's head, Julije Mestrovic, said that this health institution cared for all patients in need of hospital treatment in the area, urging local residents to adhere to epidemic restrictions. Mestrovic said that that occupancy rate was currently at 70%, they had enough beds, but had to redistribute the staff. County Prefect Blazenko Boban said that until the end of this year the county authorities would provide two more HFT devices. In the last 24 hours, 290 new coronavirus infections have been detected in the county, and three elderly persons have died from complications caused by COVID-19. Currently, 157 COVID patients are receiving treatment in the Split hospital and 14 of them are placed on ventilators. Croatian president says we all should get vaccinated ZAGREB, Nov 24 (Hina) - President Zoran Milanovic said on Tuesday that the he was in favour of vaccinating the whole population against COVID-19, and that he counted on principles of public mindedness in that regard. Before the ceremony of opening an exhibition in Zagreb's Museum of Arts and Crafts, Milanovic was asked by reporters to comment on the efficiency of vaccines that are currently being developed against COVID-19. In response to media reports on that topic, Milanovic said that he trusted the results published after the trials of anti-COVID vaccines in world laboratories. "I trust that. I get vaccinated when it is necessary, my children get vaccinated," Milanovic said adding that no one should circumvent that. "In my mind, everyone should get vaccinated, and I count on public mindedness," the president said underscoring that vaccinations have saved millions of lives in the last 70 years. He said that he did not know the government's position on the issue. The government is going to procure nearly three million jabs. Whether the vaccination will be mandatory, this is a very serious topic, Milanovic said. He said that he had raised this issue at Monday's session of the National Security Council (VNS). Commenting on that VNS session, Milanovic said that it "was o.k." considering his premonitions. Asked whether the relations between him and Prime Minister Andrej Plenkovic were mended, the president said that one should not look at that personally. As for the national COVID-19 crisis management team, Milanovic said that the body "gets legally rather curved" , however, he underscored, that he had not criticised any of the measures adopted by that body. The president added that he had criticised the situation in which this level of measures had been adopted without "a green light" that is approval from the parliament. EC to okay contract for purchase of COVID-19 vaccine from Moderna on Wednesday ZAGREB, Nov 24 (Hina) - The European Commission will on Wednesday approve yet another contract to pre-order160 million doses of a COVID-19 vaccine from the US biotech company Moderna,Commission President Ursula von der Leyen announced on Tuesday. “I am happy to announce that tomorrow we will approve a new contract to secure another COVID-19 vaccine in our vaccine portfolio," von der Leyen told a press conference in Brussels. This is the sixth contract the Commission will sign with pharmaceutical companies for the purchase of a COVID-19 vaccine. Von der Leyen said that the EU was working on another contract as well, stressing that the EU would have the largest vaccine portfolio in the world. She added that the vaccines would be made available after undergoing thorough checks by the European Medicines Agency. The Commission president said that a vaccine was the most effective way to stop the pandemic and that therefore the priority was to get vaccines quickly. Another priority was toto make sure that the vaccines were available to everyone in the world, she added. Von der Leyen noted that the EU had already made a great contribution to securing a sufficient number of doses of vaccines for poor countries. The Moderna company announced last week that based on results from the final stage of clinical trialsits experimental vaccine was 94.5 percent effective against COVID-19. Project launched to analyse sewage to identify COVID-19 virus traces ZAGREB, Nov 24 (Hina) - The Croatian Public Health Institute (HZJZ), in cooperation with Zagreb's sewage management authority, has launched a project to test sewage in an effort to identify possible traces of the COVID-19 virus. Analysis of sewage is used to determine the presence of biological orchemical matter for the purpose of monitoring public health and it has been used to identify the presence of pharmaceutical or industrial waste, medicaments andviruses and the potential emergence of bacteria resistant to antibiotics. Recent research has shown that identifying traces of coronavirus in sewage can help in monitoring the outbreak of COVID-19, HZJZ has said. The project is being conducted in cooperation with the World Health Organisation in Croatia and is being financed by the German government. Similar testing is already being conducted in several countries around the world including Italy, the Netherlands, Hungary, Spain and France. Monitoring sewage can lead to predicting the outbreak of infection Even though these analyses cannot identify people who are infected, theycan detect coronavirus RNA in human feces several days to a week before symptoms develop. Research has shown that by monitoring sewage it is possible to predict the outbreak of infection before individual testing and hospitalisation. "This kind of testing isan early warning tool," HZJZ said. Bozinovic announces tighter coronavirus restrictions ZAGREB, Nov 24 (Hina) - Interior Minister Davor Bozinovic announced on Tuesday that the national coronavirus response team would prepare a new set of more stringent measures against the coronavirus epidemic that would become effectivelater this week and remain in force until Christmas. Bozinovic made the announcement after a meeting with county prefects. "Tomorrow the national coronavirus response team will prepare a new set of measures which will be presented to the county prefects and which will be in force until some time before Christmas. These will be more stringent measures. Some people think that the measures already in place are enough, but the numbers are not falling, so we are moving forward with new measures taking into account that this is a long battle," Bozinovic told a press conference. He said that the new measures would target specific sectors of the economy, notably hospitality, as well as culture and partly education. "We are bringing in measures to protect people's lives, but on the other hand we must also bear in mind the economic aspect and see to what extent closures can have anegative impact on the mental state of the nation," Bozinovic said. "Draft measures will be prepared for the inner cabinet and presented to the county prefects. We will see their reactions and then take a decision that will enter into force most likely before the end of this week," he added. The purpose of the new measures is to stop the spread of the virus, ease the burden on the healthcare system and ensure that all patients, not just those infected with the coronavirus, receive adequate healthcare, Bozinovic said.. He said that as soon as a COVID-19 vaccine arrived in Croatia it was necessary to vaccinate as many people as possible, adding that 70 percent of the adult population would need to be vaccinated to stop the epidemic. Responding to questions from the press, Bozinovic said that introducing a curfew was never an option and that there would definitely not be another lockdown like the one in the spring. Opposition leader calls on PM to discuss together fight against COVID ZAGREB, Nov 24 (Hina) - Social Democratic Party leader Pedja Grbin on Tuesday called on the Prime Minister to convene a meeting with the opposition because, he believes, all political stakeholders are supposed to contribute to improving the health and economic situation affected by the corona crisis. "Croatia has one of the worst situations in the European Union today, with a large number of people infected, and the ratioof people infected to those tested is enormous," said the Opposition leader. "We have had a large number of fatalities which in November amount to 50% of the total number of those who have died. We cannot compare the current situation with that of July or during the summer and the government did not use the summer to prepare the Croatian health system for what wasto come in the autumn even though a lot of people in the health system had warned of what would occur," the head of the Social Democratic Party (SDP) said in parliament, calling out the government for not doing the job itshould have. He recalled that the opposition, and in particular the SDP, had already called on the prime minister to sit down for talks, pointing out the examples of Norway and Finland who have the best response to the crisis which resulted in serious cooperation between the ruling majority and opposition and that that is crucial for citizens to comply with restrictions. Grbin commented on Monday's meeting of the National Security Council saying that the most important thing in that regard was that the meeting hadfinally been held because talks werethe preconditionto resolving any sort of problem, including those related to national security. "It's good that a high level of consensus was achieved regarding the radicalisation of society however, an entire setof outstanding issues remain such as a response to the crisis in the health sector and economy that has been caused by the COVID-19 epidemic. The security council meeting is a good step in the right direction and with this resolving the problem has not ended but has only just begun," said Grbin. Restrictions in force in Varazdin County should be introduced countrywide, says daily ZAGREB, Nov 24 (Hina) - Experts demand that stricter epidemiological measures be introduced right away and that the restrictionsin force in Varazdin County be introduced countrywide, the Vecernji List daily issue of Tuesday reports. Many of the prominent scientists sitting on the government's scientific advisory council are in favour of urgently introducing stricter epidemiological measures than those in force, the daily says. "Among other things, one should try to limit family gatherings because at this stage of the epidemic, such gatherings are sufficient for the uncontrolledspread of the virus. I can understand why one is not opting for a complete closure, not only of businesses but also of schools, notably lower grades, but some activities that include gatherings as the main source of the spreading of the virus must simply be banned and breaches must be penalised," said one of Croatia's leading viral immunologists, Stipan Jonjic. Epidemiologist Branko Kolaric says that over the past 14 days Croatia has been fourth in the EU in terms of the number of new infections, with an incidence of 894.7 infections per 100,000 inhabitants, and that only Austria, Slovenia and Luxembourg are worse in that regard. Some EU countries were right to introduce stricter measures before the surge in the number of new infections and they did so exactly to prevent it, says Kolaric. New epidemiological restrictions introduced in counties ZAGREB, Nov24(Hina) - The national COVID-19 response team on Monday decided to introduce, at the request of the local health authorities, new epidemiological restrictions for Zagreb County, limiting the number of attendees atcultural events, includingfilm screenings, to50. Face masks will be obligatory in enclosed spaces wherepublic or business activity is performed and where cultural and other events, religious or other social gatherings are held, if it is not possible to keepa minimum two-metre distance. As of Tuesday, visits to retirement and nursing homes are banned and it has been recommended that visits to other welfare institutions be suspended as well. Employees of medical institutions, kindergartens and schools as well as providers of social services have been advised not to participate in larger gatherings. Residents of Zagreb County have been advised not to leave the country unless they have to for business or personal reasons. The said restrictions will be in force in Zagreb County until December 31. The national COVID-19 response team on Monday also decided to ban masses and religious gatherings in Sali, Zaglav, Zman and Luka, communities on the island of Dugi Otok. The restriction, imposed at the request of the Zadar County COVID-19 response team, will be in force from November 24 to December 15. Businesses are making an effort to comply with anti-COVID measures - survey ZAGREB, Nov 24 (Hina) -Businesses are making an effortto comply with epidemiological measures at points of sale, according to a survey on how much people feel safe when going to the shops, visiting restaurants and bars and in their everyday outdoor activities. The survey was carried out in 15 countries in Europe and Africa between October 25 and November 13. It was organised by the Mystery Shopping Providers Association (MSPA) Europe/Africa, of which the Croatian agency Heraklea is a member. Heraklea hired mystery shoppers who made 116 visits to restaurants, bars, banks, supermarkets, retail shops, pharmacies, petrol stationsand other points of sale in Croatia, the mystery shopping agency said in a statement on Tuesday. Its mystery shoppers checked compliance with internationally recognised epidemiological measures aimed at preventing the transmission and spread of the COVID-19 disease, including sanitisation, signage, physical distancing, staff protective equipment and customer mask wearing. The survey found that insufficient compliance with the necessary hygienic measures has an unavoidable impact on health and the economy as 9% of customers said that they did not feel safe at the place they visited, which means that one in ten customers was potentially lost, the statement said. The survey also found that 8.5 out of 10 customers would recommend the place they visited to others. "This is seemingly a good result, but some businesses failed to make a good impression, while we are dealing with a continued threat from the virus," Heraklea said. It said that despite good scores in some areas, over 30% of staff failed to observe physical distancing rules, and half of locations failed to ensure proper customer distancing. "Customers and staff frequently ignored safety measures, so businesses need to consider what to do to enforce the epidemiological measures where they can, because signage is not always enough," the statement said. The survey also showed that both staff and customers should change their behaviour. In Croatia, it is necessary to increase the physical distance between staff and customers, and it is important that businesses themselves ensure this to increase customer confidence and sales, protect future revenues and mitigate the risk of infection, Heraklea said. Corporate compliance important for attracting investors, conference says ZAGREB, Nov 24 (Hina) - A conference on the importance of compliance in business processes was held in Zagreb on Tuesday to raise awareness of compliance with rules and regulations as a mechanism that increases efficiency and productivity and reduces corruption and irregularities. The conference was organised by the Croatian Employers' Association with the support of the Institute for Compliance, Criminal Compliance and Anti-Money Laundering (ICCrA). "More compliance means less corruption, fewer scandals andbusiness irregularities, greater responsibility and success in doing business and better relations in society," HUP Director-General Damir Zoric said. US Ambassador to Croatia Robert Kohorst said he saw compliance as the key to promoting success in business. Speaking of the investment environment in Croatia, Kohorst said that the government had taken positive steps in recent years by simplifying the procedure to start a business and cutting red tape. He also mentioned the government's anti-corruption strategy for the next ten years, saying that it would be an important tool in combating corruption. Kohorst said that the government efforts and support for developing a culture of corporate compliance was an important part of Croatia's goal as a destination for American and other foreign companies, adding that it was necessary to continue implementing reforms aggressively. He said he was confident that U.S. companies wanted to come to Croatia, but the investment climate remained a challenge. Improving corporate compliance and risk management will complement government efforts to make Croatia a more attractive investment destination, the US ambassador said. ICCrA President Davor Iljkic said that the Institute's working group was developing compliance guidelines in partnership with the HUP and that he could see no reason why the government would not adopt them once they were finalised and presented to the public. Iljkic described compliance as "a vaccine against corruption" that would lead to an orderly economy and attract investors, stressing that compliance standardsshould be observed by both private and state companies. He said that the government's decision to introduce compliance rules in state-owned companies in October last year truly marked the beginning of the fight against corruption. Croatian president receives founder of Turkish Rixos Hotels ZAGREB, Nov 24 (Hina) -President Zoran Milanovic on Tuesday received the founder of the Turkish Rixos Hotels group, The land of Legends, and SML Construction Co,FettahTamince, the president's office said in a press release. During the talks Tamince informed President Milanovicof the Rixos company's business and the possibility of expanding its business operations in Croatia. Tamince,one of the leading entrepreneurs in Turkey, does business in many countries and apart from owning the Rixos Hotels in Croatia, he owns and manages 12 luxurious hotels around the world, which is one of the fastest growing hotel chains. During the reception in Zagreb, he was accompanied by a member of the board at TheLand of Legends company, Murat Suglun. After intensive reconstruction, which costHRK 150 million, the Rixos Premium Dubrovnikhotel was opened in June this year. Rixos Hotels are part of the international Accor hotel brand and has hotels in Turkey, the United Arab Emirates, Egypt, Switzerland, Russia, Kazakhstan and Croatia. Premium isthe highest category of hotels within the group. Gender pay and pension gap is a social problem, says ombudsman ZAGREB, Nov 24 (Hina) - A conference "Equal rights - equal pay - equal pensions," on Tuesday discussed ways to reducethe risk of poverty for women, and of the social problem of the gender pay and pension gap, which in Croatia amounts to 12.74 percent. According to available datafrom the national statisticaloffice the average gross wage for employees in legal entities in 2018 amounted to HRK 8,837 for men and HRK 7,711 for women, which indicates that the pay gap is 12.74%, Gender Ombudsman Visnja Ljubicic said opening the conference. The conference was held in the month that marks Equal Pay Day which was observedon November 10 this year. Croatia better than EU average for gender pay gap Labour and Pension System Minister Josip Aladrovic underlined that according to ***Eurostat*** ***data*** Croatia fares better than the European average. In Croatia that gap is 10.5% whereas the European average is 14.8%. The thing that is concerning is that the impact of the COVID-19 pandemic has led to a lot of lay-offs on the global level which will probably have a negative impact as far as gender differences in wages are concerned. Lay-offs in weaker paid sectors such as the textile industry where there was already a certain dose of uncertainty considering lower incomes and precariouscontracts in fact affects women who are more predominant in that industry, said Aladrovic. Science and Technology Radovan Fuchs underlinedthat women have exceeded men in education but the fact that more women have higher qualifications does not mean equal representation in research as men are predominant in technical fields. Research has shown that statistical differences exist in income for men and women and Fuchs noted that the cause could be the greater representation of women at lower levels of the hierarchy and lower paid jobs. The research shows that women work longer and have more breaks for maternity and parental leave and are more likely to choose flexible forms of employment to balance work and private lives. "That is why it is important to do awaywith stereotypes and traditional male and female jobs and careers and design mechanisms that will enable women to balance working and private lives," said Fuchs. Minister: Amendments to Enforcement Act protect dignity of debtor and rule of law ZAGREB, Nov 24 (Hina) - Justice and Public Administration Minister Ivan Malenica said in parliament on Tuesday that the amendments to the Enforcement Actwould protect the dignity of debtors and establish a balance between debtors and creditors. Presenting the bill in parliament, the minister said that they would add balance and improve the existing system and that procedures would be conducted faster, cheaper and be more economicalwhile at the same time protecting the rights of debtors and creditors. According to ***data*** from the FINA financial agency at the end of October there were 247,000 consumers who had not settled due debts which is a mild increase compared to March when there were 238,000, said Malenica. "Taking into consideration that the outbreak of the epidemic resulted in a reduction of economic activities which consequently led to the loss of jobs and reduced citizens' purchasing power, it was essential to intervene and to protect the dignity of debtors while retaining the principle of proportionality between the interests of debtors and creditors," said Malenica. One of the novelties proposed is electronic communication between stakeholders with online applications to public notaries to launch proceedings and that cases be assigned to public notaries equally in alphabetic order. It also prescribes that public notaries conduct these proceedings ascommissioners of the courts. The costs of proceedings would be reduced. Also, public notaries will act as court commissioners in the procedure. The amendments envisage that public notaries notify debtors that they can settle their debts within 15 days, in which case there will be no cost to the enforcement procedure. Furthermore, evictions will not be carried out from November 1 to April 1 and the amount of the principal for which the foreclosure on a property cannot be initiated is being raised from HRK 20,000 to 40,000. The type of income which cannot be enforced will now include Christmas and Easter bonuses, holiday cash grants and other financial bonuses. Opposition criticise amendments to Enforcement Act as cosmetic Opposition MPs on Tuesday criticised the draft amendments to the Enforcement Act as cosmetic and stopgap measures that would only benefit public notaries. Pedja Grbin of the Social Democratic Party (SDP) said that by proposing such amendments the government was trying to pulling the wool over the eyes of debtors and that there were no technical requirements for e-enforcement procedures. Grbin said that the SDP was in favour of imposing a moratorium on enforced ***collection*** actions. Zvonimir Troskot of the Bridge party said that the purpose of the legislation was to protects 300 public notaries and their families to the detriment of 300,000 enforcement debtors. Darko Klasic of the Croatian Social Liberal Party called for fine-tuning the proposed legislation and criticised the declaration of public notaries as court commissioners. All opposition amendments to bill on aliens rejected ZAGREB, Nov 24 (Hina) - Representing the government in parliament on Tuesday,Interior MinistrySecretary- General Zarko Katic turned down the Opposition's32 amendments to the final draft bill on aliens with one amendment by the parliamentary Legislation Committee being adopted albeit it was of a technical nature. The majority of the rejected amendments were tabled by the left-green bloc who had called for the requirement to produce a certificate of not having a criminal record to be abolished due to objective circumstances. Katic rejected the amendment as well as one which would defer legal actions before the Administrative Court and an amendment according to which a person without citizenship would not be required to produce any travel documents. Considering that some of the proposed amendments related to the area of employment, Katic explained that it is necessary to differentiate between work permits from applications for residency. MP Katarina Peovic (Workers' Front) had tabled an amendment to which Katic respondedthat employers have to fulfill the set conditions with Peovic warning that after quotas for foreign labour had been abolished employers can import workers how they like and that there is no test of the labour force on the market to see whether someone in Croatia might apply for a particular job. She recalled that the average wages for Croatian workers were 37% of the European average and said that there was an enormous number of time-restricted contracts claiming that working conditions in Croatia were exploiting workers and that ***statistics*** were being manipulated with. Katic explained that the government would propose an immigration policy that would be coherent so that Croatia's economy can obtain a labour force and that foreign workers can contribute to building Croatian society together with Croatian citizens. Opposition says denied constitutionally guaranteed rights ZAGREB, Nov 24(Hina) - After quarrelsabout the number of MPsallowed to attendthe parliamentary session on Tuesday, Croatian Sovereignists and Bridge MPs warned that MPs were still denied their constitutionally guaranteed right to workwhile at the same time there were no MPs of the ruling majority in the parliament. "The decision that only one person can speak in parliament on behalf of the Croatian Sovereignists,two on behalf of Bridge and three on behalf of the Homeland Movement is unacceptable. We can agree that there can be a maximum 41 persons in the parliament hall due to the epidemiological situation, but it should be irrelevant which group they come from,"MP Marijan Pavlicek told reporters. On the other hand, there are no members of the ruling majority in the parliament, he said, adding that it should only be important that there are no more than41 deputies in the parliament hall. "When the parliament hall is empty and there are no MPsof the ruling majority, why wouldn'twe be allowed to be there, regardless of which party group we come from," said Pavlicek. Bridge MP Marin Miletic said that they were "evicted from the parliament by Speaker (Gordan) Jandrokovic" and that the decision was both ridiculous and sad, noting that 13 hours ago five Bridge MPssat in the parliament hall and that Deputy Speakers Zeljko Reiner and Ante Sanader did not mind it. "Yesterday we could be in the parliament hall, but not today not even though there was not a single HDZ MP in the parliament either yesterday or today. As regards cooperation, this is not a good message," said Miletic. As for the fact that the government rejected all 160 amendments put forward by his party to the state budget and the budgets of extra-budgetary users for 2021, Miletic said that it was an act of arrogance. Of some 300 amendmentsput forward by the Opposition, the parliament accepted only four, two by Social Democrat MP Vesna Nadj, one by the Istrian Democratic Party (IDS) group and one by independent MP Marijana Petir. The parliament will vote on the amendments and the state budget for 2021 on Wednesday. Education minister says teachers union's demands are over the top ZAGREB, Nov 24 (Hina) - Science and Education Minister Radovan Fuchs said on Tuesday that the demands by the Preporod teachers' union, which has announced a protest rally for Wednesday, were over the top. "I think their demands are rather questionable and problematic, especially now that this government has honoured all of its promises despite the projected GDP decline in the last quarter," Fuchs said in an evening news programme on the RTL commercial television channel. "These additional demands are a bit over the top," he added. Fuchs said that representatives of the protesters would be received at the Ministry "by someone at the level of state secretary at least." The Preporod union has announced a protest rally for Wednesday to draw attention to problems faced by teachers during the coronavirus outbreak, including the conduct of both online and in-person classes, teachers' costs of holding online classes, and sick leave pay. Vukovar gets new Homeland War memorial: shell embedded in footpath ZAGREB, Nov 24 (Hina) - Vukovar has a new memorial to the Homeland War in the town's centre downtown in the form of a shell embedded in the footpath with a tree growing above it so that it can be visible to passers-by. "Today we are presenting an exhibit to the public, a new memorial that we locally refer to as the shell because it represents the shells that fell onto the city and represents an authentic mortar shell tail with a diameter of 82 mm which was unearthed in Olajica downtown quarter. This is yet another of the rare remnants from the Homeland War that we have in Vukovar, luckily because most public spaces have been rehabilitated," Vukovar Mayor Ivan Penava said at the unveiling ceremony. According to Penava that memorial has both tourism and educational purpose because it testifies to everything that occurred in Vukovar in the autumn of 1991 andthe aggression that the town was brutally exposed to during the three-month-long siege by the former Yugoslav peoples' Army (JNA) and Serb paramilitary forces. "Unfortunately, it is missiles like this thattook the most lives in Vukovar with 70% to 80% of civilian victims being killed by shrapnel from mortar shells," said Penava. The authentic shell has been placed at the bottom of a glass box together with an appropriate text which has been embedded in the footpath. Referring to the recent memorial parade, Penava said that everything was conducted according to plan in a dignified way and that city authorities did everything in their power for epidemiological measures to be adhered to. SABA leader warns destruction of memorial heritage continues ZAGREB, Nov 24 (Hina) -The head of the Association of Antifascist Fighters and Antifascists of Croatia (SABA), Franjo Habulin, has strongly criticised what he describes as a policy of erasing the memory of the WWII antifascist struggle through ongoing monument destruction, with 3,000 memorials having been destroyed to date. In a statement issued on Tuesday, Habulin says the "virus of defaming antifascism and flirting with fascism" started at the time when Croatia gained independence and had since become a lasting component of the national political and public scene, with around 3,000 monuments commemorating World War II partisan fighters and victims of fascism having been destroyed. Habulin believes that this laidthe groundwork for "the rehabilitation of Ustasha ideology as Croatian patriotism". Even though the government has announced that it will fight right-wing radicalism, the policy of erasing the memory of the antifascist struggle continues, Habulin says, noting that there are plans to remove or convert memorials honouring WWII antifascist fighters and victims of fascism in the municipalities of Perusic, Hum na Sutli and Martijanec. A free and independent Croatia, which all its citizens will feel as their homeland, can only be built on the lasting values of antifascism, says Habulin. 59 die to COVID-19 in Slovenia; government calls for rigorous penalties ZAGREB, Nov 24 (Hina) - Slovenia has registered 1,302 new cases of coronavirus in the past 24 hours and 59 people have died, the highest number to die in one day yet, the government said on Tuesday, calling for rigorous penalties for anyone failing to adhere to measures against COVID-19. The ***data*** is not encouraging at all and the epidemic is not calming down, the government's COVID spokesman, Jelko Kacin, told a press conference. Since it is estimated that one of the main causes of the virus continuing to spread is non-compliance with epidemiological measures, thegovernment has forwarded a bill to parliament to ramp up penalties for violations, with the maximum fine being set at as much as €10,000, compared to the €400 finesthat were in force in the spring. The Opposition considers the fines to be disproportionateand has called on the government to communicate better with citizens. Epidemiologists are concerned that despite restrictions, the number of new infections is still high as is the number of hospitalised patients and fatalities. According to ***data*** published by Slovenia's health ministry, the number of active cases is 20,337 while the 14-day incidence rate is 970 and the number of people seeking hospital treatmentis continuing to increase. There are currently 1,299 COVID-19 patients in hospitals, 204 of whom are in intensive care units. Slovenia's health minister sceptical about massive testing Earlier in the day, Health Minister TomazGantar expressed doubts about mass testing for coronavirus, saying that tests should be directed ataged care facilities and medical staff. Last week Prime MinisterJanez Jansaannounced a plan to mass-testthe population by using antigen tests to determine the incidence rate of infection in the population. Gantar, however,has said that this is questionable because of limited capacity and that he saw the proposal for mass testing primarily as targeted and systematic testing of medical staff and residents and staff of aged care facilities. Only after they are tested should fast antigen tests be made available to those who wish to get tested, said Gantar. According to Gantar, there is insufficient personnel to conduct mass testing because in the past 14 days 1,080 medical staff have come down with the virus and they need to be tested twice a week while the government's decision to testresidents of aged care facilities means 20,000 tests a week. He also wondered about the purpose of mass-testing the entire population with antigen tests, given thatthey are not as reliable as molecular tests. Gantar also warned that in the current situation, when the number of hospitalised patients is continuing to grow, easing epidemiological measures would be a mistake and very dangerous. Bosnia reports 1,129 new coronavirus cases, 49 fatalities ZAGREB, Nov 24 (Hina) -Bosnia and Herzegovina has registered 1,129 new cases of coronavirus with 49 fatalities in the last 24 hours, the country's healthauthorities reported on Tuesday. Since Monday slightly fewer than3,500 swabs were taken confirming 717 positive cases in the Federation entity and 412in the Republika Srpska entity. The latest figures are lower than last week's average and it seems that the virus has stagnated over the past ten days. The Federation entity's coronavirusresponse team extended until the end of the year its decision on mandatory wearing of masks both indoors and outdoors andan overnightcurfew for everyone except those who have to go to work at that time. Since the outbreak of the epidemic in the country in March, more than 81,000 people have been infected and almost 2,400 have died as a consequence of SARS-CoV-2. Montenegro extends curfew, bars and restaurants to work until 6 p.m. ZAGREB, Nov24 (Hina) - Montenegrin health authorities on Monday decided to extend a previously imposed curfew to make it last from 7 p.m. to 5 a.m., two hours more than previously prescribed, while bars and restaurants will have to close at 6 p.m. The country's health authorities opted for the latest restriction due to what they describe as a "very complex epidemiological situation" and the restrictionwill go into force at midnight on Wednesday and last until December 8. Leading epidemiologist Boban Mugosa said that the transmission of the virus is very high and that the authorities must not allow the collapse of the health system. The section of the hospital in the capital Podgorica intended for COVID-19 patients has been filled to two-thirds of its capacity and the situation is similar in hospitals in the rest of the country. Health officialNermin Abdic said that 91 COVID-19 patients are being treated in the Podgorica hospital and that as many as 42 of them are in critical condition. "A total of 73 COVID-19 patients who are receiving treatment in hospitals around the country are in critical condition," Abdic said. In the last 24 hours, 556 new coronavirus infections have been confirmed while five patients have died. According to local health authorities, there are currently 11,132 active cases in the country, and since the outbreak of the epidemic there have been 31,062 positive cases, which is more than five percent of the total population being infected with the virus. Based on information published on the Worldometers.info website, Montenegro has the third highest number of coronavirus cases per one million people. A total of 439 patients have died in Montenegro since the outbreak of the epidemic, which ranks the country 17th for the number of fatalities (699) per one million people. Serbia reports rise in coronavirus cases, 37 deaths in last 24 hours ZAGREB, Nov 24 (Hina) - Serbia on Tuesday reported a further rise in the number of new coronavirus cases, with nearly 7,000 infections and 37 related deaths in the last 24 hours. According to the country's Health Ministry, 21,476 samples were tested, the largest number in a single day to date, of which 6,842 returned positive. The number of infected people requiring hospital treatment increased from 6,329 on Monday to 6,478, and 225 of them were on ventilators, nine more than on Monday. Since the outbreak of the epidemic in the country in early March, 1.66 million samples have been tested and 133,028 have returned positive. The death toll has reached 1,274. The mortality rate fell from above 2% at the height of the second wave of the epidemic to 0.96% on Tuesday. In other news: Croatia and Dubrovnik among best travel destinations for Americans ZAGREB, Nov 24 (Hina) - Dubrovnik and its surrounding area have been included among the 10 best European travel destinations for Americans for 2021, and Croatia is listed among 20 countries where Americans can travel to this winter with proof of a negative coronavirus test result, the Croatian Tourist Board said on Tuesday. In an article headlined "Top 10 best places to visit in Europe in 2021", Conde Nast Traveler magazine included Dubrovnik and its surroundings in ninth place, describing the medieval walled city as a popular destination for Game of Thrones fans. The nearby small island of Lopud was highlighted for the beauty of a 15th century Franciscan monastery and for its stone houses and exotic gardens. The TravelPulse website included Croatia among 20 countries Americans can travel to this winter. "Croatia is one of the few exceptions when it comes to Europe's ban on travel from the U.S. Americans can visit this Adriatic gem with proof of a negative COVID-19 test result taken within 48 hours of their arrival," it said. No new cases of bird flu on Croatian farms ZAGREB, Nov24(Hina) - There havebeen no new cases of infection with the avian influenza virus in Croatia after the detection of the infection on a poultry farm near Koprivnica in mid-November, the ***Agriculture*** Ministry said on Tuesday. As soon as the bird flu was detected, several thousand turkeys were euthanised on the poultry farmin the village of Novigrad Podravski in Koprivnica-Krizevci County. Other measures were also taken to prevent the spread of the infection, including a ban on the transport and transfer of animals in that area. The virus detected on the farm wasH5N8 bird flu, and the possibility of its transmission to human beings has not been confirmed to date. ZSE indices close in red ZAGREB, Nov 24 (Hina) - The main Zagreb Stock Exchange (ZSE) indices closed in the red on Tuesday, with the Crobex falling by 0.34% to 1,690.23 points and the Crobex10 by 0.50% to 1,055.11 points. Turnover at the close of the trading session reached HRK 7.5 million, about 800,000 higher than on Monday, and three stocks passed the turnover mark of one million kuna. The highest turnover, of HRK 1.3 million, was generated by the HT telecommunications company's stock, which closed at HRK 176.50 per share, down by 0.28% from Monday. The preferred stock of the Adris insurance and tourism group turned over HRK 1.2 million, its price rising by 1.08% to HRK 375 per share. The Podravka food company's stock turned over HRK 1.03 million. Its price dropped by 0.65% to HRK 462 per share. Thirty-nine stocks traded on the ZSE today, with 15 of them recording share price increases, 17 registering price decreases and seven remaining stable in price. 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EGi Web News

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LISTEN: At Knight Frank’s annual London breakfast briefing, the need for real estate to continue to shift the dial when it comes to customer service was made abundantly clear.

Buildings without occupiers are valueless and occupiers – and their employees – are becoming increasingly discerning and demanding when it comes to space requirements. Office space is now much more than just a cost to occupiers, it can be the difference between winning and losing commercial.In this podcast we talk to Lee Elliott, global head of occupier research at Knight Frank, about what landlords need to understand about their customers to have “property with purpose, property that performs and ultimately property that prevails”.To send feedback, e-mail [*samantha.mcclary@egi.co.uk*](mailto:samantha.mcclary@egi.co.uk) or tweet @samanthamcclary or @estatesgazette

JOURNAL : Farmers Weekly

For livestock farmers signed up to the Red Tractor Assurance scheme, an annual review of antibiotics use is required to meet assurance criteria.

Vet Tim Potter from the VetPartners group says this process should be seen as an opportunity to focus on improving animal health and reducing antibiotics use, rather than just being a tick-box exercise.

Below, Dr Potter explains the four key stages to carrying out a review, takes a look at how each sector has progressed and what their focuses should be.

1. Identify what antibiotics are being used for

As a starting point, review the total amount of antibiotics bought over a 12-month period to help identify what they have been used for and when.

Once you understand your antibiotics spend, the information can be used to help prioritise which areas of animal health need improving to reduce antibiotics.

See also: How a farmer-led project helps dairies reduce antibiotics use

For example, if 75% of antibiotics spend is for treatment of calf pneumonia, this is a solid indicator that preventing the disease will save money and improve animal health.

An antibiotics review is also a useful opportunity to check and review standard treatment protocols.

For each medication, make sure you clarify the situations when it should be used, the correct dose and how to administer it. Misconceptions are incredibly common, so it’s worth clarifying these questions with your vet.

2. Review relevant ***data***

Other forms of herd or flock health ***data*** can be used in conjunction with antibiotics spend to plan how to change management practices.

The types of ***data*** worth evaluating vary depending on species and at what point antibiotics are being used.

For example, if the highest proportion of antibiotics spend is during lambing, consider performance ***data*** related to lambing. Farmers and vets can go over the trends in numbers born and weaned, to identify when losses arise.

For dairy farms treating mastitis, it will be cell counts and the rates of clinical cases, combined with bacteriology results.

3. Strategy to prevent disease

Once a priority area has been identified, changes can be made to help prevent the occurrence of disease.

This may include tightening biosecurity protocols, considering vaccine use to improve immunity or, in some instances, infrastructure changes.

As an industry, there have been a lot of quick wins in terms of reducing antibiotics use. This means farmers and vets increasingly need to look at systems as a whole.

4. Check the effect of changes on antibiotics use

Antibiotics reviews are not required by law, however, they are part of the Red Tractor Assurance scheme and therefore many livestock farmers do carry out an annual review.

The best time to review progress with a vet will depend on the disease or condition that is being tackled.

If antibiotics are mainly used to treat seasonal issues – for example, at lambing, it is worth reviewing before and after lambing.

On a dairy farm calving year round, there are more likely to be constant challenges, in which case a six-monthly review will be beneficial.

How are antibiotics used today?

Sheep

Historically, there have not been high levels of use of highest-priority critically important antibiotics (HP-CIAs) in sheep.

The areas of focus identified by Responsible Use of Medicines in Animals (Ruma) (PDF) included reducing antibiotics when treating:

Lameness

Ewes in late pregnancy to avoid abortion

Prophylactic treatment of all newborn lambs against neonatal disease

Beef

In beef, the key areas have been to reduce antibiotics use to treat infective lameness, mycoplasma, respiratory disease, calf scour, calf navel ill, calving problems and caesareans.

There has been a shift away from using HP-CIAs in beef over the past few years, although use was never high.

Dairy

In dairy, antibiotics are most commonly used in treating mastitis, infective lameness and reproductive disease.

In terms of HP-CIAs, there has been a shift away from third- and fourth-generation cephalosporins to treat lameness and reproductive infections. These were previously used frequently because they had a short milk withdrawal period.

Fluoroquinolones were being used to treat toxic mastitis; this has dropped as people have focused more on prevention and supportive therapy.

JOURNAL : Farmers Weekly

Channel 4’s How to Steal Pigs and Influence People documentary has drawn more than 300 complaints, Farmers Weekly can reveal.

Dozens of angry farmers and people in the ***agricultural*** industry have contacted the broadcasting regulator Ofcom after the programme aired on Tuesday (14 January).

Hosted by presenter Tom Costello, the documentary featured vegan activists “liberating” pigs from farms.

See also: 7 ways to deter incursions by pig activists

The main focus was an incursion on an unsuspecting Lincolnshire pig farm by animal rights movement Meat the Victims, led by vegan activist Wesley Omar, who shared the footage online to a number of followers.

The overall response to the programme was unsympathetic from the public, who questioned the motives of the vegan activists after they admitted the heists would increase their following on social media and attract thousands of pounds in crowdfunding.

Sponsorship dropped

4x4 manufacturer Mitsubishi Motors withdrew its sponsorship of the programme following complaints by the National Pig Association (NPA) and other farming groups.

Ahead of the documentary being shown, Channel 4 defended its decision to air the programme, saying “it complies with the Ofcom Broadcasting Code and does not condone or encourage criminal activity”.

But the NPA branded C4’s decision to air footage of vegan activists embarking on multiple cases of illegal theft as “irresponsible” and it is taking legal advice about the programme, which it said “showcased blatant criminal activity on farms”.

A spokesperson for Ofcom told Farmers Weekly: “We have received 313 complaints about the C4 programme, How to Steal Pigs and Influence People.”

[*https://twitter.com/RuralCrimeNtwk/status/1217434548612608002*](https://twitter.com/RuralCrimeNtwk/status/1217434548612608002)

The watchdog said it was looking at the complaints made against the programme before deciding whether to launch its own investigation.

“We are assessing complaints about this programme against our broadcasting rules, before deciding whether or not to investigate,” the spokesperson confirmed.

Unions concerned

The four main UK farming unions – NFU, NFU Cymru, NFU Scotland and the Ulster Farmers’ Union – said they were “deeply concerned” that C4 had decided to air the documentary, given the “dreadful impact” that these attacks have on the health and wellbeing of farmers.

They said they wanted to understand what efforts the broadcaster had made to pass on to police any criminal behaviour either filmed or featured in the programme.

“We do not understand why farming families are being seen as fair game by the broadcaster and treated differently from other British citizens who all have the right to be protected from criminal behaviour and not to see those criminals given airtime and profile,” they added.

Livestock farming has come under fire this month during the Veganuary campaign, which urges people to ditch meat and switch to a plant-based diet.

But despite the campaign, according to the AHDB meat sales remain strong and the proportion of people in the UK actually living a vegan lifestyle is less than 1%.

[*https://twitter.com/MissKCross/status/1217213468039884800*](https://twitter.com/MissKCross/status/1217213468039884800)

JOURNAL : Farmers Weekly

Greater power for tenants, modified succession rules and new guidance for rent reviews are among the changes proposed in the new ***Agriculture*** Bill.

The 2020 ***Agriculture*** Bill was introduced on Thursday (16 January), after an earlier version was dropped following the dissolution of parliament for the 2019 election.

The new Bill, which applies specifically to England, contains some key differences to the previous version in relation to ***agricultural*** tenancies.

See also: What the new ***Agriculture*** Bill contains for farmers

In Schedule 3, it proposes several amendments to the ***Agricultural*** Holdings Act 1986, following the tenancy reform consultation last summer.

Restrictive clauses

The most significant, according to the Tenant Farmers Association (TFA), is the introduction of provisions for tenants to object if landlords refuse consent for changes necessary to enter new financial assistance schemes or meet new regulations.

Tenancy agreements governed by the Act typically contain restrictions to prevent tenants from undertaking activities which will change the land use or fixed equipment of the holding without first gaining consent from their landlord.

Examples of restrictive clauses include those covering erecting or altering buildings, sub-letting, changing ***agricultural*** production, or diversifying into non-***agricultural*** activities.

These could create difficulties for some tenants in accessing public money for public goods, the government’s current favoured system for replacing the Basic Payment Scheme.

Concerns were also raised that such clauses may prevent tenants undertaking activities necessary to meet new regulatory requirements, such as updating or putting in new slurry stores to meet water pollution prevention regulations.

The Bill proposes giving tenants the right to apply through arbitration or third-party determination to resolve such a dispute.

George Dunn, TFA chief executive, said: “This will give tenant farmers the confidence they need to participate as they desire in whatever new schemes the government brings forward.”

More arbitrators

The Royal Institution of Chartered Surveyors (RICS) is currently the only organisation that can appoint arbitrators, but this could be set to change.

Extending this list to include the Central Association of ***Agricultural*** Valuers (CAAV) and the ***Agricultural*** Law Association (ALA), the Bill aims to widen the choice for tenants and landlords, and improve the quality of the services offered.

Minimum retirement age

The Bill proposes amending the minimum age (currently 65) at which applications to the tribunal for succession on retirement can be made, so that such applications can be made at any age in the future.

Currently, Case A of the 1986 Act states local authorities can issue tenants a retirement notice to quit at age 65. This could be replaced with pensionable age, in line with State Pension legislation.

Succession on death or retirement

The commercial unit test – which specifies that a tenant who already occupies a commercial unit of land is not eligible to succeed to an ***Agricultural*** Holdings Act tenancy – would no longer apply under the new plan.

Meanwhile, the criteria for determining a person’s suitability to become a tenant ("the suitability test") could change and must relate to the person’s capacity to farm the holding commercially to a high standard, both of efficient production and care for the environment.

Louise Staples, NFU senior rural surveyor, said the team welcomes the efforts to expand those eligible for succession by removing the commercial unit test, as this could be key to productivity, though care must be taken to ensure this is workable alongside the principal source of livelihood test.

Ms Staples said: “The NFU would like to see the reform modernise and extend succession rights to include nephews, nieces, grandchildren and cohabitees. We have concerns in regard to the reform of the suitability test, including the wording ‘environmental care’, as there is no clear definition and this could be very subjective.”

Rent reviews

The Bill proposes replacing a demand for arbitration in the rent review process with a notice of determination, which may be followed by either arbitration or third-party determination.

Additionally, if by written agreement the tenant has agreed to make payments to the landlord for improvements to the holding that are wholly or partly financed by the landlord, such payments should be disregarded from considerations of changes to rent.

Any benefit to the tenant from the improvement should also be disregarded from rent considerations while the tenant is making payment for that improvement.

Further reform needed

Mr Dunn said the TFA is disappointed not to see all of the changes proposed in the tenancy reform consultation being brought forward at this stage, but understands there will be further discussions within the Tenancy Reform Industry Group to look at these in more detail.

Additionally, the association feels further measures are needed to assist older tenants into retirement, encourage landlords to let for longer periods of time and protect tenants from spurious notices to quit.

“Rather than supporting non-active landlords, it is also essential to ensure that future financial assistance properly supports active farmers – those in occupation of land, taking the entrepreneurial risk for the activities occurring on that land and in day-to-day management control,” Mr Dunn said.

“If the Bill does not spell this out, there will be a significant risk that public funding will be misdirected.”

JOURNAL : Farmers Weekly

Defra minister George Eustice has pledged to tackle poor profitability and look after farmers as the government pushes ahead with its plans to reform support for ***agriculture***.

Mr Eustice made the promise as the government reintroduced its ***Agriculture*** Bill to parliament on Thursday (16 January) – paving the way to phase out direct payments to farmers in favour of a new system largely based on environmental support.

See also: OFC 2020: Defra to push ahead with new farm support scheme

The government has long argued that direct payments based on the amount of land farmed unfairly skews taxpayer-funded support towards the largest landowners – rather than towards growers and livestock producers who deliver specific public benefits.

New measures

But the Bill contains a number of new measures, too.

This includes a new requirement for the UK government to regularly report on food security to parliament – including when food comes from, its availability and the resilience of the food chain (see "What’s new in Ag Bill?").

Defra says the new system of support – introduced over seven years from 2021 – will maximise the potential of land for food production while encouraging farmers to improve air and water quality, raise animal welfare standards, improve access to the countryside and reduce flooding.

Writing exclusively for Farmers Weekly, Mr Eustice said he recognised many farmers relied on direct payments for a large proportion of their income.

But rather than maintain a system that masked poor profitability, the ***Agriculture*** Bill would tackle its causes.

Grants would help farmers invest in new technology and equipment to reduce costs.

The Bill would also help improve transparency and fairness in the supply chain so farmers could “stop being price takers and start getting a fairer share of the cake”.

Risky business

Even so, Mr Eustice acknowledged that farming is a risky business.

And he added: “There will always be circumstances where the government must act and intervene in a crisis to support farmers or stabilise markets and the Bill makes provision for that, too.”

The Bill is expected to make a swift passage through parliament due to the government's large majority.

Although basic payments will be phased out as the new system is phased in, overall annual funding for ***agriculture*** will remain at current levels for the current parliament.

Later in the transition period, the government plans to delink direct payments from the requirement to farm land.

It says this will give farmers greater flexibility to plan their future by either investing the payments in their business, diversifying or retiring from the industry.

Mr Eustice said: “We want to make it easier for farmers to retire with dignity and simultaneously help new entrants get access to land.”

What’s new in Ag Bill?

Food security – requiring the UK government to regularly report on food security to parliament

Financial assistance – monitoring, evaluating and regularly reporting on financial schemes

Soil quality – helping farmers protect and improve soil quality, including monitoring and research

Animal traceability – better ***data*** ***collection*** relating to identification, movements and animal health

Fertiliser – effective regulation, including updated fertiliser definitions as technology advances

Organics – powers to tailor regulations so producers can continue to trade organic produce globally

Source: Defra

JOURNAL : Farmers Weekly

Waving goodbye to our Christmas trees and setting resolutions for the year ahead, many of us have gone into the New Year with ideas and changes we will make.

Despite this, every year the motivation and buzz gets masked for farmers by the return of Veganuary – encouraging people to ditch products from an animal origin for a whole month – the very same products we have all spent many months working to produce.

Last month, after writing about positivity in farming and how we can help ourselves recruit new farmers, I received so many messages from people involved in farming or wanting to join the industry.

See also: More columns from our young farmer writers

Many were speaking up about their farming experiences, telling stories of what made them proud to farm.

Farmer fear

Less than a month later, many have been silenced by this campaign, not wanting to speak out in fear of what might follow.

For me, this year has been the quietest ever in terms of Veganuary "noise".

I’ve seen many celebrities and TV presenters sticking up for British farmers, and I had to ask myself why we can’t stick up for ourselves.

I hate to think that anyone is scared of speaking out because of one campaign.

We are all entitled to our own views and we should proudly continue to support the British farming industry just as we do every other month.

We know the facts, and it’s our job to educate people on why British food really is of the highest standard.

We produce local, quality food and should be happy to say so – it really is something to be proud of.

Regain confidence

I hope we will regain the confidence to defend our industry, regardless of what’s going on around us.

Sharing farm anecdotes with friends or on social media should be done with pride, encouraging others to learn something new about where their food comes from.

It might seem the simplest fact or story to you, and it’s probably a job that feels like second nature, but it could be hugely beneficial in teaching someone else and protecting the reputation of our produce.

We shouldn’t be scared to tell our story – someone has to.

JOURNAL : Farmers Weekly

Farmers worried about meeting the three-crop rule because of impossible drilling conditions are being encouraged to consider their options if they want to safeguard the greening element of their Basic Payment Scheme (BPS) money.

Defra has yet to agree to any relaxation of the crop diversification rules for 2020, although the NFU is continuing to push for a derogation following the dismally wet autumn and winter.

Meeting the three-crop rule is important, as the greening element of BPS accounts for about 30% of its total value.

See also: Which rules are relaxed when farmland is flooded

Defra has recently published new guidance reminding farmers of their options if they continue to struggle to get crops in the ground because of extreme weather.

It also suggests that farmers start ***collecting*** evidence that will be helpful if they need to put in a request for a force majeure exemption as a last resort.

Current exemptions

If the area in fallow, temporary grass and leguminous crops together makes up more than 75% of the arable land, growers are exempt from the three-crop rule.

A further exemption may apply if more than 75% of all the ***agricultural*** area (all of the claimed land apart from woodland and ineligible areas) is permanent or temporary grassland.

Other guidance includes:

Land left uncropped can be managed to count as fallow for crop diversification requirements. Fallow and temporary grass each count as arable crops to meet the crop diversification rules.

Spring cropping can be used to help meet crop diversification rules, as spring and winter varieties count as different crops independent of their sowing date.

Failed crops can count as the crop originally established, or be managed to count as fallow land. However, supporting evidence such as seed invoices and delivery notes, crop records and photographs will be required if it is no longer possible to identify that the crop was in the field

Fallow management

Growers planning to use fallow land as a crop to count towards the three-crop rule are reminded that it must be present from 1 May to 30 June 2020 and the fallow management requirements must be met.

Anyone also wanting to use fallow land to meet their Ecological Focus Area (EFA) requirements must follow more restrictive management rules which apply from 1 January to 30 June 2020.

Force majeure

Defra has suggested that if bad weather or flooding continue to prevent farmers meeting the crop diversification requirements, growers may be able to claim under force majeure arrangements.

But it will not consider any force majeure requests until later in spring 2020.

For now, Defra is suggesting that growers start ***collecting*** evidence to support a possible future claim, if it becomes clear that it won’t be possible to establish spring crops.

Examples of appropriate evidence include rainfall ***data*** related to your farm or local area, seed invoices supported by delivery notes, evidence of your original cropping plans for 2020, and photographs showing the conditions in your fields.

Defra’s full guidance note on claiming BPS and greening payments in extreme weather can be found here.

JOURNAL : Farmers Weekly

Farm leaders and environmental campaigners have joined forces to secure a fair deal for British ***agriculture*** and the countryside.

New alliances are needed to ensure British farmers can continue to deliver high-quality food at affordable prices for consumers while looking after the environment – including measures to mitigate climate change, believes NFU leader Minette Batters.

Ms Batters was speaking as she launched her campaign to serve a further two years as NFU president.

Her bid to remain leader is unopposed, paving the way for her re-election by the union's ruling council next month.

See also: Defra to push ahead with new farm support scheme

“There is a critical need for us to reach out across all political parties – across society – and to really build stronger coalitions with the environmental NGOs,” she told NFU members during a hustings event at Wisley, Surrey.

Brexit

Farmers face an “extraordinary reset moment” with a completely new ***agricultural*** policy due to be introduced after the UK leaves the European Union at the end of this month, said Ms Batters.

It is the most important moment for the industry for 80 years, she added.

Brexit will see direct payments phased out – and replaced by a new support system largely based on rewarding farmers who deliver environmental measures, including protecting soil and water, enhancing the rural environment and combating climate change.

But then NFU and other organisations remain concerned that post-Brexit trade deals with other countries could see British farmers undermined by a flood of cheap food imports produced using methods that would illegal in the UK.

Mrs Batters and Friends of the Earth chief executive Craig Bennett have outlined their concerns in a joint letter to Defra secretary Theresa Villiers.

The same high standards must also apply to food imports – not just British food, they warned.

“We cannot have the situation where British farmers may be undercut by food producers operating in other countries to lower environmental, food or animal welfare standards,” said the letter.

CLA - transition scheme

With so many farmers reliant on direct payments for their income, the Country Land and Business Association (CLA) has also warned that any new system must be properly introduced, rather than rushed in a way that disadvantages British producers.

It wants the seven-year transition scheme to the new environmental land management (ELM) scheme delayed beyond its proposed start in 2021 until a proper adaptation programme is in place – providing grants, advice and training for farmers.

The new policy was a “once-in-a-lifetime” opportunity, said CLA president Mark Bridgeman.

But he added: “The vast majority of direct payments should not be removed until individual farmers are able to take up the new scheme.”

The government says it remains committed to maintaining high standards post Brexit.

A spokesman said: “The government will stand firm in trade negotiations to ensure any future trade deals live up to the values of farmers and consumers across the UK.”

JOURNAL : Farmers Weekly

It's back, and it's bigger and better than ever. Britain's Fittest Farmer has returned for 2020 to champion physical fitness and mental wellbeing in ***agriculture***.

The hunt is now on to find one man and one woman who will be crowned Britain's Fittest Farmers, with a £1,000 cash prize up for grabs for each winner.

Britain’s Fittest Farmer is a competition designed to encourage a vital discussion about the physical and mental health of our farmers in a fun and friendly atmosphere.

See also: Meet the 2019 Britain's Fittest Farmers – Sean Cursiter and Fiona Penfold

As farming becomes less active and more mechanised and office-based, it’s more important than ever before to make sure Britain’s farmers are getting the exercise they need to stay fit and healthy.

Farming can also be a stressful and occasionally isolated job, which is why this competition be focussed on the importance of mental health and wellbeing.

Watch the video and read more detail below.

For full competition details and to apply, visit the Britain's Fittest Farmer website. Read the full terms and conditions for this competition.

True grit

“This competition is all about getting our hard-working farmers to think more proactively about their health, both mental and physical," says Farmers Weekly's community editor Oli Hill.

“It aims to support farmers’ amazing work to put food on our plates and care for our countryside by helping them to ensure they are fit to farm.

“We're looking for farmers who make fantastic ambassadors for health and fitness in ***agriculture***, to help break the taboo of talking about mental health issues such as depression, eating disorders and rural isolation.”

After a hugely popular debut for the competition in 2019, Farmers Weekly has again joined forces with Farm Fitness – a unique outdoor gym with an ***agricultural*** twist set up by Essex farmer's son Tom Kemp.

See also: Visit our health and wellbeing page for useful advice and tips

Guest judge Tom and the Farmers Weekly team have been working hard to build on the strong foundations of the competition to make this year's the ultimate test of strength, agility, speed and stamina.

"We’re looking forward to going even bigger in 2020, with a true test of mental toughness, strength, power and endurance, whittling away the contenders until the last man and woman are left standing," says Tom.

"Farm Fitness is honoured to be partnering with Farmers Weekly to once again help in the hunt for Britain’s Fittest Farmer. It’s our ongoing mission to honour our ***agricultural*** roots, so this is a great privilege for us."

How the competition works

Round 1: Apply online

To apply, go to the dedicated Britain's Fittest Farmer website. Simply fill in your details, answer three questions about your ties with farming, what you do to keep in good shape and look after your mental wellbeing and upload a photo or video of yourself.

You don't necessarily need to be a farmer to apply, but you do need to be working within the ***agriculture*** sector. The competition closes for entries at 11.59pm on 17 April 2020.

View the contestants for Britain’s Fittest Farmer.

Round 2: Regional qualifiers

All applicants will be invited to compete in one of three regional qualifiers, to be held in Wiltshire, Leicestershire and the Scottish Borders in March and April.

The contestants’ all-round fitness will be put to the test in a variety of physical challenges. This is set to be an exciting series of events, with family and friends welcome to support contestants.

Qualifier 1: Melton Mowbray, Leicestershire – 29 March 2020

Qualifier 2: Marlborough, Wiltshire – 4 April 2020

Qualifier 3: Jedburgh, Scottish Borders – 18 April 2020

The judges will then select 10 men and 10 women to proceed to the final stages of the competition.

Round 3: The interviews

The competition's charity partner The Farming Community Network (FCN) is getting involved to help with judging the finalists' mental health awareness.

Each finalist will be interviewed by the judges on how they deal with stress, make an effort to socialise and promote a healthy mindset in themselves and others.

Round 4: The final

Our finalists will face one last challenge, the ultimate physical assault course designed to test their speed, power and endurance.

Held at Tom Kemp's Farm Fitness gym in Essex on 9 May 2020, finalists will battle through a series of blistering events.

Points from each round will be combined with scores from the interview round to see one man and one woman emerge as Britain's Fittest Farmers 2020.

Britain's Fittest Farmer: Our partners

Farm Fitness

Farm Fitness has rapidly become a burning beacon on the UK fitness scene, attracting spectators and participants from all over the country to come and take a swing at its almost alchemic blend of modified strongman, functional bodybuilding, calisthenics and blistering cardio efforts.

The gym, founded by farmer’s son Tom Kemp, was voted one of the best gyms in the world and 'coolest outdoor space' by Men's Health (PDF).

Tom has blended his farming background with his love of training to create a raw and exciting outdoor environment for people of all strengths and abilities to get fit.

The Farming Community Network

The Farming Community Network (FCN) is a voluntary organisation and charity that supports farmers and families within the farming community through difficult times.

The charity has helped thousands of people deal with a variety of issues, including financial difficulties, animal disease, mental health and family disputes.

Volunteers provide free, confidential, pastoral and practical support to anyone who seeks help, regardless of whether the issue is personal or business-related. FCN also runs a confidential national helpline and e-helpline.

JOURNAL : Farmers Weekly

Strong cast ewe prices have met resistance from buyers, leading auctioneers to fear that trade has hit a ceiling.

Prices are £20 or more up on the year for cull sheep across UK marts, with lowland sections seeing £100 averages and the very best of the heaviest ewes passing £190 a head at some centres.

Tight supplies are supporting a flying trade. GB mart throughputs have been back 20% on the year so far in 2020.

See also: Tips on maximising returns from cull ewes

Longtown

This is certainly the case at Longtown, where numbers are tighter, with mart reports showing throughputs 30-39% back this January compared with the previous two years at an average entry of 2,542 head.

Light ewes have averaged £62.74 in the first three weeks of 2020, compared with £35 in 2018 and £42 in 2019.

Heavy pedigree terminal ewes have been selling to £180 and £190 and the heavy section has averaged £101 this new year.

“Farms culled quite a lot of ewes last year and then in August/September time ewes weaned much fitter because it was a better summer, meaning more were sold earlier,” said Nick Woodmass, auctioneer at C&D Auction Marts.

“When people typically buy feeding ewes in August to October, they weren’t really around to buy and there weren’t as many ewes around to feed. Good scanning this time has meant fewer empty ewes as well.”

Mr Woodmass said he did not think buyers could give any more, so a bit of price resistance was likely to be seen.

Skipton

Trade was back on the week at Skipton for an entry of 505 cull ewes, rams and goats, but was still historically strong.

Auctioneer Ted Ogden of Craven Cattle Marts said he was starting to see resistance from buyers, indicating a market top had been reached.

“There is still a fair bit of trade at the moment,” said Mr Ogden. “Prices are £20-£25 dearer than last year.”

Skipton has seen big heavy purebred ewes hitting £140-£160, heavy Suffolk- and Texel-cross ewes at £120-£130 and heavy Mules hitting £90-£105, which is £15-20 dearer than last year.

Mid-road ewes were hitting £70-£90, with buyers after meaty but lean ewes.

Mr Ogden noted that Defra sheep and ram slaughter figures were up 6% to 1.7 million head in 2019, indicating that supplies could be tight in 2020.

JOURNAL : Farmers Weekly

Canary seed could offer an alternative option for growers looking for a niche cereal that is simple to establish, has low input costs and is easy to harvest.

The crop is exclusively used in wild birdseed mixes and demand continues to grow, with nearly 6,000t of seed imported annually.

Poor weather in Canada has left gaps in the market, while growing demand from British birdseed packers for the sourcing of national crops offer new opportunities for UK growers.

See also:Tips on growing a successful crop of naked oats

About the crop

Canary seed is an annual grass that produces a small, buff-coloured seed, similar in size to linseed, ideally suited to heavier, moisture-retentive soils.

Nigel Padbury, seeds and marketing manager at Premium Crops, explains how the crop proves to be very profitable, with low production costs and yields of up to 3t/ha, worth about £380/t.

“Canary seed is a short-season crop that is very competitive and combines well. It’s drilled late in the season, providing good blackgrass control through stale seed-bed activity. ” he adds.

Drilling

Optimum drill dates are between the middle of March and late April, when soils are warming. Later plantings in May are acceptable on land where moisture is not limited.

Seed should be sown shallow, at a depth of 1.5cm and at 400-450 seeds/sq m. Deeper sowings of 2.5cm are required if the grassweed herbicide Avadex (tri-allate) is applied.

Weeds, pest and disease

For grassweed control, apply 15kg/ha of granular 15g Avadex Excel, to be incorporated into the soil a few days before planting, or as a surface application after sowing.

“There isn’t much chemistry available for the crop, with Avadex the only product available for grassweed control” warns Mr Padbury.

Despite the limited range of weed control, canary seed isn’t threatened by any diseases and pest risks are minimal, making it a robust and easy-to-manage crop.

Nitrogen

Fertiliser demands are extremely low in canary seed, with no nitrogen (N) applications required for soils with a soil N supply index of two and above and just 60 kg/ha of N recommended where there is an index of zero.

Growth regulator applications of Optimus (trinexapac-ethyl) and Stablian (chlormequat) are recommended, with one or two sprays required, depending on the season.

Harvest

Harvesting takes place during late August, with glyphosate applications often required before harvest.

Canary seed does not shed its seeds easily, so a good thresh is needed to free the grains. Care should be taken to avoid skinning the grains, as this can reduce crop value, with a purity of 98% required.

Case study

Canary seed success at Knightlayers Farm, Cambridgeshire

Cambridgeshire grower Stephen Edgley has grown canary seed for four successful years on his 800ha farm near Chatteris, as the crop offers a simple, low-input approach to spring cropping.

Mr Edgley began trialling the crop on a small scale in 2015 as a replacement for second wheats within his rotation, and now grows 65ha of the crop.

“Wheat crops are returning less than £120/ha, with very small margins, but canary seed saves money on time and fuel, as you’re not travelling through the crop as much and it is also easy to combine,” he explains.

Yields have averaged 2.5t/ha and with no pre-emergence spray, one post-emergence spray of Mircam and just 50kg/ha of nitrogen applied, canary seed is a profitable crop to grow.

“We also had to make two plant growth regulator applications last season of Alatrin and Moddus [trinexapac-ethyl], but usually this is just the one spray,” he adds.

Furthermore, the last canary seed crop Mr Edgley grew did not require a desiccant before harvest, driving input costs down even more.

Cropping at the farm consists of winter wheat, followed by a spring crop of either sugar beet, potatoes or canary seed.

Canary seed area is now likely to increase, as the remaining winter wheat ground may not be planted and the end of a three-year sugar beet contract is nearing.

“We have looked at other spring crops, including soya and oats, but soya just doesn’t sit right within the rotation, as it clashes with the potato harvest, while oats haven’t yielded well,” explains Mr Edgley.

JOURNAL : Farmers Weekly

A battle looms over who will support NFU president Minette Batters as she strives to secure a good deal for Britain’s farmers outside the EU.

Mrs Batters, the union’s first female president, is set to be re-elected unopposed in the NFU’s leadership elections next month.

But the roles of NFU deputy and vice-president are being contested by five candidates.

See also: Minette Batters: Fighting for a fair deal for farmers

Current deputy president Guy Smith faces a challenge to keep his job from vice-president Stuart Roberts, who is himself being challenged by three farmers who are seeking election to the NFU top table.

West Sussex farmer David Exwood, Essex grower Tom Bradshaw and West Midlands dairy producer Michael Oakes all set out their stalls as NFU election hustings got under way on Monday (20 January).

Whoever wins will be tasked with making the case for British ***agriculture*** over the next two years – a period of seismic change for the industry as the country will exit the EU and the government will introduce the first domestic ***agricultural*** policy in more than 70 years.

Regional tour

Four days of hustings started on Monday (20 January).

All candidates tour the regions, each giving three-minute presentations, followed by seven minutes of questions from NFU members.

At the first hustings at the RHS Garden Wisley, in Surrey, Mr Smith called for the same team to be re-elected.

“On Brexit, I think we’re halfway through and I think it makes sense to return the same team of officeholders as we have now to get the job done.”

He said he was proud to work under Mrs Batters as her deputy and had worked very well with Mr Roberts, who had done “a great job” as vice-president.

If he were re-elected as deputy, Mr Smith said he would lobby the government on future agri-environment schemes to ensure they are “designed with working farmers in mind” and tested rigorously, adding: “They must be deliverable.”

Trade, access to labour and climate change were “very important".

But Mr Smith also promised to work hard on the everyday issues that affect members, such as fly-tipping, rural crime and a lack of broadband access.

Mr Roberts, who is standing for deputy and vice-president, said strong leadership was needed to turn the challenges ***agriculture*** faces into opportunities.

“Every single survey shows that we are trusted, supported and believed more than any other profession,” he said.

“But we must use every opportunity to turn this passive support into an army of advocates.”

Mr Roberts said the NFU must “fly the flag for the nutrition, provenance and quality” of British food.

“We cannot allow politicians to sacrifice our standards or retailers and processors to undermine our supply chains,” he said.

“If we do, every farmer, and huge parts of the rural community, will lose out.”

Michael Oakes, chairman of the NFU National Dairy Board for the past four years, said he would bring more of a livestock focus to the NFU’s top table if he were elected as vice-president.

First generation tenant farmer David Exwood said livestock farmers had been under fire and the NFU needed to tell the positive story of farming, which is why he started the #farmingcares social media campaign.

Tom Bradshaw said climate change is “the biggest challenge of our time”, but to achieve net zero carbon emissions, farmers would require investment in research and development and a fully functional carbon trading scheme.

Farmer reaction from the floor

Harry Holt, dairy and sheep farmer, East Sussex

“I’m really interested to know how the NFU’s plans for net zero carbon emissions by 2040 will be rolled out to young farmers.

"We’re going to have to educate every farmer. It relies on everyone getting on board.”

Kate Faulkner, farmer, Hampshire

“There is so much negativity in the media about farming.

"It’s really important to elect strong leaders.

"Minette Batters has been great and engaging. It’s important we are not isolated.”

Peter Appleton, dairy farmer, East Sussex

“Minette Batters has done an excellent job. She has widespread industry approval.

"Brexit is a once-in-a-lifetime opportunity to shape the future of our industry.”

Further hustings events were due to be held this week in Builth Wells, Wales; Exeter, Devon; Telford, Shropshire; Skelmersdale, Lancashire; York, Rutland; and Newmarket, Suffolk.

JOURNAL : Farmers Weekly

Vegan advertisements are being removed from buses in Northern Ireland following complaints from livestock producers.

Bus operator Translink took action after the Ulster Farmers’ Union (UFU) said the adverts demonised the livestock industry.

See also: Meat eaters or vegetarians – who has the better arguments?

An advert funded by the Go Vegan World Group and seen on the Translink Foyle Ulsterbus read: “It’s not a personal choice when someone is killed. Use plants not animals.”

Another advert said: “Dairy takes babies from their mothers.”

UFU president Ivor Ferguson said farmers – including those with children who used the buses to get to school – were outraged by the adverts.

Mr Ferguson said: “A public service should be impartial on all matters but the vegan adverts on the Translink buses use emotive language that singles out our local farmers.”

The adverts had potential to do serious damage to the ***agricultural*** industry and the livelihood of farming families, he added.

Northern Ireland farmers met some of the highest environmental and animal welfare standards in the world so consumers could enjoy quality food without worrying, Mr Ferguson pointed out.

He added: “Translink’s adverts dismiss the facts, helping to perpetuate a negative narrative about eating meat and consuming dairy products.”

Mr Ferguson said the UFU respected all personal decisions when it came to diets but to demonise the livestock industry to promote another industry was wrong.

“Translink’s vegan adverts wrongly link ***agriculture*** to plant-based diets,” he said.

“The language is attempting to influence the general public to isolate the farming community through misinformation.”

After initially saying it could not remove the adverts, Translink said on Saturday (18 January): “These bus-side advertisements are in the process of being removed.”

The Go Vegan World campaign group said it had paid for the campaign to run on Translink buses between 30 December 2019 and 12 January 2020.

“Despite complaints from the Ulster Farmers’ Union demanding that the ads be removed, our campaign ran until the end of our contract,” it said.

The adverts had then continued to be shown free on an “over-show” basis – standard practice when the space had not been booked for the next advertising cycle, it added.

JOURNAL : Farmers Weekly

Police have warned of copycat attacks after a TV programme highlighted the illegal methods used by animal rights activists who target livestock farms.

Called How to Steal Pigs and Influence People, the Channel 4 programme was screened on Tuesday (14 January) – despite efforts by farm leaders to get it stopped. The broadcaster was accused of trivialising livestock theft and its effect on farmers and animal welfare.

See also: Channel 4 defends ‘how to steal pigs’ programme

The 47-minute documentary showed how vegan “pig-nappers” and other activists are racking up hundreds of thousands of followers by filming their exploits and posting them online. Afterwards, police took to social media to warn against anyone following their example.

Sergeant Rob Simpson, of Cheshire Police, said: “We support people's varied lifestyle choices, but stealing livestock is a crime. Committing crime for social media likes and risking the biosecurity of the farm could result in all the livestock being destroyed.”

See also: How to deal with animal activists and difficult neighbours

'Criminal behaviour'

The UK's four farm unions issued a joint statement voicing deep concern about the programme. The criminal behaviour it showed has a “dreadful impact” on farmers, their families, business and livestock, said the NFU, NFU Cymru, NFU Scotland and the Ulster Farmers Union.

“We believe the title and trailers for How to Steal Pigs and Influence People – with promotional wording talking about ‘daring farmyard heists’ – shows that the programme makers regard this illegal activity as trivial and humorous,” said the statement.

It added: “We do not understand why farming families are being seen as fair game by the broadcaster and treated differently from other British citizens, who all have the right to be protected from criminal behaviour and not to see those criminals given airtime and profile.”

'Potential to distress'

Channel 4 said it did not glamorise or condone illegal activity. But Channel 4 sponsor Mitsubishi – which sells thousands of 4x4 pickups to farmers – said the programme had the potential to cause distress and “we will not be associating ourselves with this documentary”.

The National Pig Association, which urged Channel 4 not to air the programme, is taking legal advice on the situation. Mitsubishi should clarify its arrangement with Channel 4 regarding the documentary, said NPA policy services officer Lizzie Wilson.

“We would like to understand just what that statement means a little better,” said Ms Wilson. She added: "We are urging members to contact Channel 4 directly to make their feelings known. We want to send a clear message that this sort of programming is unacceptable.”

JOURNAL : Farmers Weekly

Crop production could plunge if climate change causes the collapse of an ocean current that brings warmth to the UK, scientists have warned.

Land suitable for arable farming could drop from 32% to 7%, triggering a major reduction in the value of ***agricultural*** output.

In this worst-case scenario, a decrease of £346m per year – a reduction of 10% – is estimated in the net value of British farming.

See also: What UK farmers should expect from weather trends

This would happen if the an ocean current known as the Atlantic Meridonial Overturning Circulation (AMOC) is weakened as a result of climate change.

The AMOC carries a large amount of heat northwards from the tropics, warming the north Atlantic region.

While global warming is expected to increase food production, if this current collapses, it would not only wipe out these gains but cause the “widespread cessation of arable farming”, according to scientists from the University of Exeter.

“”If the AMOC collapsed, we would expect to see much more dramatic change than is currently expected due to climate change,” said Dr Paul Ritchie, of the university’s Global Systems Institute.

“Such a collapse would reverse the effects of warming in Britain, creating an average temperature drop of 3.4C and leading to a substantial reduction in rainfall [>123mm during the growing season].”

The warning is contained in a paper published in the journal Nature Food, focusing on the stark impact of the collapse of the AMOC on ***agriculture***, entitled Shifts in national land use and food production in Great Britain after a climate tipping point.

The study examines a “fast and early” collapse of the current, which is considered a “low probability” at present – but the AMOC has weakened by 15% over the past 50 years.

'Tipping point'

Such a collapse – a climate change “tipping point” – would leave Britain cooler, drier and unsuitable to grow many crops, the study says.

Reduced rainfall would be the main problem, and although irrigation could be used, the amount of water and costs “appear to be prohibitive”.

The scientists behind the study warn “we would be wise to act now to minimise the risk of passing climate tipping points”.

JOURNAL : Farmers Weekly

The Dairy-Tech event returns to Stoneleigh Park, Warwickshire, on Wednesday 5 February, which showcases the very latest gadgets and innovations.

Organiser, the Royal Association of British Dairy Farmers (RABDF), has announced there will be more than 300 exhibitors and 55 new products at this year’s show.

Here is a taster of some of the innovations that will be there.

Bovine Ketone Monitoring System

Rapid Labs CentriVet bovine ketone monitoring system provides an early warning of ketosis development in cattle.

The condition can have serious consequences but the lack of early clinical signs mean animal health, welfare and production often suffer before it is picked up.

The CentriVet meter and test strips have been specifically calibrated for measuring bovine blood Beta-HBA.

The test sensitivity identifies sub-clinical signs of ketosis in just 10 seconds, allowing prompt nutritional changes to be made before the animal suffers.

Contact

Email: [*vet@rapidlabs.co.uk*](mailto:vet@rapidlabs.co.uk)

Online: rapidlabs.co.uk/centrivet

Phone: 01206 250484

Herdwatch NG

The NG or Next Generation version of the Herdwatch app promises faster response times, quicker links to other smart devices and improved displays.

The app registers calf births, manages breeding-cycle information, stores animal movements and holds individual health records.

The smartphone camera can read tag numbers and text, making it easier and safer to log livestock tag details at a distance.

It also scans barcodes or QR codes to capture product information and uses the smartphone’s Bluetooth system to integrate with EID systems and weigh scales.

Contact

Email: [*conor@herdwatch.com*](mailto:conor@herdwatch.com)

Online: herdwatch.com

Phone: +353 87 621 3238

Cargill Pulmatop ruminant feed additive

Pulmatop is an antioxidant-rich feed additive designed to boost ruminant immune and respiratory systems.

It is particularly beneficial for youngstock fed routinely ahead and during critical periods in their development such as weaning, regrouping, housing changes or in weather fluctuations.

The additive contains a balance of polyphenols, organic selenium and rumen-protected vitamin C, combined with plant-based essential oils to support the respiratory system.

Clay minerals encourage digestive function and provide intestinal protection.

Contact

Email: [*Josie\_hatch@cargill.com*](mailto:Josie_hatch@cargill.com)

Online: cargill.com/feed

Phone: 01932 861000

Gallagher Complete Solar Station

Gallagher offers a neat, plug-and-play solution to power electric fences.

The module overcomes complex installations of the various components needed to charge electric fences even in remote locations.

Each unit consists of an energiser, heavy-duty batteries, large solar panel and earth pegs within one robust portable steel housing.

Once the unit is switched on, the case is electrified protecting it from wildlife, stock and thieves. Available as two battery MB1800i or four battery MB2800i.

Contact

Email: Via website

Online: gallagher.eu

Phone: 0247 647 2825

IMV Technologies AlphaVision

The AlphaVision is an insemination gun equipped with a miniaturised waterproof camera and light.

The real-time image is transmitted to a viewing terminal worn on the arm or a neck strap, which provides images of the cervix and simplifies the insemination process.

Its endoscopic function can also be used to diagnose metritis and deformities, identifying reasons why cows may be difficult to breed. The AlphaVision comes as a complete kit with a 12-month warranty.

Contact

Email: [*miracle@miracletech.co.uk*](mailto:miracle@miracletech.co.uk)

Phone: 07751 414265

Ambic Locate’n’Spray

Locate’n’Spray is a fully automated, customisable teat spray system.

Available as a standalone setup or integrated within a rotary milking parlour, the equipment cuts the need for an operator at the "cups-off" stage, the manufacturer claims.

The locator device sits at floor level and is designed to ensure the cow straddles it, which exposes the teats for effective spraying.

The Locate’n’Spray system can be customised with options, including choice of pre-spray, post-spray or pre-and post- spray systems; four or eight nozzles; adjustable spray duration; and double-hit spray to improve coverage.

Contact

Email: [*sales@ambic.co.uk*](mailto:sales@ambic.co.uk)

Online: ambic.co.uk

Phone: 01993 776555

Jydeland Bobman Super

The Bobman Super is a ride-on sweeper and bedding and disinfectant spreader that can carry out all three tasks in one pass.

The large front hopper can hold enough chopped straw, sawdust, wood shavings, waste paper, lime or disinfectant powder to service 150 cubicle spaces.

An attached rotating brush, with extending arm, sweeps the old material in front of the machine's front-end scraper for removal. The raised ground clearance allows the machine to mount edges and rough surfaces.

Contact

Email: [*jydeland@jydeland.dk*](mailto:jydeland@jydeland.dk)

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Phone: +45 86 36 33 00

JOURNAL : Farmers Weekly

Applying early nitrogen (N) and phosphate fertiliser to wheat crops is the starting point for nursing them back to health, as farmers look to minimise the effect of waterlogging on crop yields.

Some cereal crops have rotted away in the cold, wet soils, while those that have emerged and survived are still sitting in saturated soils.0

This waterlogging will produce plants that are physiologically different to those in more normal seasons. They will, therefore, need to be managed differently if they are to yield.

Effect of waterlogging

Yara agronomy manager Mark Tucker pointed out at recent Association of Independent Crop Consultants annual conference that one key difference is that waterlogged crops have shorter and smaller leaves.

See also: How to avoid the top 5 ***nutrient*** deficiencies in OSR

Leaf area is essential for capturing as much sunlight as possible to drive grain production.

On top of this, root growth will have been be impaired by waterlogging and root structure will have deteriorated.

“The seminal root will die off, resulting in a different structure, with more adventitious roots,” Mr Tucker says.

Adventitious roots are shallower, which means plants will be more vulnerable to any spring drought and less able to search out ***nutrients***. "Drought in March will be the last thing these crops need."

However, not all is lost, as Mr Tucker points to research showing that under certain conditions, wheat can recover from prolonged waterlogging (42-80 days), with yields achieving 82-96% of controls.

February-drilled wheat

Farmers should consider treating February-drilled winter wheat more like a spring crop when it comes to fertiliser strategy, says Yara's Mark Tucker.

Crops drilled this late have 4-6 weeks until they tiller, so they will need to be pushed hard. "You want them in, up and away rapidly."

Applying 60% of the fertiliser in the seed-bed in a big hit will help achieve this, he says.

Early fertiliser

The current anaerobic soil conditions means any N will have been depleted, forcing plants to start taking N from older leaves for new growth, so crops will look poor.

Therefore, Mr Tucker says there is a need to go on with fertiliser in the next two to three weeks, if conditions allow tractors to travel and drains aren't running.

This early N will help increase the size of leaves, as well as feed root development and maximise tiller numbers. The aim is to boost the number of ears/sq m.

Mr Tucker suggests two options. The first is to go with 30kg/ha and, if the crop is viable, follow up with another 30kg/ha two to three weeks later.

“If farmers don’t think they will have time for the follow-up application, the second option is to apply 60kg/ha.” But Mr Tucker adds that there will be a higher environmental risk of N losses when there are higher levels of soil water.

“Patience and a little-but-often approach may be key this season,” he says.

Don’t be too hasty

Mr Tucker also advises not to write off crops too early.

“We had one site last year that really struggled after being drilled late in dry conditions and suffering from grazing by birds. We considered writing it off, but still managed to get 7.5t/ha."

For those deciding whether to cut back on overall rates, he suggest sticking with the standard 150-160kg/ha in first two applications then consider if the crop needs the last 50kg/ha using technology such as leaf tissue testing.

Soil phosphorus levels will also be at their lowest and now is a good time to start thinking about getting some fresh P on.

“Phosphorous helps encourage root development,” he says.

Mark Tucker was speaking at the recent Association of Independent Crop Consultants annual conference held near Towcester.

JOURNAL : Farmers Weekly

After months of political deadlock around Brexit, the updated ***Agriculture*** Bill will return to parliament this month.

The government hopes the bill will be passed by the spring, allowing the country outside of the EU to develop its own ***agricultural*** policy for the first time in decades.

Writing exclusively for Farmers Weekly, farm minister George Eustice acknowledges that change is on the way, but we can look forward to a better future for farming.

See also: ***Agriculture*** Bill: What’s new and what’s Eustice promising?

Defra farm minister George Eustice explain's the government's vision for farming

Last month’s general election result has finally brought clarity and direction, following three very difficult years with a hung parliament where no one could get anything done.

The government now has a very clear mandate. The new Withdrawal Agreement negotiated by the prime minister last October will be implemented, and quickly.

We will leave the EU at the end of this month without fail. There will be an orderly Brexit with an implementation period running until the end of this year.

There will be no extension to that implementation period. Under our future partnership from January 2021, we will not be part of the customs union, nor will we be part of the single market, but we will seek a free-trade agreement.

We will not accept regulatory alignment, nor will we be bound by the European Court of Justice (ECJ), but we will seek to establish agreements and understandings based on equivalence. Things will change. We will become a genuinely self-governing country again.

We also now have the freedom to press ahead with our plans to develop a new ***agriculture*** policy that is fit for purpose in the 21st century and delivers for British farmers and the environment.

The ***Agriculture*** Bill has returned this week for the second time. As before, we seek to replace the bureaucratic shambles that is the Common ***Agricultural*** Policy with something that has coherence.

I grew up on a farm and spent a decade working in the industry. Domestic food production is crucial and plays a vital role in contributing to our nation’s food security

Rather than arbitrary area-based payments, where land ownership and tenure is subsidised, we will instead direct future funding to support activities and interventions that deliver for our environment and enhance animal welfare.

We want a package of incentives to support sustainable farming practices and the bill creates the powers to do this.

We recognise that Basic Payment Scheme payments currently make up a significant proportion of net farm income. However, rather than maintain a system that just masks poor profitability, the ambition behind our ***Agriculture*** Bill is to tackle the causes of that poor profitability.

So, the bill creates the power to make grants available to deliver a prosperous future for farming by helping farmers invest in new technology and equipment to reduce costs.

There is a section in the bill to improve transparency and fairness in the supply chain, so that farmers stop being price takers and start getting a fairer share of the cake.

Also, we want to make it easier for farmers to retire with dignity and simultaneously help new entrants get access to land.

I grew up on a farm and spent a decade working in the industry. Domestic food production is crucial and plays a vital role in contributing to our nation’s food security.

The government takes this very seriously, so the revised bill creates a duty to review food security every five years and a duty to consider the production of food when devising policy.

I also know that farming is a risky business and there will always be circumstances where the government must act and intervene in a crisis to support farmers or stabilise markets. The bill makes provision for that too.

Finally, I know that change must be delivered in an orderly and progressive way. It won’t happen overnight. Our bill envisages a seven-year transition period from the old legacy system to the future policy, starting next year.

Our ambition is to use our new-found freedom to embark on a journey to a better future for farming. We want to innovate and develop the policies of the future.

A decade from now, I want the rest of the world to be coming to the UK to see how it is done, and I know we have some of the best farmers in the world who can do just that.

Farm minister George Eustice was writing exclusively for Farmers Weekly about the forthcoming ***Agriculture*** Bill and the UK’s future food and ***agriculture*** policy.

JOURNAL : Farmers Weekly

Police have released an image of a man they want to speak to after tools and machinery were stolen from a farm in Northamptonshire.

An angle grinder was used to break into an outbuilding at the farm in Welford Road, Chapel Brampton, just after midnight on Tuesday 10 December.

See also: 9 tips to combat farm theft during darker nights

Once inside, they stole the items before leaving in a vehicle.

Anyone who recognises the man is asked to call Northamptonshire Police on 101 and quote incident number 19000659208.

JOURNAL : Farmers Weekly

On this side of the tennis ball it is summertime so everyone (well, except farmers, firemen, nurses and such) disappears for three weeks, leaving us bereft of service and parts.

My New Year's Eve was spent babysitting irrigators that had developed a bad attitude, but we have got through a tough dry patch and harvest is close, and crops generally are looking exceptional. Hopefully a good harvest is on the way.

We have had many days where our sky has been a brown and orange haze due to smoke from the Australian bushfires.

See also: How a YEN winner grew top-yielding wheat and OSR crops

There is no doubt a personal, societal, economic and environmental tragedy is taking placing and we can’t be anything but stunned by the images being broadcast of this crisis.

But once again, ***agriculture*** is the whipping boy blamed as the cause of climate change.

Misguided celebrities

I watched a snippet of the Golden Globes, the elites and the influencers making their very public contribution to reducing climate change by eating a plant based feast, with meat cast as the evil villain.

Those elites and influencers had travelled from every corner of the globe by private jet or first class suite, sat in a theatre adorned with flowers flown in from Italy and Peru, and drank bottled water imported from Iceland.

To me, their vitriol towards animal ***agriculture*** couldn’t be more ironic or misguided.

Many would say that the absence of livestock in the Australian bush lands in recent times has been a contributor to fuel loadings.

The problems in Australia are complex. The various eucalyptus species predominant in the bush rely on regular, intense fire as part of their natural cycle and most contain very high levels of terpenoids (turpentine).

Undergrowth clearing and fuel reduction works have been scaled back due to budget cuts and environmental protests; areas have been locked up for carbon credits; and there are now much higher levels of human habitation in these bush lands – bush lands that rely on natural fire cycles.

It’s a hard one really: at what point do we as humans expect natural processes and cycles to pause, or submit to our control?

A tragedy, no doubt, that has given a thoughtful start to the year.

JOURNAL : Farmers Weekly

It’s always good to kick-start the year with a busy calendar of training events, conferences and shows, and this year is no exception.

It’s good to get off the farm and meet other people, get ideas and learn some new things to put into action for the coming year.

Farm-wise there has been little change since last month. Wheat that has been drilled is now fully emerged and looks good, with little difference between drills.

See also: Mixed farm invests in direct drill for shift to no-till

Seed rates may have been slightly high so I will do some plant counts later this month to see how established plant numbers compare with the estimates made when deciding on the seed rate.

Cover crops

My ecological focus area cover crops will now be sprayed off as soon as conditions allow.

This year they are in fields that have been direct drilled with a cover crop followed by a direct drilled spring crop for two years.

The resulting improvement to the soil structure is amazing compared with a field next to them that has been min-tilled for the past two years.

They have walked much drier all season, with top soil in good condition and last year’s tramlines virtually invisible, other than there being no stubble in the wheelings.

They probably would have drilled well in the autumn when other fields wouldn’t, but being down as EFA unfortunately they had to stay as cover crop until now.

Whilst it isn’t a system for everyone, and we need to remain flexible, I will certainly be using cover and catch crops more in future.

Lamma was a worthwhile day out with a good mix of things to see and people to catch up with.

The move to the NEC has certainly been for the better but it is a shame there are still some of the bigger players missing from the exhibitor list.

There are a lot of machinery shows these days that must cost a frightening amount to exhibit at – and that we all end up paying for somehow. Is it time that the number is reduced, and Lamma becomes a three-day event held every other year?

JOURNAL : Farmers Weekly

As the only way not to work is to actually leave the farm, we drove to Bruges for a few days before Christmas.

From our corner of the country we can get to Belgium quicker that we can get to Norfolk or Northampton, and it seems much easier to get out of Kent via the Channel tunnel than it does via the M25, for now at least.

I had absolutely no interest in the Christmas markets but the drive through northern France was fascinating, in a horror film type of way.

See also: How a YEN winner grew top-yielding wheat and OSR crops

Unfortunately for the farmers of this region it has obviously rained there as much or more than here, and the heavily cultivated soil has simply turned to slop in many fields.

Escape bid

There were many small in-field lakes interspersed with a patchwork of green drill lines indicating the establishment attempts.

Even worse were several fields where spraying had been desperately risked, leaving cavernous ruts along the tramlines.

Here and there they got gradually deeper before the tractor tracks then veered off across the field in an escape bid.

Some of these had been unsuccessful, leading to the convergence of other tracks from different directions and an eventual trail of devastation across to the field edge.

Back home on slightly drier land, the sheep grazing cover crops failed to get out or die on Christmas day this time, which was a nice surprise present.

Last year we cut some covers before grazing and had them analysed to estimate the amount of ***nutrients*** that might be available to the following spring crop.

However, I do like to graze all of ours so perhaps I should instead be ***collecting*** droppings for testing.

It would be easier if someone could do some trials on the subject, although I’d give priority to work on barley yellow dwarf virus.

Can bunging in an insecticide with the first pass in the spring, because it only costs £2 a hectare, really be right?

JOURNAL : Farmers Weekly

At the beginning of 2019 I hoped for a drier, warmer spring, more rain in early summer and a dry harvest.

The first six months actually were almost ideal, but from July onwards things went downhill and I was surprised that the total rainfall was only 880mm, bang on average.

It felt as though the second half of the year was continuously wet, but this corner of the country has actually been relatively lucky in that we have not had the damaging downpours that caused so much flooding further south.

The images of flooded farms in England and the devastating fires in Australia highlight the damage from extremes in climate and put our damp few months into perspective.

See also: OSR yields rise after fertiliser cut by 30% on Shropshire farm

With mild temperatures recently, our crops have greened up as the soil has dried out, and on the whole, I am pleased with our winter crops at this stage.

My father had a clear-out recently and gave me a copy of a conference report from December 1968, entitled Developments in Crop Production.

Increased mechanisation

It was fascinating to read of the changes that had occurred in the 1960s, with the Scottish barley area increasing by 179% at the expense of oats and root crops such as turnips.

OSR was not in the rotation and on the livestock side there were huge increases in pig and poultry numbers.

Increased mechanisation had meant that 40% of farm workers had left the industry in the decade.

Farms mostly had a wide range of enterprises, and potatoes were seen as a key earner on suitable land, with labour and machinery levels geared to match this crop.

While fixed costs were mentioned as starting to be a concern, there seemed to be a great deal of optimism for the future, with rapid advances in plant breeding and chemical inputs expected to increase output to cover these costs.

We are certainly in a different era now, with chemicals disappearing and plant breeding really just maintaining yields.

Increased scale to dilute fixed costs has been the solution for the past decade, but will technology change this in the coming decade to bring a new leap in output to cover ever-increasing costs?

JOURNAL : Farmers Weekly

A year ago I wrote a very tongue-in-cheek piece about my wishes for the perfect lorry driver.

Today I have loaded some beans for Frontier and I can say it was the perfect process.

They emailed and texted well in advance about the ***collection*** date. I received a phone call from their driver with an accurate time of arrival.

See also: How trials are helping two farmers maximise crop margins

The lorry arrived bearing a large photo of one of their grain traders. (It was not our grain trader – he may not be good looking enough. Only joking, Russell.)

The lorry was parked exactly where I asked. Loading took just minutes, with a jolly pip of the horn when the required tonnage was in.

The icing on the cake was the number plate on the cab dash bearing the nickname of the driver: Sazzles.

I was proud to hear from her that after a year in the job she has received overwhelming friendliness in the whole grain chain.

The cherry on the top was a text an hour later to say the beans had been tipped at Tilbury with ideal moisture and low admixture.

Plough Sunday

The Essex farming fraternity turned out in force for the annual Plough Sunday service at the beautiful and historic Thaxted church.

It had everything: colourful Morris dancers who pulled a horse-drawn plough into the centre of the church, modern ploughs outside which were blessed by the bishop, and a very spectacular procession at the end of the service by 27 tractors driven by members of Essex Young Farmers.

This was the first time they have done a tractor run but looking at the popularity of the event, it will be an annual fixture.

Hundreds of pounds were raised for the air ambulance and the Farming Crisis Network.

It was a positive and uplifting display to all onlookers who hooted and clapped in support as they went along the roads.

I enjoyed the bit in the service when our rural dean, Janet, observed that of course not all farmers plough these days.

She agreed, though, that Zero Till Sunday probably didn’t have the same ring as Plough Sunday.

JOURNAL : Farmers Weekly

Another calendar year has begun. Will it be a good one? Only time will tell. It will certainly be an interesting one.

As things stand we have got a very busy spring to contend with. The miserable autumn has left us with half the planned cereal planting still to do plus all the normal spring work.

It’s seasons like this that make me glad that I have retained a plough and combi drill system.

Without it there would be nothing in the ground.

See also: How to grow a 10t/ha-plus malting spring barley crop

If I had listened to a lot of the consultants and advisers out there, I might have believed that I had too much capital tied up in machinery and that I was killing the worm population and ruining my soil structure.

In the real world, where you have to produce something to make a living, I am glad that I run both a plough-based and a min-till system.

Both systems have their place. The secret is knowing when to use which one.

I hope that those putting together the post-Brexit ***agricultural*** strategy take the time to listen to those on the ground rather than putting in place overly prescriptive ways of managing our land which may not be either sensible or practical.

January started with the now customary team trip to Lamma. Year two at the NEC has seen some improvements, with less empty space.

It would be good if all the major manufacturers supported the event – after all, some of us spend some fairly significant amounts of money on their kit each year.

It is good for our staff to have the opportunity to meet the main players and discuss their likes and dislikes.

I hope that the show continues to flourish. It would be a huge shame if the British ***agricultural*** industry was not strong enough to support a significant machinery event.

We have a vacancy for a tractor driver for the season as we say thank you and goodbye to little Nick, who is leaving us to pursue the bright lights of farming in the eastern counties.

He came to us from outside the industry, learnt his trade and now has the opportunity to experience a different system. Contact me if you are interested.

JOURNAL : Farmers Weekly

Farmers ended 2019 on a more positive note with the perceived progress on Brexit contributing to their optimism, according to Farmers Weekly’s Sentiment Tracker.

Since the Conservatives won a landslide victory in the general election, the tracker has seen a small rise in the mean score for positivity around the likely impact of Brexit on farm businesses, with the UK set to leave the EU on 31 January after Boris Johnson’s deal was backed by MPs.

See also: Exclusive: Eustice on government’s farming policy ambitions

The score of 2.75 out of five is the third highest on the study and the highest since September 2018. The mean score for farmers’ perceived prospects for the next six months (2.92), and the next two years (2.84), also both rose in December.

!function(e,i,n,s){var t="InfogramEmbeds",d=e.getElementsByTagName("script")[0];if(window[t]&&window[t].initialized)window[t].process&&window[t].process();else if(!e.getElementById(n)){var o=e.createElement("script");o.async=1,o.id=n,o.src="[*https://e.infogram.com/js/dist/embed-loader-min.js*](https://e.infogram.com/js/dist/embed-loader-min.js)",d.parentNode.insertBefore(o,d)}}(document,0,"infogram-async");

Although Brexit divided opinion among farmers, the results suggest that now a decision to leave the EU has been made, farmers see their short- and medium-term business prospects in a more positive light.

The tracker also showed that farmers expect to be working in a more favourable financial climate than they did during the summer months.

Prospects for costs

In December, the mean score for “expected input costs” for the next 12 months fell for the third month in a row. Conversely, the mean score for the “expected price received for outputs” increased for the third month in a row.

The two measures are now as close as they have been at any other time on the study, bar the very first measure taken in July 2018.

The survey was carried out at the end of the year and farmers were asked how 2019 had been for them and their farming businesses. The result was “so, so” for nearly half of farmers (46%) while 29% said it had been a “great or good year” and 25% said it had been a “bad or terrible year”.

Each month the Farmers Weekly Sentiment Tracker asks readers five simple, but topical, questions to help us gauge the mood in the industry.

JOURNAL : Farmers Weekly

A government-backed scheme to reward farmers in England for storing carbon by converting farmland to woodland is set to offer landowners a guaranteed income for up to 35 years.

A fledgling trade in selling carbon credits to corporate buyers looking to offset the emissions they generate already exists, but variability in the market has not instilled confidence among farmers.

However, the launch of the Woodland Carbon Guarantee in November – an incentivised scheme to address the "climate emergency" and accelerate woodland planting rates – enables landowners to sell their sequestered carbon dioxide for a long-term guaranteed price.

See also: Q&A: Should you consider agroforestry on your farm?

The scheme

Currently only available in England, the £50m Guarantee allows new tree planting projects registered with the Woodland Carbon Code to sell verified Woodland Carbon Units (WCUs) to the government for a guaranteed price over 30-35 years.

Existing woodland is not eligible for this scheme.

Approved applicants participate in online reverse auctions, offering their best calculated price per WCU – equivalent to one tonne of carbon dioxide.

The government then agrees to buy successful bids until 2055/56 subject to the status of the woodland being verified five years after planting and then every subsequent five or 10 years.

Applicants will also have the opportunity to sell WCUs to the private sector instead if it commands a higher price, but will still be subsequently able to return to the terms of the government contract if the market is lower at the following break point.

The price paid by the government will rise in line with with the 12-month Consumer Price Index measure of inflation in April of each year from the start date of the project.

The scheme only accepts applications from projects registered with the Woodland Carbon Code, and although no auctions have been held yet, WCUs sold to the government could potentially command higher prices over the life of the contract than would be attained on the open market, he says.

The first auction will be held between 12 noon on Monday 20 January and 12 noon on Friday 31 January and will  be open only to applicants who have been approved by the Forestry Commission.

Further national auctions are anticipated every six months for the first four to five years, dependent on the rate of uptake and funds.

Flexible scheme

The scheme favours the landowner, says Edward Shephard, Woodland Carbon Guarantee adviser at the Forestry Commission.

“Both the private and public sectors are responding to environmental pressures by looking at offsetting their own and their customers’ emissions. Buying verified carbon credits is a way they can achieve their objectives.”

The contract is also flexible, and should not be affected by Brexit concerns.

“Landowners will still be able to sell to the private sector at any point in their contract if the price or timing is more favourable,” explains Mr Shephard.

“And they shouldn’t be put off by political uncertainties, there is no reason why this project should be affected.”

Creating carbon woodlands

Planting woodland on less productive areas of land can help farm businesses boost their income while also benefiting the environment, says Matt O’Connell, project developer and owner of Sylvawood ***Agriculture***.

Landowners can plant any species or type of woodland which suits the project site, with the amount of carbon sequestered dependent upon soil type, tree species and how the woodland is managed.

Oak has the greatest capacity for carbon sequestration over a lifetime, but is slow growing, while Sitka Spruce has a shorter lifetime but provides a faster return.

Grants are also available to cover some of the cost of the saplings, including through Countryside Stewardship, the Woodland Carbon Fund or HS2 Woodland Fund.

However, projects will not be eligible for the guarantee if work is started before an offer is received.

The landowner must ensure that their target stocking density is achieved, so it’s worth planting around 5% extra to account for this, says Mr O’Connell.

“Woodland provides an array of benefits besides this income opportunity; from livestock sheltering to flood prevention and from pollinator habitat to game management,” he adds. “Forestry income from carbon and timber is also tax free.”

Good time to decide

Now is a good time to decide whether to convert a small area of a farm to woodland, says Vicky West, UK Woodland Carbon Code Manager at Scottish Forestry.

“With a corporate price of £5-15/t of carbon dioxide alongside the guarantee, grants and funding, it is now a much more viable prospect than before,” said Dr West.

However, landowners may want to consider using a project developer to advise and assist with the planning, registration and validation/verification of the project, warns Mr O’Connell.

“If different farms have small parcels of land for conversion, we bring them into one group of projects which helps reduce costs. Verification can cost £800-£1,000; creating a group splits that bill.”

Project developers can also help to manage woodland throughout establishment and beyond, from applying for grants to assisting with woodland maintenance contracts, fencing requirements and pest control.

What to do next

Check if you are eligible on the government website and register your project on the UK Woodland Carbon Registry. You will need a carbon sequestration forecast and projects must meet the following terms:

Landowner commits to permanent change of land use to woodland

The land must NOT have been wooded for at least 25 years

Soil must have less than 50cm organic/peat layer

Get validated – you will need to complete a project design document with the Organic Farmers and Growers or Soil Association and they will need to validate your project within three years of application.

Stay verified – At year five and then every 10 years, survey your site, complete a progress report and get it verified. Projects can last up to 100 years.

JOURNAL : Farmers Weekly

We really enjoy seeing your shots – whether it’s livestock and crops or people and pets. Thanks to everyone who has been sharing pictures of life on and off farm with Farmers Weekly.

From the scenic and the arty to the fun and the adorable, your pictures are a wonderful snapshot into ***agriculture*** and rural living – and Farmlife Framed is the regular feature where we pull some of our favourites together.

See also: Meet Britain's youngest council farm tenant

These curious Clun Forest ewe lambs were captured on the move to some fresh pasture by Chloe Burrough.

Thomas Redshaw from Hampshire sent in this lovely photo of his one-year-old daughter Evelyn, who is loving the tractors in Farmers Weekly.

Here's eight-month-old lambing assistant Iona Taylor in Aberdeenshire. Christine Croal sent this one in.

Kerry Rogers from Montgomeryshire took this super-cool shot of Mr and Mrs Snowman on her farm one frosty morning.

Shepherdess in the making Arabella, aged two, feeding the sheep. Bethany Thompson shared this one with us.

Sherard Block sent in this photo of him carrying his short-legged friend through the long grass while out at the shoot.

Sophie Harris and pal Alice, from Somerset, are the best of friends. They have the same birthday and even the same overalls.

One of Emily Spencer-Mawer's new highland heifers seems more interested in licking her rather than scoffing the feed bucket.

Send us your farming snapshots

Keep your farming photos coming in. We really can’t get enough of them. It’s really easy to submit yours – simply upload your snaps to the Farmlife Framed page.

Be sure to send your photos in as high resolution as possible – the higher the better for print quality. They can be cute, funny, romantic – pretty much anything goes (within reason).

Not only is there a chance that they will appear in the magazine and on our website in our regular Farmlife Framed feature, there’s a chance they could be shared on our Facebook, Twitter and Instagram pages, too.

JOURNAL : Farmers Weekly

UK food and drink exports to the US could be further damaged as Washington considers extending its import taxes on EU food and drink products.

The US introduced a 25% import tax across a wide range of food and drink products from specific EU member states, including the UK, in October 2019.

This followed a World Trade Organisation (WTO) dispute over EU subsidies provided to aerospace giant Airbus, which the US argues caused harm to Airbus’s US rival Boeing.

See also: US 25% import tax hits British food and drink export markets

As a consequence, the US was given permission by the WTO to introduce “countermeasures” against France, Germany, Spain and the UK, with affected products including single-malt Scottish whisky, certain cuts of pork, cheese and other dairy products.

Tariff review

Peter Hardwick, trade policy adviser to the British Meat Processors Association, said that to date meat exporters had managed to limit the effects of the tariffs by making adjustments to their products so they fell outside of the scope of the rules.

But he warned that Office of the United States Trade Representative had recently closed a month-long consultation reviewing the current arrangements.

This included asking if the tariffs already in place should be increased, if additional products should be added to the list and whether the taxes should apply to other European countries.

“The effect so far [on meat exporters] has been limited as businesses have been able to adjust,” Mr Hardwick said.

“But we don’t know the impact of this [consultation]. We could see products taken off the list, or we could see products added..

“Alternatively, it could be that tariffs are applied to more countries.”

If the US did choose to extend or increase tariffs, Mr Hardwick said it would have a “more profound effect” on the UK meat industry.

For example, if tariffs were extended to cover countries such as Denmark and the Netherlands this could apply downward pressure to the wider European pig market.

The US is an important non-EU market for British pigmeat.

In the year to the end of October 2019, the UK exported 9,000t of pork to the US, compared with 63,000t to China.

But behind the disparity in the tonnage figures, the US pays far more per kilogram, buying high-value, antibiotic-free meat which was worth £24.5m in the year ending August 2019.

Whisky fears

Meanwhile, Scotch Whisky Association (SWA) officials flew to Washington last week to discuss the ongoing dispute with US officials.

The association is worried that if the US increases tariffs it will turn a challenging situation into a devastating one for the industry.

About £1bn worth of Scotch whisky was exported to the US last year and £350m of that was single malt.

The SWA forecasts that at their current level of 25%, if the tariffs remain in place for one year then its market share could fall by 20%.

Many exporters pre-shipped significant quantities of product ahead of the tariffs being introduced in 18 October, which got them through the Christmas/New Year period.

But the SWA warns that the tariffs are now starting to bite, particularly for small and medium-sized distillers.

“These tariffs were applied due to the subsidies given to Airbus, which the WTO ruled to be illegal,” said a spokesman.

“But we are an unrelated sector to aviation and we are having to shoulder the lion’s share of the UK’s tariff liability.”

JOURNAL : Farmers Weekly

Meadow Foods is raising its farmgate milk price by 0.5p/litre from 1 February.

This means its 650 farmer suppliers will be paid 25.5p/litre for their standard A litres.

Meadow contracted volumes (A litres) include a tolerance of +7% to -7.5%, so the vast bulk of farm supplies to the processor falls within those limits.

Above these levels, a B milk price is paid, calculated through an amalgamation of market related, spot and trade prices as well as concentrate values.

See also: Rules on temporary slurry storage when pollution risk is high

“This means that the B price is more reflective of the market rate and can be higher than A price – as it often is,” said a spokesperson.

The B price changes each month, and for December was 24.4p/litre.

“December is always slightly lower due to the Christmas break and the weaker prices it brings. The estimated B price for January is 26p/litre,” said the spokesperson.

Mark Chantler, chief executive of Meadow Foods, said: “We are aware of continued pressures on farmers and are pleased to be able to pass on this price rise, despite the mixed messages on price we are receiving from the markets we sell into.

“The market is expected to remain challenging as we assess the implications of Brexit going forward, however, we will continue to carefully monitor how both supply and demand develop over the next couple of months.

“We will be meeting with our producers next month to share our views on the current market position and to listen to their perspectives.”

Meadow Foods supplies value-added ingredients to the food industry. It employs more than 400 people across four geographically widespread sites, and processes more than 650m litres of milk/year.

JOURNAL : Farmers Weekly

It turns out that I brought home more than just a broad smile and bag of brochures from Lamma. Somewhere in the car, lurking surreptitiously, was a particularly nasty case of man flu.

I can’t for the life of me work out how I picked it up; I know the day was long and fun, but I’m sure I didn’t exchange any bodily fluids with anyone.

The whole jolly event was limited to warm handshakes and backslapping. Little did I know what was on the way.

The gentlemen among you will be nodding in sympathy at this point, but the ladies will be wondering what all the fuss is about; so let me run through, for them, the horrors of a proper dose of man flu, not least to suggest that they are lucky never to experience such misery.

See also: Read more from Charlie Flindt

By the Thursday, I was feeling a bit off colour, getting grumpy with the ex-vet’s loose spaniel on the farm rough shoot.

(Mind you, most of central Hampshire will agree that getting cross with the ex-vet’s loose spaniel is no guide to health at all, unless we all have imminent man flu right through from October to January.)

Of the weekend, I remember little. Hazel says that at one stage I refused a chocolate Hobnob so she wasn’t sure whether to send for an ambulance or the knackerman

Gone off the Hobnobs

By Friday night, I admitted defeat. The lovely Mrs Flindt lit a big fire, dragged my duvet (which may or may not have still had Cain the cat wrapped in it) down from my quarters in the west wing, and a made a nest on the sofa.

My new best friends Mr Paracetamol and his cousin Miss Hot Ribena joined me, along with their chum Mr Voltarol – by this stage a violent sneeze had sent a lower back facet joint spiralling out of line.

Of the weekend, I remember little. Hazel says that at one stage I refused a chocolate Hobnob (another packet had arrived at random in the post from a book buyer), so she wasn’t sure whether to send for an ambulance or the knackerman.

Cain the cat spent a lot of time with me, occasionally kneading his way up my chest and dribbling with glee. Well, one of us was dribbling, so I’m blaming him.

Two flatcoats were thrilled for the excuse to boing their way in at regular intervals and deliver an unwelcome paw-based pummelling. All they did was prove that the facet joint was still out of line.

Scratch and sniff

The Malinois, now that she’s almost qualified as a search/security dog, decided I was worthy of inspection. I was given a long, slow steady sniff-over – which, bearing in mind I’d done 48 hours of weapons-grade sweating, was quite an achievement on her part.

She seemed happy that I had no guns, ammo, or money on my person, but was unconvinced I was clear of drugs. I gave her a Hobnob and told her to bugger off.

There was a lot of terrible television involving border controls, and something hideous called The Masked Singer – although that could have been me hallucinating. In fact, I hope I was imagining it, or civilisation is truly entering the End of Days.

By Tuesday, I was off the sofa, but my eyeballs were red and hurt when they moved. Reluctantly I had to cry off the Clun Forest NFU Dinner (sorry, folks; next year).

By Thursday, I felt slightly human again – but only just. The duvet went back upstairs, the Hobnobs vanished, and my crusty jimjams went off to be incinerated. A whole week gone. Mind you, at least I wasn’t trying to drill – that’s one small mercy.

So, ladies, when we go on about man flu, be kind to us – and be grateful you’ll never know anything like it.

JOURNAL : Farmers Weekly

I was in slow-moving traffic on the M42 on a cold, dark and rainy Tuesday evening.

On Radio 4’s PM they were still whining like stuck pigs about the election result, and I doubted I’d make my regular Flowerpots evening with neighbour Robert.

But, oddly, I was in a remarkably good mood. You see, I’d just enjoyed Lamma.

See also: Read all the latest news from Lamma

Many of us have missed big farm shows since the end of Smithfield. I have been known to log on to Google, find Earl’s Court, and click on the Street View function.

Despite the building having been demolished some years ago, you can still do a ghostly virtual walk around the venue; in through the Warwick Road entrance, round the enormous columns, up deserted elevators and past the endless food and drink outlets lining the edges.

All that’s missing is the livestock smell, and the rosy-faced Agrics in dealer boots and gilets.

Of course, other shows went on after the hasty demise of Smithfield 15 years ago.

The Royal staggered on for a few years, and was marvellous for livestock, double-glazing, water softeners and tacky clothing, but hopeless for machinery buffs. By 2009, that was gone, too.

Cereal offender

There’s Cereals these days, but it is always in the wrong place if you’re coming from anywhere but eastern England, and a bit heavy on agronomy for me.

And it seems to rain a lot. And the Spanish Inquisition seemed to be in charge of ticket acquisition. And no one expects that.

So, with still no drilling possible last week, and free entry, and a relatively short drive to reach the NEC, I thought I’d give Lamma a go.

The day didn’t get off to a terribly good start: the nation’s entire stock of tank transporters were noodling their way noisily up the A34 (is there something we should know?), so reaching the M40 took a lot longer than planned.

But I swung off the M42 roundabout and into the NEC pretty well on schedule.

Yes, the car parks were chocker, but the shuttle buses were frequent, steamed up and very noisy – a bit like the District Line in the Smithfield days.

We were through the main doors, pausing only for our tags to be "bleeped", and into the hall in no time.

I was in machinery heaven. New, shiny kit as far as the eye could see. One or two big names hadn’t graced us with their presence, but the range of heavy metal kit was vast.

Kuhn seemed to have a whole hall to itself, JCB hadn’t scrimped either (including showing its not-a-tractor-anymore fastest tractor).

At the other end of the scale were little booths lining the sides, some not much more than two men and a desk.

Something in the air

It was dry, just the right side of too busy, and best of all was the atmosphere: one of optimism, of looking forward.

An industry supposedly up to its knees in despair and guilt was having a great day out. It was a bit of a throwback to 1980s Smithfield – without the livestock, and the smell, and the dealer boots.

These days, all the bright young farming folk are looking foxy in Fairfax & Favor.

So, thank you, machinery dealers, for bringing all your kit – even if Grammer couldn’t explain (a) how to remove the plastic covers, and (b) why its seats make duck noises after six years.

And thank you, Lamma, we all had a great day out. I’ll forgive you the £11 my bun and a bottle of water cost – and, of course, for the fact that I missed Tuesday in the Jolly Flowerpots. There’s always next week.

JOURNAL : Farmers Weekly

Wading through 94 pages of civil servant speak, as contained in the new ***Agriculture*** Bill, is not for the faint-hearted. All those clauses and subclauses, “may do’s ” and “must do’s” can quickly fuddle the mind.

Good news, then, that Defra has produced a handy little Farming is Changing leaflet, setting out the basics in just eight pages.

See also: What the new ***Agriculture*** Bill contains for farmers

Obviously, not everything gets a mention – for example, the fact there is to be a multi-annual budget, or that government retains the option to intervene in exceptional market circumstances are glossed over.

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Read more articles by Philip Clarke

But it does provide a fairly comprehensive overview of the broad thrust of the planned new policy for England, and even a few details of how it will work in practice.

Not many will be pleased about the plan to phase out direct payments, with the largest recipients facing a 25% scale-back in the first year alone. Farmers may also be wary of the intention to improve public access to open farmland.

Positives

But there are plenty of positives in the new Bill that weren’t in the old one, which shows that ministers and civil servants have been paying some attention to the pleas of farmers.

As well as setting budgets for at least five years (rather than annually), and paving the way for market intervention in a crisis, the government has also attached more weight to basic food production.

It says that, in developing any new funding schemes, government must “give regard to the need to encourage the production of food by producers in England”. It is also committing to report on food security every five years and adapt its policies if necessary.

It’s all very well government revamping the farm support system to make it more appealing to taxpayers and the treasury, but if farmers are left to compete against cheap, substandard imports, they will quickly become unviable

Delinking Basic Payment Scheme payments (as they are phased out) from a need to farm will also give farmers greater flexibility, while plans to invest in infrastructure, R&D and training will help improve productivity.

Strengthening primary producers’ position in the supply chain – through greater transparency, statutory codes and support for collaboration – should also help them get a better deal from the marketplace.

And the ***Agriculture*** Bill includes some positive provisions for tenancy reform, making it easier for tenants to join new “public goods” schemes and invest in their holdings to meet regulatory requirements.

Finally, steps to repatriate some of the so-called “red meat levy” have gone down well in Scotland and Wales.

Glaring omission

But there is, of course, one glaring omission – and that is the failure of the Bill to address the vexed subject of import standards.

A couple of weeks ago, Defra secretary Theresa Villiers told the Oxford Farming Conference she would “not dilute our high standards”.

She went on to tell BBC’s Countryfile that no chlorine-washed chicken or hormone-treated beef will be allowed into the UK under any trade deal with the US.

But there is no mention of any of that in the new Bill. Conversely, just this week, her boss, Boris Johnson, was speaking enthusiastically about letting in Ugandan beef, telling the UK-Africa Investment Summit it would have “an honoured place on the tables of post-Brexit Britain”.

It’s all very well government revamping the farm support system to make it more appealing to taxpayers and the treasury, but if farmers are left to compete against cheap, substandard imports, they will quickly become unviable.

This point must continue to be made loud and clear, both by grassroots farmers and their representatives, as we move on to the next stage of trade negotiations.

JOURNAL : Farmers Weekly

It’s Veganuary, so it is hardly surprising that veganism is getting a higher media profile than normal. But this year it does seem to have stepped up a notch, with Channel 4 leading the way.

First it brought us Meat the Family, in which city families look after farm animals as pets for a few weeks, and then decide whether to eat them or save them.

See also: 7 ways to deter incursions by pig activists

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The first in the series triggered a social media storm, not least from farmers who complained that the programme was showing livestock production in foreign countries, rather than on British farms, which could give consumers a distorted impression.

Next on the menu was Channel 4’s Apocalypse Cow: How Meat Killed the Planet – another diatribe from environmentalist George Monbiot about the supposed perils of livestock production, built on exaggerated claims, distorted figures and false premises.

Farmers were fuming that the programme lacked balance, took things out of context and gave no credit for the massive efforts they are already making to reduce their impact on the environment.

New technology is fast emerging that will help to raise food output to feed a growing population in a more sustainable way. Yet Mr Monbiot ignored all this, instead advocating a future based on lab-grown meat and protein sludge.

And then we were treated to How to Steal Pigs and Influence People.

The backlash from farmers started before the programme had even aired – to the extent that Channel 4 sponsor Mitsubishi was forced to disassociate itself from the show.

But the programme still went ahead, showcasing the activities of so-called “vegan influencers” as they broke into pig farms, removed individual animals from their pens and posted footage on social media to supposedly highlight the alleged cruelty of livestock production.

The film makers were quick to dismiss any criticism, saying they were simply “shining a light on vegan activism in the UK”, rather than “glamorising, encouraging or condoning it in any way”.

And, in truth, it probably was the vegan activists who came out worst from the programme, with farmers and other vegans condemning their approach on social media as “attention-seeking, reckless and illegal”.

Copycat worries

But there is no doubt that the footage will still have turned some people off meat and will likely encourage copycat incursions.

It’s easy to understand Channel 4’s enthusiasm for this series – there is no shortage of vegan food advertising to be had. The broadcaster also recently purchased a multi-million-pound stake in the Meatless Farm Company. But with this programme, it has overstepped the mark.

Rural crime is already at endemic levels and anything that either trivialises or glorifies it is fundamentally wrong. The programme was also one-sided – failing to offer any explanation as to why certain things are done the way they are on farms, or to put things in their proper context.

The biosecurity risk of breaking into pig farms was not addressed properly, nor were the health and welfare implications for the animals.

But most important of all is the human cost. Many farmers are already under severe financial pressure, and having to protect themselves against illegal intrusions, or pay to repair any damage, just adds to the burden.

The vegan onslaught means livestock farmers are already feeling victimised and undervalued. Some are living in genuine fear. Such programmes are not only irresponsible, they are dangerous.

Instead of showcasing these lunatics in action, Channel 4 should be condemning them and reporting them to the authorities, before any further damage is done.

JOURNAL : Farmers Weekly

Grain prices are rising on the back of increases in global markets, alongside growing concerns for the UK’s crops in the ground and those yet to be drilled.

Old-crop UK feed wheat futures put on £5/t in the first half of this week, standing at £158/t for May 2020 on Wednesday (15 January).

Despite a fast wheat export pace so far this season, much of the bumper 2019 crop overhangs the market, limiting price rises.

See also: How does tax averaging work for farmers

Weaker sterling has contributed to the most recent rises, with spot feed wheat also gaining more than £5/t on the week to 15 January to average £148.75/t ex-farm. Feed barley was up £2.50/t to average £122.61/t ex-farm midweek.

New-crop futures rose by a slightly greater degree, with the November 2020 contract up by just over £6.50/t on the week to 167.50/t at midday on Wednesday.

Many traders are reluctant to make firm new-crop bids because of the uncertainty over 2020 production.

New crop ex-farm prices

A limited number of price quotes obtained by Farmers Weekly put feed wheat for harvest movement at £152-£156/t and feed barley at £126-£132/t ex-farm.

One of the main firming factors this week was Russia’s decision to limit January-to-June grain exports to 20m tonnes.

The move comes as a result of rising domestic grain prices, and while traders say this is not a tough limit for the market, it has had an effect.

“More government involvement from the major wheat exporters could spell higher volatility ahead, increasing the buying activity in today's trade,” said commodity analyst CRM.

Further global influences

Support for wheat prices also came with the US Department of ***Agriculture***’s world supply and demand (Wasde) report late last week.

The US winter wheat area, at 12.466m ha, is the smallest since 1910. However, this was largely already factored in to grain prices, said traders.

The report also forecast the lowest end-of-season stocks for five years for 2019-20.

The size of the US maize crop remains uncertain, as 8% of the crop was still not harvested by 8 December.

A 6m-tonne increase in expected feed demand means tighter US end-of-season stocks and a reduced export forecast, also keeping prices firm.

December US stocks were down 5% year-on-year, with an increase in feed demand tightening supplies.

Further afield, Australia’s bushfire crisis has put a stop to farmer selling, pushing futures up to fresh contract highs, said Cofco traders.

Other global factors affecting trade include the planned signing this week of the first phase of a US-China trade deal. However, there is growing doubt over how much trade this will deliver, keeping markets nervous.

Ongoing Middle East tensions continue to affect market sentiment, most directly on oil prices.

Export progress

UK exporters shifted 741,500t of wheat between 1 July and the end of November 2019, compared with 134,200t in the same period the previous year.

The large harvest and pressure to export by the 31 October Brexit deadline were the main drivers, helped by a weak pound.

However, HMRC figures show that at 67,700t in November, wheat exports were the lowest monthly volume since July 2019, and way down on October’s 257,300t.

Wheat imports at 39,000t in November were at the lowest monthly rate since February 2007.

Maize imports so far this season (July-November) totalled 1m tonnes, just below last year's record of 1.1m tonnes.

JOURNAL : Farmers Weekly

There are many good reasons for growers to use some form of soil moisture-sensing technology to monitor conditions and how the water is being used in irrigated crops.

First and foremost, it can make good business sense, as irrigation can be fine-tuned and result in savings or improvements in crop yield or quality that can soon claw back the investment in sensor systems.

In addition, with climate change and tighter regulation of water abstraction putting pressure on supplies for ***agriculture***, using water resources more wisely and having a record of doing so is becoming much more important. Sensors can tick these two boxes.

See also: Low-input cropping plan slashes costs and risk for tenant farmer

Sensor types

Essentially, there are two types of soil moisture sensor, water potential sensors such as tensiometers, and granular matrix sensors, and those that give a percentage or relative water content of soil.

A tensiometer measures suction pressure at its porous tip, replicating how hard a root has to work to extract water from the soil.

These sensors are high-maintenance and only work well in situations where soils stay relatively moist. They also display readings in kilopascals (kPa), which is more difficult to directly relate to water use.

Granular matrix sensors pass a current across a porous media such as gypsum, with electric resistance changing proportionally to the amount of water drawn in and out. They are cheap and low-maintenance, but accuracy can be variable.

The drawbacks have largely seen irrigators move away from both these types of water potential sensors and towards capacitance sensors or time and frequency domain sensors.

Capacitance sensors

Capacitance sensors typically measure soil moisture at several depths and at 10cm or 20cm intervals, tracking how water is moving through the soil profile and the relative soil moisture at each interval.

As they only measure a small volume of soil near the access tube or the wall of the sensor, readings aren’t entirely representative.

The kit can also be affected by salts in the soil – they tend to increase electrical conductivity and cause the sensor to overestimate the water content of the soil.

Installation is critical, as soil contact with the sensor needs to be maximised and soil structure disturbance around the sensor minimised to ensure the readings are accurate.

Time domain reflectometry (TDR) sensors are very accurate and typically consist of two or three metal prongs between 5cm and 30cm long. These are installed by digging a hole and pushing the prongs into the undisturbed soil.

Soil moisture is measured 3-6cm around the sensor, so they can monitor larger volumes of soil and, when installed correctly, offer more representative results than other types of sensors.

There are three main players in soil moisture sensing, either selling direct to growers or through selected dealers. These include Australian firm Sentek, US-based Meter and British maker Delta-T, although others are available.

Sentek

While Sentek offers a range of products for soil moisture monitoring, the one of interest to UK potato and veg growers is its Drill and Drop capacitance sensor, which can work at depths between 30cm and 120cm.

However, as the majority of roots in crops such as potatoes rarely reach more than half the probe’s maximum depth, a common set-up in the UK would operate at 60cm.

Along those 60cm, six sensors at 10cm spacings take moisture readings every 30 minutes and send a soil moisture content reading in millimetres (mm) and soil temperature reading to a ***data*** logger at the soil surface.

The logger then uses a GPRS signal to send the ***data*** to a cloud-based system, which can be accessed by farm or irrigation managers on the ground via a computer, tablet or smartphone.

Most Drill and Drop installations have an electronic rain gauge positioned on top to account for precipitation and applied irrigation and their effect on soil moisture content.

There is also the option of Sentek’s Triscan sensor, which offers all the same features as the Drill and Drop, as well as additional ***data*** on soil salinity. This can be used to track ***nutrient*** leaching and crop use through the soil profile.

The Drill and Drop probe installation method is unique and should provide accurate results.

Instead of digging a pit to insert sensors into the profile or using a “slurry mix” to backfill around the probe, a tapered auger drills a hole in the ground.

The probe is then gently pushed in and because the soil structure around the instrument isn’t significantly disturbed, it provides representative and repeatable results. The ease of installation and removal also makes it ideal for annual crops.

Most existing users in the UK will buy or hire the equipment from a service provider such as Suffolk-based Soil Moisture Sense, with the company also taking care of installation, service and ***data*** handling.

A single Drill and Drop with electronic rain gauge costs £975 to buy, with a £65 installation fee. Users then pay £275/year for the support service, which includes ***data*** handling, two soil moisture content graphs a week and an-end-of-season report.

The annual subscription can be reduced where multiple sensors are installed. Hiring costs are £635/season, inclusive of all costs.

Meter

US company Meter – formally known as Decagon – is another well-established brand in the soil moisture sensor market and Hampshire-based specialist Labcell sells, supplies and supports its range across the UK.

Its core offering is the Teros range, which uses high-frequency capacitance technology to measure soil moisture, temperature and conductivity.

The sensors – which consist of three sharpened stainless-steel prongs that output the gadget’s charge into the soil – have a low power requirement and give either analogue (Teros 10) or digital (Teros 11 and 12) signal to a datalogger and/or handheld device.

Cable length is typically 5m, allowing the sensors to be placed at a number of depths through the soil profile. Cables can also be extended to, say, 40m, where a grower or researcher wants to monitor soil moisture over a much wider area.

The sensors are compatible with a number of dataloggers, but Meter recommends its ZL-6 box, which can take inputs from up to six sensors in the field and transmit ***data*** straight to a cloud-based platform.

Information is stored on the logger and uploaded hourly to the cloud via a mobile signal. A yearly subscription to Zentra allows users to access, download and analyse it in detail.

Labcell sell and support the hardware, including sensors, cabling, diagnostic/installation checkers and dataloggers, but don’t offer hire of sensors.

The biggest difference is in the installation of the Teros-type sensors. Rather than being drilled into the ground, a larger hole is dug, sensors placed at the desired depths through the profile and then backfilled once the cables are connected to a datalogger.

This lends their use to more permanent installations, rather than in annual crops, but they can still be used in these situations if placed in areas representative of the crop and soil type.

Sensors for Teros 10, 11 and 12 cost £100-£200, depending on the quantity purchased and cable length. A six-channel, GPS-enabled ZL6 ***data*** logger, compatible with a smart device app, is £560, and an annual ***data*** subscription using the Zentra cloud platform is £160.

This sees a system comprising six sensors, datalogger and first year subscription costing about £1,900.

Delta-T

Cambridge-based Delta-T's range of soil moisture sensors are well established in research and horticultural sectors.

It has a number of sensors suitable for spot moisture readings when growing crops in substrates, such as strawberries, but for broadacre farmers looking for season-long monitoring of soil moisture, its PR2 Profile Probe is a good option.

The PR2 is dual purpose, so it can either be permanently installed to log soil moisture over time, or it can be portable, with the farm or irrigation manager dropping the probe into access tubes buried in the ground and taking a spot reading when required.

The PR2 is available in two sizes measuring to a depth of either 40cm or 100cm. The PR2/4 has four sensors at 10cm intervals, while the PR/6 has two additional sensors at 60cm and 100cm.

When installed, up to three PR2/4s and two PR2/6s can be hooked up to Delta-T’s GP2 datalogger, which stores the soil moisture ***data*** readings. The ***data*** can then be downloaded to a laptop or, with the addition of a GPRS modem, wirelessly sent back to the farm office.

The company offers a free ***data*** gathering and file sharing service to complement the hardware, or there is the option to use compatible third-party software or cloud-based systems to manage and interpret the probe’s output.

For the portable option, a HH2 handheld meter can be used along with the probe to record soil moisture. Information is transferred to a computer via USB, providing a fast and efficient way to get ***data*** covering a large area.

The price of the Delta-T PR2 probe depends on which options customers choose, the situation and resource, but an approximate cost for a probe, datalogger and modem with battery and ***data*** package is £2,600, including a two-year warranty.

Delta-T stresses there is no annual fee for the cloud site and the ***data*** package can last up to three years, depending on customer setup.

Other factors include the frequency and amount of ***data*** they wish to download and whether certain options are bolted on, such as the ability to remotely change programmes.

For installation of the PR2, users will have to purchase an installation kit, which includes augers for drilling holes.

Some of the information presented in this article was provided by irrigation expert Rohan Prince of the department of ***agriculture*** and food in Western Australia.

JOURNAL : Farmers Weekly

New technology could help tackle lameness in sheep by providing farmers with an early warning of a developing problem in their flocks, researchers have found.

More than 90% of UK farmers report lameness in their sheep and the condition costs the sector about £80m a year. Much of the issue is due to foot rot caused by a bacterial infection.

See also: How hill farmers keep production costs to £43 a ewe

The key is to spot the disease early to prevent it spreading and becoming a major, costly health and welfare problem for the whole flock.

However, researchers at the University of Nottingham found that making an accurate diagnosis was being hampered by the sheep's instinctive behaviour.

As sheep are a “prey” species they are likely to mask signs of lameness that might identify them to a predator as an easier kill. The behaviour pattern is repeated when they feel threatened by the presence of observing farmers and vets.

Early diagnosis hard to detect

This means that, until now, early diagnosis has been difficult and reliant on close visual inspection, a spokesman for the university said.

However, the researchers have developed and tested an automated lameness detection system that identifies the modified behaviour in the sheep when standing, lying and walking.

The prototype technology is based on a tagging and monitoring system developed by Nottingham associate professor Jasmeet Kaler, in conjunction with computer hardware giant Intel and software developer Farm Wizard.

Dr Kaler explains that the smart, wearable technology, consisting of a sensing device worn on the sheep’s ear tag, gathered accelerometer and gyroscope ***data***.

How it works

The tag effectively tracks the animal’s behaviour and movement, and its way of walking, standing and lying.

Software algorithms then create different alerts for farmers. For each of the three activities (standing, walking and lying), the study identified features that differed between lame and non-lame sheep.

This is particularly novel in the cases of lying down and standing, which have less obvious lameness-related behaviours that had been difficult to spot with the human eye previously.

The results suggest that instead of lameness affecting activity levels of sheep, they carry out activities differently, leading to a change in acceleration and rotational movement.

For example, lame sheep showed a change in gait, with peculiar head nodding in line with stride, compared with non-lame sheep which had a smoother stride pattern.

A particularly interesting find was that lame sheep could be spotted with higher accuracy when lying and standing.

Differences were recorded in the variability and smoothness of movements for both standing and lying down.

Lame sheep redistributed their body weight to an unaffected leg, leading to postural changes when standing. The research also suggests that lame sheep may lie differently than non-lame ones, which again could be due to the animal attempting to alleviate the pain.

Dr Kaler added: “Our study has shown conclusively that there are behavioural differences between lame and non-lame sheep when walking, standing and lying.

“This has been the first report of its kind and, given that lameness classification is possible within all these activities, this helps to improve the accuracy as well as flexibility in terms of energy requirements."

He added: "This automated system for lameness detection can help improve sheep health and welfare on farms.”

JOURNAL : Farmers Weekly

A Welsh farm has successfully tackled an infectious form of lung cancer in sheep with a radical scan-and-cull policy.

Ovine pulmonary adenocarcinoma (OPA) is caused by a virus which infects cells in the lung and leads to tumours.

At College Farm, Trefecca, Powys, the disease was first identified at post-mortem in sheep.

Father and daughter Peter and Nicola Drew were alerted to the problem after ewe mortality started to increase.

Nicola says: “In 2015 we noticed it was creeping up, I had a look on the AHDB website and read the expected level of ewe mortality in a lowland flock was 4-6%. Ours was 5% and that felt like a lot to me.

“There was a pattern of ewes going thin and antibiotics not working, one of the chronic symptoms of OPA.’’

Farm facts: College Farm

280 acres farmed

Sheep flock consists of mainly Texel crosses

Charollais tups turned in with ewes on 22 October

20 Aberdeen Angus-cross, Belgian Blue-cross and Hereford suckler cows

Ewes wintered on swedes and turnips

180% scanning percentage in 2018

Fluid also flowed from both nostrils of affected ewes when their heads were lowered, another indicator of OPA and post-mortem examinations confirmed the disease.

The disease can be transmitted via respiratory fluids as well as colostrum and milk. Best practice is to identify and cull out sheep with any sign of the disease as early as possible, and this was the advice of the farm’s vet.

The Drews first wanted to rule out other possible causes of wasting.

“We blood-tested a bunch of thin ewes, to make sure there weren’t any other underlying diseases, and we also had worm and fluke counts done,’’ says Nicola.

See also: 7 crucial topics for sheep business viability

“They were completely clear of everything so we knew OPA was the problem and not anything else.”

From that point on, in 2016, a rigorous approach was taken to culling ewes suspected of having the disease.

“At one point our culling rate was 20% but it was a price we were willing to pay to have a healthy and productive flock,’’ says Nicola.

Diagnosing OPA

In the absence of an accurate laboratory test for the disease, ultrasound lung scanning is used as a diagnostic tool to identify tumours at an early stage.

This is the approach the Drews have now taken to help control OPA. “We had support through Farming Connect to scan the sheep,’’ says Nicola.

In 2019, a decision was taken to reduce the size of the flock, so the 240 ewes selected to be retained were all scanned.

“These were the fittest and youngest ewes and yet through scanning we still found six with small tumours,’’ Nicola says.

As they were not at the chronic stage, they were separated from the flock and fattened to maximise their cull value.

“There is a definite value in scanning and finding cases early enough,” she says. “The difference between a thin ewe and a fit cull ewe can be £40-£50. Also, if a ewe dies it costs us £15 to have it taken away.’’

Identifying cases at an early stage also reduces the risk of healthy sheep becoming infected.

Reducing infection spreading

Protocols are now in place at College Farm to reduce risk of infection further.

Buying in OPA-infected stock is known to be a major risk factor so the decision has been taken to rear replacements rather than buy in yearlings, as practiced previously.

Although rams will still have to be bought, these will be scanned before entering the flock.

Another risk is keeping sheep in close proximity to one another so ewes are housed for only a minimum period prior to lambing; this is weather-dependent but the target is no longer than two weeks.

The mineral requirements of sheep are now met through boluses rather than buckets to prevent the virus from spreading from respiratory secretions.

Benefits

The detect-and-cull policy has resulted in a healthy and productive flock with ewe mortality at just 2%, from 3.5% in 2017.

Flock performance has improved too.

“When you are culling hard the overall productivity of the flock increases,’’ says Nicola.

“It was difficult to cull so hard because everything we do is based on increasing numbers, but if we hadn’t taken this approach we would have continued to see an increase in mortalities and flock performance would have gone down.’’

There have been positive repercussions for lamb health too.

“A thin ewe isn’t able to look after her lambs as well as a fit animal,’’ says Nicola.

“We no longer have to help ewes or hold them back and if they are producing sufficient quantities of good quality milk it has an influence on a lamb’s performance for the rest of its life.’’

The future

Ewe numbers have reduced from 600 to the 240 tupped this autumn.

This reduction has in part been due to higher rates of culling but also because Peter and Nicola decided to reduce flock numbers and disperse 130 Suffolk-cross Mules as they change their breeding policy and move away from producing early lambs.

“The Suffolk-cross Mules were run completely separately from our March-lambing flock and we had no OPA issues with those,’’ Nicola points out.

She says scanning will be undertaken annually – the cost can be quickly absorbed when balanced against the cost benefit of selling a good cull ewe.

Scanning is charged at an hourly rate, with about 40 ewes scanned in an hour.

“We can get £75 or so for a fattened cull ewe so that quickly covers the cost.”

Had she not dealt with OPA the situation would have regressed further. She urges other farmers to confront the problem, not only to remove disease from the flock but to lift productivity.

“It is easier to make improvements in the bottom performers than in the top end.’’

JOURNAL : Farmers Weekly

Climate change means UK farmers are experiencing more extreme weather conditions which can make growing crops far harder.

What lessons can be learned from other countries to help improve feed security? Rhian Price reports from the US and Australia.

UK farmers are experiencing some of the most volatile weather in history. Four out of five farmers are experiencing extreme weather, ranging from drought to flooding.

.        Two-thirds of 176 farmers questioned as part of an exclusive Farmers Weekly survey say they are being forced to use supplementary feed due to extreme weather conditions.

Flood-hit autumns and springs have delayed and even prevented crops being planted, with respondents saying 2018 was the worst year so far.

Extremely hot summers have seen pastures burn off and grass growth halt. It has also affected the yields of vital crops of maize and grass which mean feed supplies have been in perilously short supply on many farms.

But farmers in other countries are facing even worse scenarios. Below, we speak to farmers in Australia and the US to find out how they are dealing with weather extremes and speak to an independent consultant to find out what UK farmers can do to improve feed security.

See also: How to minimise maize losses as feed supplies tighten

Perspective from Australia

Perspective from US

Expert advice

See also: Ahdb feed budget planner

Perspective from Australia

Dairying in Australia, where drought can hit at any time, means having a bank of forage is paramount for dairy manager Dan Brown.

He aims to have enough feed banked for 12 months at Coomboona Farms, two hours north-west of Melbourne, Victoria, where they milk 2,600 cows.

Forage crops such as maize, Lucerne, vetch and winter cereals are grown across the farm’s 5,000 acres with everything cropped for silage.

This means they only have to rely on buying in straw and protein – mainly cotton seed and canola meal to supplement milking rations.

“We do a whole lot of budgets based on how many tonnes of each crop we would like to feed in a year and how much land is required to grow that feed. We budget for 12 months up our sleeve,” says Mr Brown.

See also: Guide to preparing a feed budget

Farm facts

Milking 2,600 cows, mainly Holsteins with 400 Jerseys

Averaging 43 litres of milk produced daily at 4% butterfat and 3.35% protein

Farming 5,000 acres

One of three farms owned by Australian Fresh Milk Holdings

Even then they try to reduce the risk of price volatility by having their own commodity buyer who works for the Australian Fresh Milk Holding group's three farms buying feed supplies. Sometimes this is purchased 12 months in advance, or a little less if the price is favourable.

Water and irrigation

Although the farm has a plentiful supply of land to support forage production, scarcity of water makes it an expensive commodity.

When the farm was originally purchased in January, a one-off payment was made to secure a permanent licence to allow water to be pumped out of the Goulburn River. But in years of low rainfall abstraction allocation is limited by the government.

“Irrigation is very expensive and access is more restricted because it’s been so dry. Last year we only had 70% allocation,” says Mr Brown.

To bridge the deficit they have to buy on the temporary market which costs about $600/megalitre (£318/megalitre).

“We have enough water security that even in a really bad year we can grow half of our crop,” he says.

With a bank of 12 months’ feed, that means they can get through the year and have some left over. It also ensures that any cropping failures can be covered by the previous season’s harvest.

“We would be in trouble if we had two years of drought, but luckily that has not happened since 1990.”

While farmers in the UK usually have a short window to gather silage before rain, in Australia the summer’s 45C heat can quickly dry out crops, so getting forage in fast is essential.

“We like to keep everything in-house to harvest at the correct stage of maturity for each crop and we have a crop manager who oversees the budgeting of crops across all of the farms,” says Mr Brown.

Expansion

By July they hope to be milking 5,000 cows and have already lodged a development application to enable this. This means extra mouths to feed, so they have already started growing enough extra forage to meet demand.

Having such a big bank of feed is not only good for weather security, but it provides a consistent ration for long periods, meaning it is easier to maintain higher milk yields.

“We have enough maize to get through to July. We know our harvest will come in March which gives us four to five months up our sleeve before we open the pit. This gives us more consistency and reliability because the cows are on the same ration for longer periods,” says Mr Brown.

He believes housing cows year-round helps mitigate against weather extremes.

“Graziers are at the mercy of the environment,” he adds.

Perspective from the US

Hailstones as big as conkers can wipe out entire crops in the High Plains of the United States where Alex Steer helps manage a 2,700-cow Jersey herd.

 “We get a lot of damage every year from hail. It tends to be very local, which means we get a different level of failure within each field.”

Although the Texan dairy has crop insurance it often leaves them out of pocket.

When a crop is damaged an adjuster will come out to the farm to assess it. If the crop loss is estimated at 80%, for example, the insurer will usually offer to pay about 60% immediately, or the farmer can choose to wait until harvest when he will get the full amount, providing the crop only yields 20% of its potential.

The trouble is, with hungry mouths to feed, few farmers can afford to wait that long.

“As a farmer you have to take the lower deal because you have to put a crop in the ground to feed the cows.”

Farm facts

Milking 2,700 Jerseys

Producing 28 litres at 4.9% fat and 3.8% protein

Owns about 1,011ha, of which 810ha is irrigated land

Sells milk to Hilmar cheese company

Payment is linked to the Chicago Mercantile Exchange based on how much cheese will be produced from a certain amount of milk

In 2017 when the last crop failure happened they were forced to buy in about 40ha from a neighbour.

“It was a tough deal because it was a lot of money.”

Feed planning

This makes feed planning extremely difficult, but he tries to have a buffer to deal with these extreme weather events.

“I would love to shoot for a year’s buffer, but I have never had that. I’ve had 10 months.”

Another reason for this is that crop yields are so variable from year to year. In Texas, gale-force winds of up to 80mph and soaring temperatures of up to 40C can dry out crops in no time.

They mitigate this to some extent by irrigating water from underground wells to keep crops moist. This is relatively inexpensive with $500 (£389) abstraction payments made to the local district annually.

“Our biggest expense is our energy to pump the water; we have a mix of electric and manual gas. The major limitation is on how much we can physically pump.”

Even then, maize yields can vary from 16-30t/acre. This can make feed planning challenging, he concedes.

Feeders will work a week in advance planning budgets and inventories are kept up to date. Mr Steer works with a feed broker to buy protein and will lock up prices in advance if they look favourable.

The farm also works closely with a nutritionist to look at alternative supplements to keep within feed budgets of $4-4.50 (£3.30) a cow a day. The main forages grown are triticale, sorghum, maize and alfalfa with canola, cotton seed, dried distiller grains and maize purchased to balance rations.

Managing milk yield peaks and troughs can be hard with such big forage variations.

“We’ve gone for a whole year with just triticale as a forage base and I don’t think the cows made more than 26 litres of milk [a cow a day].”

Harvesting

They rely on “custom harvesters” to harvest, haul forage back to the farm and pack the clamp. The whole process is charged on a price per tonne basis. A separate team comes in to sheet the clamp.

With harvest and sheeting for maize and sorghum costing $350,000 (£272,000) it’s one of their biggest costs, but they deliver an efficient and cost-effective service.

“We looked at sheeting the clamp ourselves, but we couldn’t even come close as they get big discounts on the plastic.”

Thankfully they have 12,500t of maize in the pit from last season and are hoping this will last them up to this year’s harvest, giving them another opportunity to build their feed inventory.

How can we be better prepared in the UK?

1. Reduce your feed waste

One of the first things farmers should ask themselves is: How can you reduce waste?

The Smart Silage project led by the Institute of Biology, Environmental and Rural Sciences at Aberystwyth University concluded that average dry matter losses during silage making (from field to feeding) are 25%.

In addition to the quantity of material lost in the process, quality also suffers since the highly valuable digestible fractions will make up a large proportion of the material lost.

A prolonged and inefficient fermentation in the clamp will lead to protein, digestible fibre and sugar losses – hygiene, consolidation, sealing and use of a suitable proven additive will minimise these losses.

Farmers need to assess how they can reduce losses in the following key areas: in the field, in the clamp and during feed out.

2. Value feed

To properly reduce waste, farmers have to start valuing the forage they make so they realise how much waste is costing them.

The cost of establishing, growing, harvesting and ensiling crops is significant and the value of high-quality forage in terms of increasing livestock performance and reducing concentrate cost should not be underestimated.

Many US farms have to buy in a large proportion of their forage from specialist growers, so they have a clear understanding of the cost, and how dry matter and ***nutrient*** losses must be minimised.

But in the UK, there can be a temptation to underestimate the cost and value of wasted forage because farmers have grown and stored it themselves and fail fully to cost out the whole process.

3. Improve storage capacity

Many farms have increased stock numbers, but have not expanded facilities for forage, and may not even have enough capacity for the forage they have, let alone more.

There is nothing worse for waste than overfilled clamps that cannot be well compacted.

While a greater depth of silage reduces the volume of surface in material in proportion to the whole clamp, it often means poor shoulder consolidation, difficult sealing and spoilage.

Many clamps may already be unfit for purpose, and these units will require upgraded facilities to meet tougher environmental regulations on effluent pollution.

Farmers should capitalise on this opportunity to expand storage and design in flexible options at the same time.

Open-ended clamps provide easy access at both ends, which allows farmers to refill half-empty clamps with fresh forage at one end, while they finish older preserves at the other.

This allows more flexibility when harvesting and simultaneously feeding silage through the season, with up to five cuts of grass, wholecrop, and maize often requiring storage and access for feeding for fully housed units.

Bales can be made without having to invest in extra storage, but they don’t always fit into everyone’s feeding systems.

Ag Bags are also an option, but both represent higher ongoing costs. However, they are good options for those with surplus forage who do not wish to incur the capital cost of additional clamp storage.

Clamps are a big capital cost, but it’s a good investment when you look at how much you spend on forage. If you spread the repayment over 20 years it would probably be the cheapest option, but it is a long-term commitment.

Other farmers have made good use of large feed pads against the wall of an existing clamp. It is relatively cheap but it creates a bigger surface area for run-off.

4. Spread your risk by growing more than one crop

Lucerne is worth considering on suitable land as it is a drought-tolerant crop. Alternatively, wholecrop offers farmers some flexibility in terms of a mid-summer harvest and reseeding opportunity.

It can help cover shortfalls of grass in a dry season or, if farmers have a plentiful supply of good quality grass silage, they can leave the crop and combine it.

Conversely, if maize goes in late and establishment is poor, winter wheat can help make up forage deficits because the crop will already be well established by March/April.

You need to assess your growing risks, soil type and forage requirements first, however.

Don’t leave yourself vulnerable. Look at your system and build in some resilience.

5. Build a bank of forage

To build a buffer you need just one year where you grow or buy more forage. Ideally, farmers should carry out a forage budget and plan so they have at least three months’ worth of maize in storage.

There’s a big advantage to not feeding maize fresh and to be in that position you need to have 15 months’ worth in year one. This enables the new crop to be fed from January through to December.

This means farmers could wait to open clamps in January rather than straight after harvest in the autumn and give the crop more time to ferment.

If all things are equal you only need to grow 12 months’ worth but if a poor year comes around you can end up back to square one. So in a good year you have to bank that feed again.

The downside is farmers need enough cash to make more. Conversely, banking too much can tie up too much cash in feed stocks and limit storage, so careful balance is required, depending on relative risk factors for each farm.

JOURNAL : Farmers Weekly

Wrexham dairy farmer Stephen Massey says using technology to sample individual quarters for cell counts has given him the confidence to start using teat sealant alone on some of his cows at drying-off.

Mr Massey is one of three Welsh farmers trialling the VetScan DC-Q Scout as part of a Farming Connect-funded two-year study, which started in November 2019.

Previously, he was using antibiotic tubes only on every animal at drying-off, however, a few mastitis cases were common in fresh cows.

This is not unusual, with some farmers using antibiotics-only because they believe they are long-lasting – in fact, they only last in the udder for a short period.

See also: How on-farm mastitis test helped farmer cut antibiotics use

Farm facts

Pentre Isaf Farm, Ruabon, Wrexham

Milking 330 Holstein cows

Yielding 8,500 litres at 4.28% butterfat and 3.35% protein

Calving year-round

Suppling Tesco Sustainable Dairy Group (TSDG)

240 beef cattle sold annually; some sold finished and others as strong stores at 25 months and 60 home-bred replacement heifers reared annually

Lifetime tenant on the Wynnstay Estate

Farming 295ha partially owned and rented, including home farm and a separate dry stock and beef unit and rented summer grazing

Farming in partnership with his wife, Sarah, parents, and alongside their three sons Harry, 19, James, 16 and Ben, 14

Working with vet, Claire Whittle of LLM Farm Vets, steps were taken to reduce infection.

These included using more limed woodchip on top of mattresses to keep udders cleaner and alternating between two dry-cow sheds – one at the home farm and one at their dry stock unit – which has allowed them to rest sheds for one month after cleaning.

This helped reduced fresh cases of mastitis, but Mr Massey knew he needed to start carrying out selective dry-cow therapy (SDCT) to meet his Tesco Sustainable Dairy Group (TSDG) contract requirements.

Still nervous about using teat sealant only, Mr Massey joined the Farming Connect trial to get the most up-to-date cell count ***data*** and reassure himself that he was using it on the correct cows.

How the test works

To identify which animals are suitable candidates for SDCT, milk samples are taken from each quarter the day before drying off.

The sample is then picked up by vet tech development co-ordinator Natalie Parker. from LLM Vets, who is overseeing the trial.

Samples are taken to LLM’s Wrexham lab for analysis, with Zoetis’ VetScan DC Q Scout using fluorescent microscopic technology.

The test – known as Milk Leukocyte Differential – counts and differentiates the immune cells lymphocytes, neutrophils and macrophages. These are mobilised when pathogens are present so provide an indication of infection.

The test takes just five minutes and the machine generates a total leukocyte count – positive or negative – as well as the percentage of each of cell types present in each quarter of the udder.

This farmer can then use the information in combination milk records to treat each quarter appropriately at drying off.

Currently, all animals are being tested before to drying off as part of the trial.

Any cow with a cell count over 100,000cells/ml on her last milk recording, or if her highest cell count during lactation exceeds this limit, will automatically be given antibiotics.

The benefits on farm

The precision technology is having real advantages in identifying lower cell count cows with subclinical mastitis that would have otherwise been missed using milk records alone.

“The three cows we have dried off today have come back positive, even though we thought two would be fine according to their cell count.

"If we hadn’t treated them with antibiotics, they could have calved down with mastitis,” explains Mrs Parker.

The dry-cow period is a good time to clear existing mastitis infections because a higher antibiotic dose can be administered outside of lactation.

Since the trial began, Mr Massey has dried off 29 cows and has used teat sealant on only 11 animals; saving 18 antibiotic doses.

Test costs

To save money, Mrs Parker suggests using the test strategically by automatically giving high cell count cows antibiotics.

Then test as a "fail safe" on "outliers" – cows with cell counts rising towards the end of lactation or those exhibiting one high count during lactation.

“It is especially good for farmers who are nervous about moving towards SDCT.

"Antibiotics are there for a reason and they work well if used correctly,” adds Mrs Parker.

Mr Massey says that’s exactly what the test has achieved at Pentre Isaf, adding: “It has given us the confidence to start using teat sealant alone on some of our cows.”

Test pros and cons

Improves accuracy at drying-off – disadvantages of being solely reliant on cell counts is that averages can disguise subclinical infection in a quarter and ***data*** can be invalid by the time it comes to drying-off, especially where milk is not recorded monthly

More accurate than the Californian Milk Test (CMT)

Currently can’t be used to diagnose type of pathogen causing infection

Must know what pathogens are causing mastitis: if you have Staphylococcus aureus mastitis, you shouldn’t use SDCT and the VetScan DC Q Scout wouldn’t be recommended. It is highly contagious and antibiotics may be needed

Easy to take samples: cleanliness isn’t vital, however, the cow should be stripped out first before the sample is taken

Easy to store: samples need to be kept out of direct sunlight and kept cool, but don’t need to be refrigerated

Next steps for testing

As part of the trial, Tom Bletcher is using the test to further reduce antibiotics by treating cows on an individual quarter basis.

Mr Bletcher, who has applied SDCT for the past three years in his 350-cow herd, near Mold, in conjunction with Willow Vets Group, is already using teat sealant only on half of his herd.

Antibiotics and a teat sealant are administered at drying-off to the positive quarter. The remaining three-quarters are given sealant only.

There is a risk the infection could spread to the other quarters through the blood, concedes Mrs Parker, however, risks are lower in dry cows.

As cows calve, the test will be conducted again so they can monitor infection spread. It is hoped preliminary results will be ready in six months.

More information

VetScan DC-Q test

This test is not yet commercially available widely and costs to farmers is still being negotiated.

Zoetis is working with vet practices to offer the service.

For more information, visit the VetPartners stand 167 at Dairy-Tech next month.

What is the VetTech service?

The VetTech service at LLM offers hands-on farm support with vaccinations, youngstock health, mobility scoring, worm egg counts, transition checks, body condition and teat scoring.

VetTechs can also carry out training with farmers and farm staff in co-ordination with their vet to maximise the effectiveness of on-farm protocols.

The service has worked well, which is why the VetPartners Group is looking to introduce VetTechs to an increasing number of their farm practices.

JOURNAL : Farmers Weekly

A new drilling outfit developed in Australia is using clever moisture-sensing tines to automatically alter sowing depth according to soil conditions.

Moisture Planting Technologies (MPT), based in New South Wales, has designed the kit primarily to help Aussie farmers avoid unnecessary wear and tear on machines by reducing sowing depth in areas where moisture is present.

See also: Farmer saves cash by 3D printing parts for home-built drill

According to the firm’s David Finlay, many growers are direct drilling chickpea crops down to 25cm to be sure of finding moist soil, and this safety-first seeding depth is burning barrel-loads of diesel in the process.

“Spot consumption rates can hit 80 litres/ha and the incredible force required to pull 25t, 24m planters has meant we have had to fit many with steel reinforcements to cope with the strain.”

The company decided to look at creative ways to reduce the drag force associated with drilling and noticed that the main problem was farmers laying seed deeper than necessary to mitigate varying soil conditions – primarily moisture.

However, by tracking soil water in real time, it can now alter sowing depth accordingly.

“Monitoring soil properties – moisture, temperature and pH – and allowing the drill to self-adjust to optimise placement saves working really deep when it’s not necessary,” says Mr Finlay.

The system is designed to fit most new broadacre drills and, he says, offers potential yield increases of up to 10% in the right soil and rainfall conditions.

Row units

MPT began by creating a tine-based row unit made up of a three-stage parallelogram system. All three sections – gauge wheel, tine and press – have their own hydraulic cylinder.

Unusually, all adjustments are computer controlled – there are no hole-and-pin arrangements to set the position of particular components – so each row carries a leading depth wheel to give a precise measurement of ground position.

The second linkage manages the tine depth, which is the standard soil working component.

“Tines bite into the ground much easier than a disc and, for farmers drilling deeper than 5in, it’s the only option,” says Mr Finlay.

However, it is possible to swap out the tine and fit a double-disc opener for planting oilseed rape at shallow depths, or a cultivator point, should growers simply want to loosen the ground.

At the back is a press wheel, which allows operators to vary downward pressure separately of the depth wheel. The upshot of this is packing pressure can easily be adjusted when ground conditions change.

Precision Planting Smart Firmer

The obvious rival to MPT’s system is the Smart Firmer, developed by Agco-owned firm Precision Planting.

It runs behind the drill’s discs to measure soil temperature, moisture and residue in the seed furrow, and can be fitted to any row crop planter that drills deeper than 2cm.

As it presses seed into the seed trench, a sensor gives real-time measurement of soil moisture, temperature and trash levels around the seed.

It can also sense organic matter levels and cation exchange capacity (CEC), which are both valuable indicators of soil productivity.

Organic matter and CEC are both characteristics that require sampling or an extra pass with a specialist machine to measure, with results used to retrospectively create maps for variable-rate seeding.

With Smart Firmers fitted on each seeding row, all soil-condition ***data*** is fed back to Precision Planting’s 20|20 monitor in the tractor cab.

The information is then used to vary the seed rate, fertiliser rate, crop variety and seeding depth to even up emergence or push yields in more productive areas. Conversely, seed and fertiliser can be cut back in less-productive areas.

Its unique feature is the ability to vary seed and solid or liquid fertiliser automatically in real time when used in conjunction with the firm’s various individual row electronic metering systems.

Moisture sensing

The clever part of the system involves a series of sensors that are embedded in the tine opener to monitor soil properties through the profile.

These sensors are mounted behind a ceramic plate on the side of the tine and the measuring happens during the physical process of opening the soil to provide real-time ***data*** relating to its condition.

This differs from the likes of Geoprospectors' Topsoil Mapper, which fits to the tractor’s front linkage and takes measurements without actually touching the soil.

Sensors are fitted evenly along MPT’s toolbar, but not on every tine, with a 12m machine carrying six sets in total. Initially, the company sourced them from third parties, but it has now decided to build its own to more accurately target specific soil properties.

Unsurprisingly, this is a complicated business. The end result is that several types of sensor have been developed, all of which give different ***data*** readings, but they are selected to suit a farm’s particular soil conditions and requirements.

The sensors send ***data*** to a microprocessor mounted on the toolbar, which analyses the information and automatically makes adjustments to find the optimal drilling depth.

Information is then sent via a local wifi connection to a tablet in the cab. This is effectively an interface running through an app – all the info crunching happens on the drill – and means the driver can track what is happening with sowing depth and soil moisture.

And because it is self-sensing and self-adjusting, it doesn’t require mobile ***data*** to operate.

How does it work in practice?

In terms of driving, the operator simply sets a minimum and maximum sowing depth and the computer will lift and lower the tine to suit the conditions.

Obviously, changing working depth on the go will affect power requirements, so Mr Finlay recommends using a tractor with a stepless transmission to avoid frequent gear changes.

If the drill is working at maximum seed depth and detects no moisture, it will send an alert to the driver, who can then decide whether to continue, stop or reduce the depth – there is no value drilling deep if it’s just as dry as shallow sowing.

The tablet also gives operators manual control of all the functions, including depth, and a drilling map can be downloaded afterwards to overlay with yield maps.

There are currently no built-in functions to control the seed rate, but this prospect is being evaluated and could be added through a future software upgrade. However, operators can control things manually by monitoring the soil moisture/sowing depth on the screen.

In theory, variable-depth drilling influences the uniformity of crops when they emerge, as deeper-sown seeds take longer to reach the surface.

However, Mr Finlay says that laying the seeds in a uniform moisture density is the key factor, as they all germinate at the same time and variation is much less significant.

Geoprospectors Topsoil Mapper

The Topsoil Mapper built by Austrian firm Geoprospectors uses a series of electrical conductivity sensors that fire signals into the soil profile.

The device is carried on the tractor’s front linkage and continuously measures soil moisture, texture and the depth to compacted layers throughout the topsoil profile using electromagnetic induction via an array of transmitters and receiving coils.

Depending on the type of signal that bounces back, the sensor’s brain can work out the exact depth of the compaction. This means you can carry out variable-depth cultivations without having to do any prior soil zone mapping.

The system is currently imported to the UK by CNH under its Agxtend banner.

Can it measure anything else?

The equipment has been developed primarily to measure moisture, but other sensors can be used to look at different soil properties.

Though most will have little effect on the rate or depth of drilling, they can help provide maps or ***data*** for future reference. These include pH, which could be used for variable-rate fertiliser spreading, for instance, and soil temperature.

The holy grail, says Mr Finlay, is soil carbon, but we’re a little way from that right now.

What about variable-depth cultivating?

The same combination of sensors and artificial intelligence can also be applied to European systems and could offer growers the opportunity to run a variable-depth tillage system.

Such setups are yet to gain much traction in the UK, though there was a surge of interest three years ago with Geoprospectors' Topsoil Mapper, used in conjunction with Plowman’s Omni-Lift subsoiler and the Titan cultivator, sold by the now defunct Cultivating Solutions.

MPT has a machine set up with tillage points and is toying with the idea of offering auto-depth cultivations.

Is it available now?

The firm currently has a three-row machine working and is in the process of building a 6m toolbar that should be finished by spring. There are already lots of research bodies and farmers keen to conduct trials.

“The long-term aim is to build compete drills, but initially we’ll adapt other manufacturers’ toolbars to carry our coulter assemblies.”

The company expects to be ready to take orders by the summer, but is planning an alternative route to market. Rather than selling them outright, it intends to start off by leasing the drills to farmers in a pay-per-hectare arrangement.

This way, it can be sure that the system is working well without farmers having to commit to hundreds of thousands of pounds and foot any unforeseen bills that may arise early on.

MPT – where did it start?

Owner David Finlay has been developing farm machinery for 20 years through his engineering, product development and design consultancy.

Having spent much of that time working on broadacre spreaders, seed drills, front-end loaders and various bits of mining kit, he found himself inundated with requests to beef up drills unable to cope with the strains of deep sowing and high horsepower.

As a result of continuing dry weather, Aussie farmers have been drilling deeper than ever to find moisture. They’ve also been experimenting with alternative crops – such as chickpeas – that offer soil benefits such as nitrogen fixation and have a long enough coleoptile to emerge from depths of well over 12cm.

However, dragging 24m toolbars at that sort of depth has caused farmers all sorts of mechanical problems and results in unsustainable fuel use, so Mr Finlay decided to develop something that could adapt sowing depth where particularly deep work wasn’t necessary.

JOURNAL : Farmers Weekly

Attention to detail during insemination is key to maximising conception rates in pigs. Ian Gillies, AI and genetics manager at Rattlerow Farms, offers some top tips on AI in sows.

One of the most important functions on a breeding unit is ensuring you get a good conception rate.

Ovulation in pigs occurs after approximately 70% of the standing heat period has passed, meaning correct heat detection is vital to ensure pigs are inseminated at least twice before ovulation takes place.

Sows should be fed ad-lib from wean to service. Additional sugar-based feed supplements can be used to help flush sows.

See also: Guide to maximising conception rates in gilts

1. Boar stimulation

Sows will usually come on heat between three and six days after weaning. For farmers weaning on a Thursday, this means Sunday and Monday is the time pigs will start displaying signs of heat and they should therefore have access to the boar to test for standing heat.

The best setup for indoor and outdoor producers is to have a designated mating area where the boar is housed. Sows should then be taken to that area.

They should not be able to smell or touch any boars on the way to the designated area as this can cause them to become stimulated and trigger standing heat too early.

Designated insemination areas should allow easy observation, and smell, sight, sound and touch between the boar and sow.

To stimulate sows:

Day one to three post-weaning: Sows should receive full boar contact (touch, sight, sound and smell) for the first three days after weaning. A vasectomised or entire boar can be used. Fence line contact is adequate.

Day three: The boar should be removed 24 hours before the start of oestrus detection to heighten the sow’s response to the boar on day four.

Day four: Introduce the sow to the boar and test for the standing heat response.

If the sows stands on heat (the sow/gilt will stand for mating and service) when they are given access to the boar on day four they should be inseminated. You should test standing heat by applying back pressure at the same time as exposure to the boar.

The standing heat response usually lasts only 20-25 minutes after boar exposure.

2. Get the sows ready for insemination

Mark the sows that have stood rigid and are ready for insemination.

Use a “breeding buddy”. This is a tool that is placed on the back of sows to mimic the pressure of a boar during natural service. This helps keep the sow stimulated. When the sow is stimulated her cervix and uterine horns contract, helping transport the sperm to the sperm reservoir where they will wait for ovulation.

3. Insemination

Take the semen from the temperature-controlled cabinet. Semen should be stored at 17C (+–2C) and horizontally. Check you have got the right breed and check the use-by date.

Wipe the outside and inside of the sow’s vulva before inserting the catheter using a clean, dry wipe or a specialist wet wipe. Do not use alcohol wipes as these can kill the sperm.

If you are using a self-lubricating catheter you do not need to use any additional lubricant. If not, add lubrication to the catheter.

Insert the catheter at a 30-40deg angle upwards until you feel it enter the cervix. At this point it will firmly lodge in place. Once it lodges just pull the catheter back slightly to test for a firm lock.

Attach the semen dose and hold it up above the sow. The sow should start sucking in the semen. Tomato reels have become increasingly popular tools for hanging AI bags above and behind the sows.

If the semen is not flowing in the first 3-4 minutes apply a bit of gentle pressure to the bag. If there’s an issue, reposition the catheter as the end of the catheter can sometimes get blocked by the cervix.

Once insemination has finished leave the pigs in situ for about 20 minutes post-insemination to avoid any disturbance and for further stimulation by the boar.

Semen storage

Store semen horizontally in a fridge temperature of 17C (+-2C).

Turn, or gently re-suspend, stored semen twice a day to keep it mixed with the protective diluent.

The shelf life of semen is relatively short (6-10 days) and does vary so always check the use by date.

Remove doses from the fridge only when they are required.

if you need to transport the semen some distance from the fridge to the service area, use a temperature controlled, portable semen storage box. This can be useful in outdoor systems.

Signs of oestrus in pigs

Pro-oestrus occurs just before oestrus and lasts about one day. Signs includes swollen and reddened vulva, watery discharge from vulva, increased restlessness, mounting other females.

Oestrus lasts for one to three days with ovulation often occurring late during the second day of standing heat.

Signs of oestrus include vulva appears normal (redness subsides), sticky discharge from vulva, tail sticks up while standing and flicks up and down, reduced appetite, pricked ears, standing with arched back, standing rigid if mounted, very vocal with long grunts.

JOURNAL : Farmers Weekly

Correcting micronutrient deficiencies in oilseed rape can raise yields by an average 0.3t/ha, according to trials, helping growers get even more from a crop that is proving to be increasingly expensive to grow.

Many growers are already tackling some micronutrients, such as manganese, in rapeseed crops, but there may be others that are holding back yields.

Yara leaf tissue tests collated at its Pocklington lab in 2019 revealed that 70% of the 6,479 samples were deficient in boron, 60% in magnesium, 30% in manganese and 15% in molybdenum.

See also: Winter barley abandoned for triticale on Shropshire farm

However, further analysis reveals that farmers are acting to tackle some problems, as there is a discrepancy between the tissue tests and soil samples, says Mark Tucker, agronomy manager at Yara.

Half of the soils tested were deficient in manganese, illustrating that some farmers are routinely applying this ***nutrient***, while 75% were deficient in boron, closely matching the tissue test.

“Some 90% of soils were deficient in molybdenum, but it’s only required in small amounts and crops are accessing it well,” he explains.

“The results are slightly at odds because we don’t think it’s a micronutrient most farmers are addressing.”

About 40% of soils were deficient in magnesium, substantially lower than the leaf test analysis.

“Farmers might be soil testing and thinking the levels are okay, but for whatever reason, the availability is poor.

"So it’s worth backing soil tests up with tissue tests,” advises Mr Tucker.

Though boron and magnesium are classically problematic in tissue tests, the growing theme across all crops is a deficiency in zinc – up to 60% in some cases.

“We have not explored the yield response to this yet, but soils appear to be in good shape – about 20% deficient – so this suggests that zinc levels are okay, but the crops aren’t accessing it.”

Impact of micronutrients

Manganese is a critical ***nutrient*** that allows the crop to metabolise nitrogen, explains Mr Tucker.

“Rather than free nitrate sitting in the leaf, it allows the plant to access its amino acids and proteins, helping dry matter growth.”

When it comes to boron, there are two critical stages when demand is high; during the autumn and at stem extension.

“In the autumn when a lot of cell division is happening, every cell produced has a demand for boron – alongside calcium – to ensure the integrity of its membrane,” says Mr Tucker.

“In the spring, roots and shoots are formed and cell expansion happens as the plant gets bigger – so it needs boron to allow the cell wall to hold its structure.

“It’s also associated with good pollen, so is good for fertilisation, pod and seed set.”

Molybdenum is also very involved with nitrogen metabolism, driving enzyme reactions.

It allows for better crop establishment and spring regrowth, as well as improving flowering – deficiency can mean lower oil content and yields.

Magnesium is especially important for photosynthesis and aids pod fill, while zinc helps root development and dry matter growth, as well as being integral to yield.

Risk factors

High sulphur is a risk with molybdenum as it can restrict access to the micronutrient.

“Be cautious with how much sulphur is applied in one go, otherwise you can end up solving one agronomic problem by causing another.

“Typically, we recommend about 75kg/ha of sulfur trioxide – even on the most extreme sites – split two ways to avoid causing molybdenum deficiency.”

Most deficiencies are driven by soil conditions: having too acidic a pH can hinder molybdenum accessibility, so ideally this should be above 6.4, explains Mr Tucker.

“The classic use of lime to raise the pH is fine.”

However, if soil pH is high – around 7 or 8 – this could increase the chance of boron deficiency.

High or low organic matter levels can also negatively impact ***nutrient*** uptake – especially boron – so 4% is the ideal level to aim for.

Testing

Looking at historic sampling results will indicate which deficiencies to expect, explains Mr Tucker.

“Autumn applications may well be driven by farm ***data*** from previous years.”

However, soil testing is more accurate: take a selection of soil cores, at least one every 10ha block.

“Growers might wish to use field maps or satellite imagery to target where to test.

"A random walk across the field might not tease out the key issues.”

In spring, there is a greater window of opportunity to get on the field, so growers should tissue test from March to drive foliar applications as the crop goes into its rapid growth stage, he adds.

If the field has a nice, even performance, taking leaf samples in the classic "W" pattern is fine.

Tissue tests should ideally be taken at least two weeks before planned fungicide or plant growth regulator applications.

“Have a date in mind and work back from that, to allow time for leaf testing, analysis, and to order the correct treatment,” advises Mr Tucker.

He also suggests reviewing the strategy each year.

“If you are testing, review your applications to see if these are putting your crops in a better position.”

Interpreting the sample results will depend on the individual lab report.

“Some have comments indicating what to do next.

"As of 2020, Yara’s reports will have a guideline specific to crop growth stage – this will give a better interpretation of what the crop needs and when.”

Treatment

Treatment should be tailored to which ***nutrients*** are deficient.

“Classically, in oilseed rape, boron, manganese, molybdenum, calcium and magnesium could be in deficit,” says Mr Tucker.

Producers can choose individual products or opt for multi-mix fertilisers where there are multiple deficiencies.

“Farmers can tank mix straight products, but make sure there is good compatibility with whatever is going on at the same time.

"Multiway mixes take this risk out as the compatibility is tested before.”

However, with multiway mixes, growers should make sure there’s enough of each ***nutrient*** required to overcome the deficiencies.

“Don’t just apply a token tonic – check product websites and with your agronomist to be sure,” he advises.

Treatments – whether seed or foliar – can be applied in both autumn and spring, but it’s likely that those who apply both are chasing 5-6t/ha crops, says Mr Tucker.

“On marginal land, the right approach may be to strategically apply in the spring.

“The important thing is that, on average, over the past four years, our datasets show a yield increase of 0.31t/ha in response to micronutrient treatment.

"If crop value is £300/t, that’s an extra £100/ha in yield,” he stresses.

“The yield response is the same, whether on 3t/ha or 5t/ha sites – it’s still worth the same value and return on investment.”

Five key micronutrient deficiencies in OSR

Detecting deficiencies is a critical part of managing crop nutrition.

Here is how to look out for the five key micronutrient deficiencies in OSR

Manganese

A plant deficient in manganese can accumulate nitrogen in the leaves, creating a feeding ground for pathogens and allowing ingress of disease.

Leaves will yellow and mottle; first appearing on middle leaves, then spreading to the older ones.

Boron

Boron deficiency appears in the younger leaves, which become small and puckered.

Stems can also crack and flowering will be poor.

Molybdenum

Molybdenum deficiency is often misdiagnosed as nitrogen deficiency, warns Mr Tucker.

“The leaves will be a good colour but smaller.”

There will be reduced leaf area and they will be pale and limp.

Magnesium

Necrosis is a key sign of magnesium deficiency, as well as older leaves developing chlorosis between the veins.

Zinc

Zinc deficiency appears as chloroses on the leaves, with white or pink necrotic patches.

JOURNAL : Farmers Weekly

The technology available to dairy farmers is developing fast and it can be difficult to decide where to invest your hard-earned cash.

To help decide which technology is really worth investing in, Ben Watts from Kite Consulting examines seven technologies; summarising their advantages and disadvantages, average cost and payback period.

See also: 5 new livestock gadgets for farming in 2020

Do the sums and look at the payback period

There are a number of objectives that any investment needs to provide to be considered. These include:

Labour savings

Input savings (improved efficiency)

Time savings

Productivity improvements (yield or quality)

A good benchmark for return on financial capital is a 10% return over and above depreciation.

Some technologies can be purchased outright, others leased, and many will have annual licences or specific running costs.

Therefore, it is best to calculate annual costs over the likely life of the asset so you can compare it directly against other systems on the market.

Remember the availability of grant funding is not a sound reason to invest in technology on its own.

Cow-side technology

Some of the best “cow-side” technology in terms of return on capital are those that determine oestrus. Combine these heat detection systems with health records and other parameters and they can lead to improvements in herd fertility and health, as well as lower vet costs.

Cost: Base units £1,500-£3,000, plus collars or ear tags from £60-£100 each (some systems will attract grant funding)

Benefits: Improved health, fertility, welfare, time saving

ROI: Generally one to two years, so 50-100%

Automatic testing

This excellent, although expensive, technology has been available on robotic milking machines for a while, but it is now increasingly available on conventional milking parlours.

These systems use sophisticated herd management software to identify cows in need of, for example, progesterone testing for oestrus/PD and then intercept and test a milk sample for an appropriate period.

It can be extremely effective and will become cheaper over time.

Cost: £35,000-£40,000 (some systems will attract grant funding)

Benefits: Accuracy, time saving, improved efficiency, health, welfare, fertility, reduced vet and treatments

ROI: Purported to be less than two years

Auto segregation

Not new but can be a great time-saving device for vet days and fertility routines.

You need to ensure the chosen system will link to your milking parlour and herd management software packages, if appropriate.

Cost: £10,000-£15,000 dependant on system and herd size

Benefit: Time saving

ROI: Varies

Cluster flush and dip systems

This is proven technology and is becoming very common on new parlour installations.

Dip and flush systems will provide a time saving and insurance that every cow is dipped effectively.

Cost: £700-£1,000 per parlour point (consider potential extra costs of dips/liners)

Benefit: Time saving, quality/hygiene improvements, labour saving

ROI: Varies

Robotic feed pushers

There are a number of robotic silage/feed pusher products on the market, which has had a positive impact on price competitiveness.

Look for a well-known system with comprehensive backup.

The benefits of regular feed push-ups include increased dry matter intake, yields, reduced sorting and improved rumen stability.

There will be some time savings, but a teleporter and push-up wheels can achieve similar results.

The real benefit comes at night, when cows still feed.

Cost: £10,000-£15,000

Benefit: Increased feed intake, productivity, time saving, lifestyle

ROI: Varies

Robotic slurry scrapers

These are especially useful in robotic systems where cows do not leave sheds for routine scraping out.

Generally, they will have a limited range and run, so a full- or semi-slatted system is more favourable.

Some of the newer systems will vacuum the slurry.

Cost: £10,000-£15,000

Benefit: Increased feed intake, productivity, time saving, lifestyle

ROI: Varies

Lighting

Research has shown that LEDs improve cow performance and responses, with optimal light levels (about 16 hours of light at 200 lux and eight hours of dark at about 40-60 lux), resulting in an 8% yield increase.

Costs vary greatly and more modestly priced systems can still meet target lux parameters and lighting spread requirements.

Cost: £10,000-£30,000 (depending on building sizes)

Benefit: Increased feed intake, productivity, fertility

ROI: Depends on system costs – generally one to three years

JOURNAL : Farmers Weekly

Syngenta is developing hybrid wheat that could be available in five years and provide a sustainable future for growing the crop in the UK.

The plant breeder is working on a programme that it says will give growers better yield consistency due to bigger and stronger plants that are able to absorb more ***nutrients*** and use water more efficiently.

The breeding programme began in France and farmers there could adopt the technology in 2022, while UK registration trials have yet to start.

Rob Hiles, seed business sustainability lead at Syngenta, said: “Wheat is the last remaining global food crop which hasn’t been hybridised.

“I would expect first products to enter registration trials in the next few years. In essence you have had to completely transform the wheat crop from a self-pollinating crop to a cross-pollinating crop and it is incredibly complex. Wheat has three genomes whereas humans have one.

“So I would expect it will be the middle of this decade, probably, when farmers will be able to get their hands on our scale.”

See also: Which wheat varieties to consider for spring 2020

French trials

A study looking at planting hybrid barley in France has given an indication of the benefits to expect from hybrid wheat, Mr Hiles said.

“With a hybrid variety of barley called Hook, we are looking at halving that first fungicide application, which you can imagine has sustainability and environmental benefits.

“And the actual outcome of that is more productivity, so we are seeing a 0.96t/ha increase for Hook which is translating into 72/ha (£61) improvement in profitability for the grower.”

Syngenta’s development of hybrid wheat formed part of their research and design showcase at the Food and Drink Federation in London on Wednesday (15 January).

The event featured innovations to help address the environmental sustainability challenges facing the farming industry.

These included advances in precision farming and conservation ***agriculture***.

JOURNAL : Farmers Weekly

Dozens of Irish farmers protesting about beef prices held a go-slow tractor drive on Dublin's M50 motorway.

The tractor protest – organised by a group calling itself the Individual Farmers of Ireland – was held to coincide with the evening rush hour on Thursday (16 January).

See also: Supermarkets blockaded in Irish beef protest

It followed a second day of traffic disruption which caused road closures and serious delays to commuters in and around the city.

The farmers said they did not want to completely blockade the motorway, which is the main orbital route around Dublin.

But the government had failed to address the issue of falling beef prices, which have resulted in heavy losses for farmers.

Farmers protest in Dublin today ? pic.twitter.com/4nBRs1SKm2

dunboy? (@tomlis71) January 16, 2020

Not everyone was impressed with the protest.

How would the farmers like it if the citizens of dublin Parked their cars across your farm entrances so you couldn’t go to work #farmersprotest

Paul Fagan (@PaulGFagan) January 16, 2020

Beef prices are about 7% down on this time last year, with R3 steers fetching 3.55/kg deadweight in the first week of January, compared with an average of 3.84 during 2019.

Irish Farmers Association president Joe Healy has warned that prices must  increase, saying they cannot continue at current loss-making levels.

The unsustainable discounting of top-quality beef is a race to the bottom that has to stop, he told a meeting of Ireland's Beef Taskforce last week.

“Retailers and factories, which work together, must pass back higher market returns with a significant and immediate price rise to farmers,” said Mr Healy.

The taskforce has hired consultant Grant Thornton to undertake a full and independent review of the beef market and customer requirements, he added.

JOURNAL : Farmers Weekly

Buyers and sellers seeking certainty may now feel more confident about making long-term decisions in the land market following the recent decisive general election, say agents.

Throughout 2019, just 10,788 acres were launched in the east of England, according to Savills, down 67% on the previous year, and few large farms became available.

With demand staying high and prices remaining firm, 2020 could see more activity, though much hangs on the realities of Brexit and the UK’s transition period.

See also: Land in your area: East Midlands

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Smaller units filling market

The supply of land coming to the east of England market tightened during 2019. In contrast to 2018, there were no farms of more than 1,000 acres publicly launched. The year’s sales were principally parcels of bare land or smaller farms, although some had significant residential elements.

The market remains active, with a relatively stable level of demand across much of the region, so farms and land that have come forward are selling – some well.

Almost all of the farms that we marketed during 2019 are now under offer or have exchanged, some of them after competitive bidding.

Location and accessibility, rather than the quality of the land, are the key factors for achieving the best prices across the region.

Overall, the spread in values achieved remains wide, ranging from £6,000-£12,000/acre. The majority of Grade 3 cereal land typically falls into the £8,000-£10,000/acre bracket.

Giles Allen, senior associate director, Strutt & Parker, East of England

Prices to remain firm

Investors love certainty and we finally have a little more of that – at least UK political, if not European – and from a party that will not be seeking to overhaul the dynamics of the marketplace to any great degree.

There is pent-up demand from buyers out there, so the clear general election outcome may get those who were perhaps wavering over the past 12 months to come off the fence and act – just how many remains to be seen.

But fortune favours the brave and there are plenty of reasons now to suggest that land prices will remain firm for 2020.

Those seeking to restructure, retire, reduce debt, or transfer wealth may well be advised to consider the implications on deferring that move and instead to take advantage of a land market that was remarkably resilient in 2019.

As long as the taxation system remains largely unchanged, it will continue to underpin what was a chronically undersupplied market this year.

Brexit and what it truly means still hangs over us and the ***Agriculture*** Bill will need to be reintroduced, but there are a number of sound reasons to think 2020 could be a very sensible time to carefully consider the options.

James Brooke, partner, Bidwells, Cambridge and Norwich

What sold well?

A versatile 300-acre block of land at Hall Farm, Bridgham, on the Norfolk/Suffolk border, was launched by Strutt & Parker and Peter Crichton in 2019 and sold as a whole in excess of its £2.2m guide price.

The mix of arable land and permanent pasture proved popular due to a significant abstraction licence, allowing a wide variety of crops to be grown.

What’s on the market?

Grapnells Farm, near Rochford, Essex, is available through Strutt & Parker as a whole or in two lots, guided at £3.075m.

The 256-acre arable unit includes a five-bedroom farmhouse, cottage, offices and a substantial range of buildings.

JOURNAL : Farmers Weekly

After years of struggling to make his conventional arable rotation pay, a tenant farmer has begun trialling a system that rewards him for environmental gains rather than bumper yields.

John Hawkins runs 239ha of marginal land at Bagber Farm, Blandford Forum, and has abandoned his min-till regime, replacing it with a low-input rotation that builds natural fertility and reduces his reliance on artificial fertilisers.

The hope is that this so-called “regenerative ***agriculture***” trial will significantly reduce his financial risk, cut his workload and give considerable environmental benefits.

See also: Driver's view: John Hawkins' Simtech T-Sem drill

This should also stand him in good stead when the Basic Payment Scheme is superseded by a system that offers rewards for public goods such as biodiversity improvements and climate change mitigation.

Mr Hawkins designed and implemented the trial himself and has funded it by signing up to a whole-farm Mid-Tier Countryside Stewardship scheme and an arable reversion project sponsored by Wessex Water.

We paid him a visit and quizzed him on how the system is working out after its first full season.

Why did you decide to change the way you farm?

Until 2018, we were operating a min-till, medium-input rotation consisting of oilseed rape, feed wheat, two spring barley crops and a small area of beans to meet ecological focus area (EFA) requirements.

We achieved fairly average yields, with wheat coming off at about 9t/ha. But because our soils are chalk downland, we were relying on 7t/ha of chicken manure, maximum nitrogen doses and a lot of chemical input to get there.

These high costs meant it was a real challenge to make a profit, plus we had an ageing machinery fleet, poor grain storage and no money to invest.

After taking part in some environmental trials, we began to see a different way of doing things. The first was an Adas-led Wagrico scheme, which focused on ***agricultural*** pollution from fertilisers.

But it wasn’t until we started working with Wessex Water that we really took it seriously. Because the farm sits next to one of its main boreholes, the water quality team was keen to work with us and help reduce spikes in water nitrate levels.

This led to some funded cover crop trials and arable reversion, both of which were less expensive to implement than our arable crops and yielded better returns.

That’s when the idea came to trial a regenerative ***agriculture*** scheme across the whole farm.

How did you set up the trial?

Wessex Water provided funding for some of the trial, but I needed an additional income for the environmental capital I would be creating.

This meant signing up to a whole-farm Mid-Tier Countryside Stewardship programme, which required a considerable amount of work.

It was hard to design a scheme that met the Mid-Tier prescriptions, complied with BPS/EFA rules and satisfied the contract with Wessex Water.

But the biggest hardship was the bureaucracy we encountered while dealing with Defra. This was intolerable at times and it was made far more complicated than necessary. Sadly, it’s the biggest barrier to setting up a system like this.

We got there in the end, but if it wasn’t for the help of our catchment sensitive farming specialist, we would have likely failed.

What is your crop rotation?

Our standard rotation starts with the establishment of fertility- and carbon-building leys, which are made up of various grasses, red clover and vetch. No livestock are allowed in the rotation.

After two years, these are sprayed off with glyphosate and a spring barley or canary seed crop is planted directly into it with our no-till tine drill.

An overwintered cover crop comes next, followed by a second spring cereal before going back into a fertility-building ley.

At the moment, we have roughly half the farm planted with cover crops (ready for establishing a cereal in the spring) and half in the leys. However, as we’re only halfway through our second season, the system isn’t yet in full swing.

The primary aim of the rotation is to improve our soil health and build natural fertility, but it’s also a far more cost-effective and less labour-intensive system than conventional crop establishment. The leys also have the added benefit of helping control blackgrass.

Generally, spring cereals have returned the best profit margins for us, so there hasn’t been much temptation to gamble on a high-input winter wheat crop.

Alongside the standard rotation, we have 6ha of wildflower meadows, 8ha of wild bird food mix and 6ha of cherry trees, which are left over from a diversification that failed to pay its way. We also carry out biennial hedgecutting.

On top of that, there is 10ha of reed canary grass planted on the main run-off areas. This is a Wessex Water-sponsored four-year experiment.

What machinery are you using?

All crops are established using a 3m Simtech T-Sem drill and we have a 3m Teagle flail-topper mounted on the front so we can mow and drill straight into the leys or cover crops.

The main aim of the flail is to reduce the bulk of material going through the drill, but it also helps release nitrogen and make it available to the next crop.

This outfit is mounted on a rented New Holland T7.210, which is the farm’s only frontline tractor. Having a new machine has allowed me to spec RTK auto-steer, which makes the job of driving the drill through thick leys and cover crops much more manageable.

In total, I’m doing about 200ha of drilling a year and I can travel at a rate of 2ha/hour. There are no other operations, so it’s only 100 hours of work each year – roughly one-third of what I was doing when I was min-tilling.

The drill is set to 18.75cm rows and I’ve upped the seed rate to compensate for the slightly more challenging conditions the seeds are going into.

I also have a custom-built fertiliser-banding machine, which I’m using to apply a small amount of granular urea in the crop row. The idea is that I’m not wasting money fertilising the areas where there isn’t any crop.

Ideally, cover crops are broadcast with a fertiliser spreader in early autumn and pressed in with the Cambridge rolls. However, this only works when rain is forecast, so if it’s looking dry, I will use the T-Sem drill.

What environmental benefits have you seen so far?

Already, we’ve seen a massive increase in butterflies and summer pollinators and, interestingly, there has been no evidence of flea beetle on brassica cover crops.

There has also been a significant rise in the number of ground-nesting birds and rare raptors, thanks largely to the bigger population of ground-dwelling mice and voles. Soil health seems better too, with a lot more evidence of worm activity.

With the help of Wessex Water, we are continuously monitoring the scheme to measure the effect it is having. It can then be enhanced and improved on a six-monthly rolling basis to deliver better results.

Sadly, we are yet to receive any follow-up requests from Defra and there still seems to be no room to improve the scheme during its life.

How does the trial stack up financially?

The most important difference in our finances is that we’ve massively reduced risk by securing a steady income and slashing our growing costs.

This means each tonne of crop we sell has cost a lot less to produce than it did when we were chasing maximum output.

Our first harvest saw spring barley yields drop from about 7t/ha to 5t/ha, but we met quality and because it was so cheap to grow, the gross margin was actually higher.

It’s also a far less stressful way of doing things and it’s nice to not be burning the midnight oil every night in the summer and autumn.

I’m hoping the funding will keep us going until the Environmental Land Management scheme is rolled out to all farms, at which point I should be in a good position to transfer straight into one.

However, if this turns out not to be the case, I still have the option of reverting back to a more conventional system, hopefully with healthier soil and a lot less blackgrass.

JOURNAL : Farmers Weekly

Adam Brewer has turned to growing miscanthus to improve his soils and the environment, while also giving him a profitable low-input crop for his north Norfolk farm.

The crop will fuel a nearby renewable energy plant, while the 3m-plus high miscanthus has attracted swallows back to the farm to feed on the multitude of miscanthus-loving insects.

After years of intensive cereal and vegetable production on the farm, Mr Brewer needed a change to revitalise his soils and to allow time for his other role, as a TV sports sound director.

See also: Cheaper miscanthus planting offers option for growers

Environmental benefit

This job took him away recently to the Rugby World Cup in Japan for more than two months, so he was on the look out for less time-consuming crops with an environmental benefit.

He says the choice of miscanthus was to help the soil recover from intensive cultivation over the years, and leave the land in a better shape for future generations.

“I was looking for a hands-off crop to give environmental benefits and also still make us some money,” he tells Farmers Weekly.

Miscanthus and Christmas trees were the answer – the first encouraged the insects that the swallows fed on, and the second prompted a plethora of earthworms.

“The telegraph wires are weighed down with swallows in the summer, and that is not a sight that I have seen for over 30 years.”

What is miscanthus?

Miscanthus is a woody rhizomatous grass species which originated in south-east Asia

Initially imported into Europe as an ornamental plant

A perennial plant with a productive life of 15-20 years

Grows to more than 3m in height, and can be harvested annually.

Sustainable future

The miscanthus crop is relatively expensive to establish, but Mr Brewer is looking to reap a profit margin of £750-£1,250/ha once the first cut is taken in February.

His 64ha all-arable Church Farm at Brinton, just south of Holt, had initially grown cereals, maize, potatoes and carrots. But seven years ago, he decided this cropping was no longer viable with costs rising and his desire to move in a more sustainable farming direction.

As part of of his plan for a minimal-input, sustainable farming future, the first new arrival was Christmas trees, which would allow him to continue with his TV work.

Then, in 2018, he introduced miscanthus, encouraged the previous year by the opening of the renewable energy plant at Snetterton, just north-east of Thetford, and only 30 minutes away by road.

The root bulbs, or rhizomes, were planted in spring 2018 with a modified four-row potato planter, and the stems soon emerged from the underground rhizomes.

Favourite for biofuel

Also known as elephant grass, miscanthus resembles bamboo and can grow to more than 3m in height. It produces a crop every year with no need for replanting. And thanks to its rapid growth and low mineral content, it has become a favourite for biofuel.

It can grow for up to 20 years and the annual cane harvest – where there is little or nothing to do apart from cutting 45cm lengths of cane – provides an income.

Miscanthus also attracts plenty of wildlife, with a multitude of beetles and spiders that draws in bird life, which gave Mr Brewer encouragement that he was on the right track towards more sustainable farming.

During autumn, the crop senesces and ***nutrients*** are transported back to the rhizomes which swell in the winter. The crop is harvested in February with a forager, then left in the field to reduce the moisture content and baled in April.

Flooded fields

Miscanthus has been shown to grow well in waterlogged and flood-prone land. The crop quality is not compromised by flooding and offers much-needed soil stability.

Research by Jason Kam, of the Institute of Biological Environmental and Rural Science at Aberystwyth University, showed there was no difference in crop yield between winter flooded and non-flooded ground.

He says the structure of the miscanthus rhizome and its rooting system helps to stabilise soils, which makes the crop more resilient against flood-caused soil erosion.

Dr Kam adds that because of the crop’s perennial nature, the annual cultivation and planting is not needed and this, therefore, reduces soil disturbance to an absolute minimum.

300 growers

Working with Mr Brewer is miscanthus specialist Terravesta, which has a long-term contract to supply the Snetterton renewable energy plant with 25,000 whole bales.

The company, which works with about 300 miscanthus growers, says the crop could be a profitable option for land unlikely to suit mainstream crops. It can stabilise land, help improve soil organic matter and encourage earthworms.

Mr Brewer calculates it is costing him £1,100/ha to establish the crop, having planted 5ha in 2018 and a further 11ha in 2019. He is set for his first harvest in February of the 2018-established crop.

Both crops had a herbicide applied, such as Harmony (thifensulfuron-methyl) to control broad-leaved weeds, like mayweed. This helps the crop get established and then it should shade out the weeds.

“I am hoping the miscanthus will compete with winter wheat and barley financially, with much less hassle and less mechanical inputs,” he says.

With the roots going down 1-1.5m, he is looking to reap great benefits in soil improvement, and recovery from years of intensive vegetable production on his light sandy loam soils.

Soil-health improver

In 20 years' time, Mr Brewer is optimistic that the miscanthus will have improved the soil health and structure to such an extent he can grow very high yielding crops of winter wheat.

He has switched to minimal tillage across the farm as much as possible, and hopes the miscanthus will add to the improvement of his soils.

Crops of winter wheat and winter barley now make up the rest of the farm with yields of some 7.5t/ha, but could well increase as his soils recover.

He has high hopes for his Christmas trees, too, as part of his low-input sustainable farming future. He buys the trees in as four-year-old plants, and hopes to grow them to sell in four to six years.

He initially planted 14ha and added another 2.5ha later, and is hopeful the crop will be even more profitable than miscanthus.

“When we started planting Christmas trees three years ago, there were no worms to see, and now there are plenty of earthworms,” he adds.

JOURNAL : Farmers Weekly

Muller, the UK’s largest liquid milk supplier, is forecasting a return to profitability in 2020 after a 12-month cost-cutting programme.

The Market Drayton-based firm has cut its number of farmer suppliers, shed 400 staff, and reduced its processing sites by two in a bid to trim £100m of costs from its business.

The programme, called Project Darwin, came after the privately owned firm made an operating loss of £132m in 2017, which it blamed on a widening gap between rising milk production and declining consumer consumption of liquid milk.

See also: How to assess if your dry cow ration is working effectively

It also claims that 90% of its contracts by volume with retailers are now profitable, having walked away from 4% where agreement could not be reached, with the remainder still under negotation.

Muller say Project Darwin has not been completed, but there are no current plans to reduce farmer numbers further.

Speaking at the Semex dairy conference in Glasgow this week, Muller UK CEO Patrick Muller said that the changes mean the company should return to profitability within six months.

He said the changes had made the company a much leaner organisation and that he hoped the company could now move towards further improving profitability by adding more value to its products.

“We are much more positive than a year ago. A year ago it was really on a tipping point – where we thought: '|s it really clever to be in this business?'" he said.

“At one point we thought ‘enough is enough’, but the steps we took worked and we see fundamental positives about this industry, which allows us to believe in a positive future.”

However, he warned that UK liquid milk usage is still forecast to fall by 70m litres a year for the next decade, from 4bn litres this year to 3.3bn litres in 2030 as consumers move away from breakfast cereals and switch from milky tea to black coffee.

Number of dairy businesses predicted to fall sharply by 2030

The pace at which dairy farmers leave the industry is set to accelerate as costly new environmental requirements push out smaller producers.

The number of dairy farm businesses in the UK is forecast to decline from 11,670 to 7,890 by 2030, according to new analysis from analyst Kite Consulting.

Kite founder and managing partner John Allen said that 3-4% of businesses currently leave the industry every year, but he forecasts this will accelerate to as much as 7% by 2024-25.

Declining direct subsidy payments and tighter environmental rules that are likely to require major capital investment in slurry storage will mean smaller producers will be unable to afford to stay in business, he said.

Kite predicts total cow numbers will fall, but milk production is unlikely to diminish as average output will rise from the current 8,090 litres per lactation to 11,080 litres by 2030, as genetics continue to improve.

This will give the dairy industry a positive story to sell to consumers as a reduction in cow numbers combined with improved feed efficiency and better use of nitrogen will allow the industry to cut its carbon emissions by 30%, said Mr Allen.

JOURNAL : Farmers Weekly

A case of non-notifiable avian influenza has been confirmed on a broiler breeder farm in Northern Ireland.

Although this is a less serious strain of influenza, government vets have urged poultry farmers and bird keepers to remain vigilant.

Authorities were alerted last week after a private vet became concerned about increased mortality among birds at the poultry unit in County Fermanagh.

See also: Avian influenza: The signs and symptoms

But the NI Department of ***Agriculture***, Environment and Rural Affairs (Daera) said results showed that the H6N1 strain was found in the birds – and not a high pathogenic strain, as had been feared. Restrictions have now been lifted.

“It is a timely reminder to us all that avian influenza is a constant threat to all poultry flocks and how devastating it would be to our poultry industry should a notifiable case be confirmed in Northern Ireland,” said Daera chief vet Robert Huey.

The Ulster Farmers’ Union (UFU) said it was a “huge relief” to poultry farmers that the virus identified was a non-notifiable strain.

UFU deputy president David Brown urged poultry keepers “to continue maintaining high standards of biosecurity and to practice good farm hygiene at all times to protect their flock from infection”.

High risk of incursion

The risk of avian disease incursion remains high in the winter from migrating birds and there have been several

confirmed cases in Europe over the last few months.

In December, 27,000 chickens were culled at a farm in Athlington, near Eye, Suffolk, after the low-pathogenic H5N3 strain of bird flu was detected.

Farmers and bird keepers in Northern Ireland can subscribe to a text alert system operated by Daera for transmitting disease information by texting “BIRDS” to 67300.

PANEL – What to do if you suspect bird flu on your farm

If a bird flu outbreak is suspected in Northern Ireland, keepers must report it immediately to the Daera helpline on 0300 200 7840.

If you suspect any type of bird flu in poultry you must report it immediately by calling the Defra Rural Services Helpline on 03000 200 301.

JOURNAL : Farmers Weekly

Quite how the vegan propaganda that has been spewing forth from that erstwhile investor in plant-based meat alternatives, Channel 4, is consistent with their remit to make “a significant contribution to meeting the need for public service channels to include programmes of an educational nature” is beyond me.

For those of you too busy, or sensible, to have subjected yourselves to it, please allow me to summarise.

See also: Channel 4 vegan series is irresponsible and dangerous

As an entrée, we were treated to a cynical exercise in emotional blackmail Meat the Family, where cute baby farm animals are given to suburban families to rear as pets for a couple of weeks and then taken away, before they get too big, smelly and destructive.

The foster family is then given the option of either going vegan or having their erstwhile family members returned to them, oven-ready. No agenda there then

This was followed by the dismally dystopian anti-farming polemic Apocalypse Cow.

The Guardian’s resident eco-fantasist, George Monbiot, was provided with a televisual platform to push his misanthropic rewilding agenda, while offering “electric flour” and synthetic meat - a kind of Soylent Green meets Dr Frankenstein - as the solution to feeding the world while averting an otherwise inevitable environmental armageddon.

Finally, the crowning turd sat atop this midden of journalistic irresponsibility was How to Steal Pigs and Influence People – a documentary that followed Wes, a self-styled and disturbingly narcissistic “vegan-influencer”, as he urged his online following of moronic millennials to join him in breaking into and “liberating” piglets from commercial pig farms.

Leaving aside the obvious legal questions around incitement to commit both trespass and theft, or the serious personal safety risk that these uninformed idiots seemed oblivious to, did the producers not consider the animal welfare and biosecurity threats posed by promoting such actions in the pursuit of ratings?

Given that the current epidemic of African swine fever in China has now resulted in the emergency slaughter of almost one-quarter of the world’s pigs, it’s not hard to see just how morally reprehensible this kind of programming is.

While viewing figures will probably be blessedly low, the fact that such programmes are considered either entertaining or educational demonstrates just how disconnected we are from consumers, and how woefully off the pace we are when it comes to educating schoolchildren about our role in society and how we fulfil it.

Our historical success in providing a plentiful, affordable and safe food supply is ironically the root cause of this dilemma.

Such is the paradox of first world problems. The race to the bottom in food retailing has at best devalued food production and at worst cast the farmer as the principal villain of an exaggerated “climate emergency”.

As we enter a new era of ***agricultural*** support, focused on rewarding the provision of public goods, we urgently need to rethink our branding and how we position ourselves in the public consciousness, both as food producers and as stewards of much of the natural environment.

While communicating this should be the responsibility of the wider food supply chain, it is a challenge that we as farmers need to take ownership of too, or risk the kind of “brave new world” envisaged by Channel 4.

JOURNAL : Farmers Weekly

Here’s a Robert Burns quote for Burns Night: “The best laid plans of mice and men often go awry.”

I thought of this recently when Jake had to cancel all scheduled activities in favour of shovelling two-and-a-half tonnes of cattle feed into bags by hand.

Overnight, some enterprising heifers had let themselves out of the shed and removed the bolt on the feed silo. This released the entire contents out into the yard for an eat-as-much-as-you-can midnight feast.

The heifers survived the episode, although, like many after Christmas, they were in urgent need of a period of reduced rations after too much cake. These things happen.

See also: ***Agriculture*** Bill - what’s new and what’s Eustice promising?

Of course, it is generally a good idea to have plans if you want to achieve anything, so I have been surprised at how slow the new government has been to share theirs.

It’s all very odd. Usually, winning parties take office keen to hit the ground running, full of purpose, ideas and enthusiasm. At least Defra managed to publish the ***Agriculture*** Bill after a month, but other departments seem to have said very little.

We’re leaving the EU at the end of the month. Then what?

It seems to me that our farming sector is facing a triple whammy of potential risks arising from Brexit:

Barriers to our primary export market (ranging from more red tape to crippling tariffs)

The opening up of our home market to cheap foreign imports produced to less-onerous standards

The loss of support payments

We have been offered reassurance on the overall level of support payments available up to 2024, but this is only part of the picture. The likely shape of future trade arrangements remains unclear.

In a clip of a BBC Countryfile interview, due to be shown on 26 January, Defra secretary Theresa Villiers said chlorine-washed chicken and hormone-treated beef would not be allowed into the UK under any US trade deal. However, if this is right, there may not be any US deal at all, which would anger those Conservatives who consider it a priority. Whose view will prevail?

There is a theory going around that the government aims to declare Brexit as “job done” at the end of January. The Brexiteers in the cabinet will then be thanked and perhaps largely dismissed, with a new team appointed for the next five years. We may then get a better idea of the prevailing philosophy in this administration.

But I suspect we will only know the government’s real priorities on the trade arrangements that are crucial to our future when the final deal with the European Union (or lack of one) is announced.

The government seems to hope that the public is bored with Brexit, disinterested in the tedious details and content to trust them on everything.

But whatever sympathetic noises have been made to date, farmers need to keep making their voices heard, so that issues such as animal welfare standards on imports and the need to maintain full, unhindered access to European markets are kept high on the agenda.

The final future arrangements are bound to disappoint some people. We have to keep the pressure up to try to ensure that they minimise the damage to our sector.

To quote a Northumbrian expression, rather than Burns: “A shy bairn gets nowt.”

JOURNAL : Farmers Weekly

In 1917, at the height of the Great War, with 80% of the country’s grain and 40% of its meat being imported from other countries, and with German U-boats taking a grievous toll on merchant shipping, the British government was reluctantly forced into implementing ***agricultural*** support to quickly increase domestic food production.

The Corn Production Act 1917 guaranteed a minimum price for cereals until 1922, and the ***Agriculture*** Act 1920 further strengthened this with protection linked to production costs.

The stability ensured by this legislation gave much-needed confidence to farmers and drastically reinvigorated an industry that had spent decades in the doldrums as a result of the decay wrought by free trade, and rural communities around the country once again thrived.

See also: What was farming's role in the First World War?

Until they didn’t. Because when trading eventually resumed after the war ended, the price of wheat halved, and in 1921, the Corn Production Act was quietly repealed, causing payouts to farmers to abruptly end.

Partly as a result of this, the industry rapidly went into outright depression, resulting in seismic cultural and social changes. It infamously became known as “the great betrayal” to a generation of country people.

It was with more than a raised eyebrow that I watched Iain Duncan Smith and Liam Fox loftily dismiss concerns over US food practices such as chlorinating chicken as “tired old lefty rhetoric”

Almost 100 years later, British ***agriculture*** now stands at another crossroads, and once again we are relying on the fragile promises of politicians to take us in the right direction.

While we have repeatedly been assured that the government will not compromise on food standards when it comes to future trade deals, a legal commitment has yet to be put in place to ensure that it will actually happen.

So, it was with more than a raised eyebrow that I watched Iain Duncan Smith and Liam Fox loftily dismiss concerns over US food practices such as chlorinating chicken and allowing a certain amount of fly eggs in drinks as “tired old lefty rhetoric” in parliament recently.

Contrary to what some would have us believe, farming in this country is an extraordinary success story.

Despite the challenges we’ve faced as an industry over the years, such as salmonella, BSE, foot-and-mouth, bovine TB, extreme weather and falling profitability, we have managed to not only maintain our world-famous landscape, but enhance it

Agri-environmental schemes are being enthusiastically entered into when they’ve been designed and administered correctly by our respective governing bodies.

We are rightly immensely proud of our animal welfare standards being second to none, with some of the most rigorous assurance schemes available anywhere applied as routine on British farms.

Though often immensely time-consuming and expensive, and with frustrating levels of paperwork involved, as an industry we have recognised the need for them and have acted accordingly.

And to top it all, we have helped to provide some of the highest-quality and most affordable food in the world, and by a distance the cheapest in western Europe, at just 8% of Britons’ total household income spend; a number that has more than halved over the past 60 years.

In short, we have achieved all that has been asked of us.

As a great figure of the 1920s, Groucho Marx, once said: “Politics is the art of looking for trouble, finding it everywhere, diagnosing it incorrectly and applying the wrong remedies.”

Let us all hope, for the sake of our communities, that history doesn’t repeat itself during the next decade.

JOURNAL : Farmers Weekly

Purely arable farms belong in the 20th century. We need to see a return to mixed farming where livestock and forage leys form a significant part of the arable rotation.

There are numerous reasons why this should happen. As an industry, we have become over-reliant on agrochemicals, both fertilisers and sprays.

These have worked reasonably well for the past 60 years, but now we are seeing more and more the long-term detrimental effects of pursuing the chemical route.

See also: Sheep grazing eliminates need for rapeseed growth regulators

Farmers instinctively know that current practices aren’t sustainable. We’ve seen yields plateau, we’ve seen super-resistant blackgrass and other weeds, we’re seeing soil erosion and flood damage.

These problems have crept up on us, and it is only in the last few years that the industry has started to become aware of the damage these practices are doing.

My solution is to return to a more biological form of farming, and I see livestock as a key component of that. We are returning to the practices of our forefathers but with a 21st century understanding of the science behind the activity.

Our knowledge of soils is growing by the week, as is our understanding of the bacteria, fungi, microscopic organisms and larger soil dwellers that help to recycle organic matter and stabilise our soils.

In some respects, we are behind the curve. I was lucky enough to be awarded a Nuffield scholarship in 2011 and travelled to places as far afield as Canada and Argentina.

The Argentinians, in particular, were fully integrating livestock into their arable systems. They would have four or five years of fertility-building forage leys, then a similar period of cash cropping.

I do acknowledge that there are problems to be overcome. For example, we will have to adapt our practices to suit the UK weather.

Probably of greater importance is the lack of infrastructure. In years gone by, virtually every arable farm also had a mix of livestock and so had fences, hedges and watering points in most fields.

These have disappeared from many of our farms along with the skills to manage and husband livestock.

We therefore need to think differently to overcome such potential pitfalls. It is possible to erect a “permanent” fence on a temporary basis nowadays, and you only need a good fence round the boundary of a block.

Internally, a single strand of electric fence will keep cattle on the patch you want to graze.

There are also opportunities for farmers to work together. Simple grazing licences, short term tenancies, share farming or other joint ventures can all provide solutions to address the lack of livestock skills on arable farms.

There are many livestock farmers, especially younger farmers, who are crying out for access to additional land. If arable farmers are serious about bringing livestock back to their land, then they should consider such arrangements.

What we need is a joined-up approach to make this happen.

Tom Chapman is head of Regenerative ***Agriculture*** at Innovation for ***Agriculture*** – a charity based at Stoneleigh, which aims to bridge the knowledge gap between farmers and researchers. It is holding a one-day conference on “Animals to Arable” in Elveden, Suffolk on 4 March.

JOURNAL : Farmers Weekly

Topping or grazing oilseed rape with sheep over winter can reduce flea beetle larvae numbers by up to 44%, according to new research.

The trial by Innovative Farmers saw eight growers defoliate their crops last season in an effort to control flea beetle larvae, as pesticides offer very limited control.

See also: Defoliation reduces flea beetle larvae numbers by 61%

Both topping and grazing successfully cut the number of larvae, but this reduction came with a yield penalty, with an average reduction of 14%.

Sacha White, senior research entomologist at Adas, and leader of the field lab, says defoliation was trialled as a control method, as OSR has been defoliated in previous trials during the winter for other reasons, without necessarily having an effect on yield.

It was hoped defoliating the crop would kill larvae through the process of being cut or eaten, and by the larvae being exposed to the cold, more predators and disease.

Top tips for successful defoliation

Target a crop that definitely has adult damage. Defoliation can knock a crop, so it is worth being able to justify it.

Target a crop that is in relatively good condition – defoliating a crop that is already struggling could be the last straw.

Crops that have been drilled relatively early will be in the best condition, as they went into good soils and will have good rooting systems. These crops will also have the most larvae.

Ideally, defoliate before February, but definitely before stem extension.

Avoid fields that will be targeted by pigeons, as this will damage the crop further.

Aim to knock off as many leaves as possible, as the larvae are in the petioles, not the main stem.

Balance larvae reduction with yield loss. Harsh grazing will see the greatest reductions, but plants will have too much to do to recover.

The principle was first tested with successful results in a replicated plot trial at Adas before being trialled at field scale through an Innovative Farmers field lab.

Grazing and topping

The field lab consisted of eight growers who defoliated 12 fields either by using a topper or flailing, or by being grazed by sheep between Christmas and March.

In 10 out of 12 fields, this resulted in a significant reduction in larvae numbers, with an average reduction of 39%.

Grazing resulted in higher reductions, up to an average of 44%, compared with 35% for topping.

It is difficult to draw conclusions on which method is more effective, as the defoliation was carried out at different times by the individual farmers, says Dr White.

While effective, the field lab did reveal that yields had suffered as a result of the defoliation.

Dr White only received yield results for seven of the 12 fields, but there was a consistent yield reduction across all of the sites.

In those fields where only part of a field was defoliated to allow for a direct comparison, there was on average a 14% reduction, with no significant difference between defoliation method.

Dry spring

Dr White believes this yield reduction was seen for two main reasons; timing and spring conditions.

“Timing is important, some of the sites were defoliated in February or March and this definitely doesn’t leave enough time for the crop to recover,” he says.

However, this cannot be the only reason, as crops that were defoliated in December and January also saw a yield reduction, while the plot trial at Adas did not, despite mowing at the same timings.

“The biggest factor is the spring weather, as it was a very dry season and that would have reduced the plants’ ability to take up fertiliser.

There were also yield reductions in the second year of the Adas plot trial due to the dry spring.

As well as not having the opportunity to branch, the cool temperatures in May would have limited the ability of the plants to pod set.

“This would especially have affected the defoliated crops, as these would have been slightly behind.”

The fact that crops were badly affected by flea beetle last year, and on top of this had to cope with being defoliated, could also have reduced their ability to yield well.

Despite seeing yield reductions, all of the farmers who took part in the first year of the trial were open to repeating it.

As spring weather is the main deciding factor of whether defoliation results in a yield penalty, it is important to give crops the best opportunity, says Dr White.

“It is very difficult to predict the weather, as we don’t get a normal spring.

“Three to four years of trials have shown that timing is key, and that if it is carried out before February, there isn’t a reduction in yield.

“There is a track record that it does work. Hopefully, next year the conditions won’t be so unforgiving,” he says.

The field lab will be repeated this winter.

Adas defoliation plot trial success

Before moving to a field-scale trial, a mower was used to defoliate a plot trial at Adas three years ago, to great effect.

Flea beetle larvae numbers were reduced by up to 55%, with the highest reductions seen from the later mowings.

Although the plots, which were mowed in December and January, yielded slightly more at harvest, it was not a significant increase over those mown later.

This replicated plot trial was repeated for a second year to compare the effect of a December mowing with a February one.

The trial also looked at the effect of rolling on a frost and on removing the debris after cutting.

“Removing debris did nothing. We thought that if the debris containing the larvae was removed it would reduce reinvasion of the crop, but the results actually strongly suggest that increases in larvae numbers after defoliation is due to late hatching,” says Dr White.

This time, the trail did see yield reductions, particularly from the February mowing, and also when the debris was removed after the December mowing.

Dr White believes mowing in February left the crop too little time to recover, given the dry spring, and removing the debris also removed nitrogen, which would otherwise give the crop a boost.

JOURNAL : Farmers Weekly

Shropshire grower Matthew Williams has increased his oilseed rape yields while also cutting his fertiliser costs by fully utilising the residual nitrogen in his soil.

Mr Williams’ OSR yields increased by 14% after he carried out N-min testing last season, which confirmed that he could cut back his fertiliser inputs without harming his yields.

As a result of identifying his nitrogen reserves, he was able to increase his margin over fertiliser costs from the crop by £280/ha.

See also: Winter barley abandoned for triticale on Shropshire farm

Increasing flea beetle costs

Mr Williams grows about 200ha of oilseed rape at his farm near Bridgnorth, alongside 320ha of wheat and 120ha of winter barley in a typical rotation of two wheats, winter barley, followed by OSR.

A lack of flea beetle in the area means that OSR has traditionally been a good breakcrop on the farm, but last season there were signs their numbers were increasing.

Last season, a single spray took them out, but this season most fields have already had two sprays and some will need a third.

As insecticide costs are likely to increase, Mr Williams is keen to ensure that all inputs are being used as efficiently as possible.

Nitrogen inputs

One area which has the potential for improved efficiency is his nitrogen inputs.

Quantities of sewage sludge has been applied to the farm in the past, and some of the arable area has previously been used for livestock, so nitrogen reserves in the soil were likely to be healthy.

Added to this, the preceding crop of winter barley failed to yield as well as he had hoped due to the drought in 2018.

As it had been fertilised for an 8-8.5t/ha yield, some nitrogen was likely to be available to the following OSR crop.

“We had a feeling there could be nitrogen available, but in truth we had no idea,” he says.

[*https://infogram.com/copy-defoliation-1h8n6m115eyj6xo?live*](https://infogram.com/copy-defoliation-1h8n6m115eyj6xo?live)

“We’re great believers in making sure every input delivers a tangible return, and this is absolutely essential when it comes to our fertiliser use.

“It’s why we have never been encouraged to use liquid fertilisers and why we don’t use urea anymore,” he says.

Nitrogen levels testing

To find out how much residual nitrogen is in his soil, Mr Williams trialled CF Fertiliser’s N-min testing.

Unlike conventional soil nitrogen tests, CF’s N-min test measures the amount of nitrogen in the soil at the time of testing, but also accurately predicts what will become available to the crop during the season.

This is adjusted to account for the nitrogen that will be supplied from the soil at depths between 60cm and 90cm, with allowances made for leaching losses, deposition and uptake efficiency.

When this is combined with the nitrogen level already contained in the crop, this makes up the total soil nitrogen supply, which is then used in CF Fertilisers' N-Calc programme.

The trial

The trial compared the farm’s standard practice, which is determined by the RB209 Fertiliser Manual, with an N-min based approach, with both being targeted towards producing a 5t/ha crop.

It was conducted over a 12ha area of medium clay loam soil, which was min-tilled before being drilled with the variety Wembley in mid-August.

The farm standard plot received a first application of DoubleTop in mid-February, delivering 67.5kg/ha of nitrogen.

This was then followed by two applications of ammonium nitrate, which added a further 100kg/ha of N, giving a total of 167.5kg/ha of N.

Meanwhile, on the CF plot, N-min testing had revealed nitrogen reserves in the soil of 197kg/ha of N.

The N-Calc system, therefore, recommended an additional 110kg/ha of N to deliver a 5t/ha crop – nearly 60kg less than the standard farm practice.

This was applied through the same DoubleTop application as the standard farm practice plot, and a single 43kg/ha of N application of ammonium nitrate, which was applied on 20 March.

“I remember looking at the CF system crop and thinking that definitely looks thin compared with the farm practice one and the satellite images confirmed this.

“In fact, we were convinced we were going to have to put some more fertiliser on it.

“But when we started harvesting, we realised it was a great crop and actually started to get excited thinking the one with more nitrogen would be even better,” says Mr Williams.

However, despite being bulkier, the more heavily fertilised crop actually yielded much less when he came to harvest it.

The CF System crop produced 5.22t/ha, while the thicker farm practice crop yielded more than 0.6t/ha less.

Optimum canopy structure

CF agronomist Alison Grundy says N-min testing allowed Mr Williams to create the optimum canopy structure by managing his nitrogen better, resulting in higher yields.

Without knowing the baseline nitrogen level that growers are working from, crops are likely to end up too dense.

“You have to aim for a canopy that has the size and biomass to give the right foundation for yield, and that is not so dense that sunlight can’t penetrate it.

“If you keep the canopy more open, you also avoid micro-climates that can potentially encourage disease to take hold, which then adds cost of control into the equation alongside lower yields,” she says.

30% cut in fertiliser use

At the same time as increasing his yield, getting a better handle on his nitrogen reserves allowed Mr Matthews to cut his fertiliser use by 30%, reducing costs by £40, from about £135/ha to £94/ha.

“The N-Min test highlighted just how easy it is to routinely apply too much fertiliser, which is not a great position to be in from either farm economic or environmental viewpoints.

“We now routinely carry out N-min testing across the rotation because there’s just too much risk in sticking with general assumptions and basing your applications on these,” says Mr Williams.

Last season, N-min testing also saw his winter barley yields increase by over 1.4t/ha, while his fertiliser spend also decreased, pushing his margin over fertiliser costs up by £193/ha.

Mrs Grundy says carrying out N-Min testing will be of most value where growers think they could have large reserves of N in the soil, or where they have been using a lot of organic inputs.

Equally, it would be a useful tool when growers think the soil N supply might be low, rather than using it across the whole farm as standard.

Rob Briscoe, Lower House Farm, Tarporley

N-min soil testing allowed Cheshire grower Rob Briscoe to save £65/ha on his oilseed rape fertiliser costs last season without sacrificing any yield.

Oilseed rape is a good option at Lower House Farm, Tarporley, because of the close proximity to the crushing plant at Liverpool, but yields are held back by the farm’s sandy soils.

N-min testing has been used across the rotation for the past three years and is targeted to where Mr Briscoe suspects the soil nitrogen supply is likely to be high.

The 20ha area of Django had previously been fertilised for a high yielding wheat crop, but this did not materialise due to the drought in 2018, so much of the nitrogen remained in the soil.

An N-min sample taken in February concluded that there was 83kg/ha of N to come from the soil, with 100kg/ha of N estimated to have already been taken up by the crop.

CF’s N-Calc system recommended a further 100kg/ha of N to achieve a 5t/ha crop.

While the final yield was only 4.2t/ha, this is in line with the farm’s 10-year average, and Mr Briscoe was able to cut back his 200kg/ha of N to just 112kg/ha of N.

“At the end of the day, we saved about £65/ha in fertiliser costs, achieved the same yield results as previous years and now understand a lot more about how we approach our ***nutrient*** needs moving forward,” says Mr Briscoe.

JOURNAL : Farmers Weekly

The D-Max Utility is a proper no-frills workhorse with a generous towing capacity, impressive payload and a reasonable price tag.

Couple this to a five-year, 125,000-mile warranty, and it makes it an attractive choice for a general farm vehicle.

Even the diminutive 1.9-litre engine performed better than expected. But the flipside is that it feels cheap, with feather-light doors and low-grade trim that makes it look dated compared with the competition.

See also: Pickup test: Isuzu D-Max Blade

Vital stats

Engine 1.9-litre, four-cylinder diesel

Power 164hp @ 3,600rpm

Torque 360Nm @ 2,000-2,500rpm

Transmission Six-speed manual

Weight 1,909kg

Payload 1,141kg

Towing capacity 3,500kg

Turning circle 12.2m

Price £20,809

Engine and transmission

When Isuzu first dropped its engine size below the 2-litre mark, a lot of people (including us) were dubious that it would be up to the job.

But despite its hatchback-sized displacement, the 1.9-litre block was the most powerful in our test group, returning a healthy 164hp and 360Nm torque.

This gives it respectable performance for a base-spec truck, and on paper it has a rather frugal 40mpg fuel combined consumption figure.

Our real-world consumption test returned a more realistic 31.66mpg which, interestingly, was almost identical to the figure we got when we tested the top-spec Blade model a couple of years ago.

During spirited driving, the lack of cylinder capacity makes the D-Max seem a little revvy compared with some of its bigger-bored competitors. It’s less obvious in the manual, but we really noticed it when we drove the automatic version.

However, the small engine does have its benefits. Notably, the fact that Isuzu has managed to meet the Euro 6 emissions regs without having to resort to using AdBlue – something that competitors need to top up every 12,000 miles or so.

This only applies to the current model, though, and when the new range comes to dealers later this year, they will be fitted with AdBlue.

As for the transmission, our test truck came with a six-speed manual transmission, which is the only option on base-spec Utility trucks. This has a low first gear, which is a little tedious for everyday driving, but comes into its own when towing.

Interior

Despite the Utility being the bottom rung of Isuzu’s pick-up range, it comes with most of the features required for a working vehicle.

There are electric windows all round, air conditioning and a rudimentary Bluetooth hands-free radio, albeit something that looks like it’s been plucked from a Halfords bargain bucket. The fact that this isn’t integrated into the dash means it’s very easy to replace, though.

There is a decent amount of storage too, with two glove boxes and a cubbyhole under the central armrest. For those with young children, there are also Isofix seat anchors.

The rest of the interior is cheap and not particularly cheerful, with some fairly low-grade black plastics, plank-like cloth seats and a thin steering wheel.

The doors are also lightweight and shut with a tinny ping, unlike the solid clunk you get with a Toyota Hilux.

But who cares – there are plenty of high-end trucks out there, so it’s refreshing that Isuzu has managed to keep the Utility so simple.

We did spot one unexpected luxury though – all double-cab models come with heated door mirrors as standard, so there’s no need to shove your arm out of the window with a cloth in sub-zero temperatures.

Towing and off-road

Towing and carrying capacity is where Isuzu has really tried to make its mark with the D-Max.

All models, including the Utility, can tow a 3.5t braked trailer with twin or triple axles. This sets it apart from the Mitsubishi L200, which is limited to 3.1t with a twin-axle unit.

Payload is also a generous 1,141kg, which has been achieved by Isuzu keeping the kerb weight to just 1,909kg. That’s pretty light for a modern double cab truck and goes some way to explaining why the doors have such a featherweight feel to them.

Isuzu has also set the gearing to suit frequent towers, with a low first gear that makes it easy to set off without having to slip the clutch. It does make it almost redundant during normal driving though.

Other features include an automatic trailer sway control system, which senses if a trailer is starting to get out of shape and reduces the vehicle’s speed to counteract it.

There is also a hill-start feature, which applies the brakes for two seconds, allowing the driver to built up revs before setting off. Descending can be automated, too, with a system that uses the ABS to make a controlled downhill run, without the driver needing to touch the brake pedal.

As for the four-wheel drive system, this is a typical switchable affair, with an electronic dial for changing between the three modes – 2H, 4H and 4L.  There’s no diff-lock for the rear axle though, which means it doesn’t have the mud-plugging abilities of some others.

Instead, Isuzu relies on the traction control system to find grip, which gives limited success in very tough conditions.

Likes

Towing capacity and payload

Powerful for a 1.9-litre

Low first gear for towing

125,000-mile/five-year warranty

Gripes

Cheap finish

Tinny doors

No diff-lock

Poor-quality radio

Rest of the range

Isuzu offers a bewildering range of pickups that span a colossal price range from £16,909 for the single-cab Utility truck to £40,180 for the fully loaded Arctic trucks AT35.

Sit the two next to one another, and there are some pretty distinct differences. But it’s worth noting that they all sit on the same basic platform.

So, peel away the leather trim, big wheels and fancy suspension, and the AT35 has a 1.9-litre diesel engine delivering 164hp and the same six-speed manual or optional automatic transmission.

Back at the entry-level end of things, buyers get the choice of three Utility models – a single cab (available in two- or four-wheel drive), an extended cab and the double cab we had on test.

These all come in van-grade flat white paintwork with steel wheels, but there is the option to upgrade to metallic silver or grey.

Those in search of a little more refinement have the option of the Eiger, which brings in alloy wheels, more colour choices, a reversing camera and the choice of an automatic transmission. Its starting price is only a couple of grand more than the Utility, so it’s not a huge leap in outlay.

Yukon and Utah models are the next two notches up the ladder, the latter of which comes with leather seats, Apple Car Play and Android Auto and 18in alloys.

From there, it starts to get a little silly, with the so-called Adventure range. This includes the Blade, XTR and Arctic Trucks AT35 model mentioned earlier, all of which have various expensive add-ons to justify their inflated price tags.

JOURNAL : Farmers Weekly

There is little doubt that budget Hilux models are well made and reliable workhorses.

Tidily laid out controls and a comfortable drive make it a particularly appealing option at this price point, as do the decent payload and towing ratings.

There are also stacks of driver assist systems included, but they can do nothing to improve the clumsy turning circle and unremarkable fuel economy.

The big catch is that it only came in under our £22,000 budget in single cab format, though the £2,000 hop from this model to the cheapest double cab won't be bank breaking.

See also: High-hour Horsepower: Toyota Land Cruiser hits 484,000 miles

Vital stats

Engine 2.4-litre

Power 148hp@3,400rpm

Torque 400Nm@1,600-2,000rpm

Transmission Six-speed manual

Weight 1,850kg

Payload 1,105kg

Towing capacity 3,500kg

Turning circle 12.6m

Price £20,502

Engine and transmission

All Hilux pickups come with the same 2.4-litre four-cylinder engine and the block feels a more natural match for the entry-level models, where the odd ***agricultural***-sounding grumble is pretty inoffensive.

It can get a bit noisy when accelerating in "power" mode, but doesn't shout quite as loudly as Isuzu's small-bored D-Max.

To calm things, throttle response can be dialled down to a meeker "eco" setting, which reduces power and helps to balance the heating and cooling of the engine to improve fuel economy. However, it does cause the pickup to feel a bit gutless.

Toyota only offers its manual gearbox in Active spec models, but that shouldn't cause too much upset for potential buyers.

We tested the automatic version two years ago and its dilly-dallying between gears and generally slow shifting means it's not a great miss.

Our experiences also suggest that the manual transmission is slightly more frugal.

The Invincible automatic recorded an unimpressive 28.44mpg over our test route, while the manual chalked a marginally more respectable 30.3mpg.

That said, there's still a seismic gap to the 39.8mpg Toyota quotes in its brochures.

The rear leaf suspension – geared up to handle a maximum 1,105kg payload – sees the Hilux struggle to iron out small bumps on country lanes, especially when empty.

Unfortunately, this is much more noticeable in a single cab and contributes to a fairly unsettled ride at low speeds.

Our test model's clutch biting point was also a touch on the high side and took some getting used to.

Interior

The single cab configuration means there is a distinct lack of dry storage, especially when both seats are occupied.

Those that travel with spanners and other workshop gear will struggle to avoid either building or buying a loadbed box (more on this later).

The interior finish is smart, with solid, workmanlike materials used throughout – doors are heavy, cloth seats are comfy and controls are easy to use, demonstrating Toyota's ability to resist scrimping in key areas.

In fact, the firm's base-spec generosity extends to heated door mirrors, all-round parking sensors and auto headlights, giving the Hilux a plush edge that some of its rivals are lacking. The D-Max looks particularly spartan by comparison.

The central screen hardware is the same as top-end Invincible models, but get up close and you will realise that most of the functions on the tablet-style touchscreen have disappeared and it’s actually just a display readout.

That said, connecting a smartphone remains easy, as does playing music wirelessly.

Steering wheel buttons offer telephone and radio controls and there are readouts for mpg and trips displayed between the dash dials.

Towing and off-road

Single cab models get the same 3.5t towing capacity as the rest of the Toyota range.

Added to that, the engine's peak 400Nm torque arrives at just 1,600rpm, which undoubtedly helps acceleration with a heavy load.

There are also various haulage-helping extras, such as trailer sway control.

This automatically detects excessive movement of the trailer and selectively applies brake pressure to individual wheels and reduces engine torque to bring it back under control.

A slip indicator light on the dash flashes to indicate that it’s working.

Hill hold assist is also included – it maintains the brake force for up to 5sec after the brake pedal is released to prevent rolling back on steep inclines.

The four-wheel drive system is pretty run of the mill, with H2, H4 and L4.

The truck has to come to a stop to engage the low range and only then can the rear differential lock be activated by a button on the dash.

Our model was also fitted with 265/65 R17 Bridgestone Duellers on optional black steel wheels, which helps lift the budget appearance up a notch.

And we had a big lockable storage box bolted in the load bed, providing extra space to store valuables.

At £287.70, it seems pretty reasonably priced by pickup accessory standards.

Of course, the major perk of the single cab setup is the football-pitch-sized load bed.

At more than 2.3m long – 800mm longer than that of the double cab – it provides plenty of space, even with storage boxes on board.

The bed has an external rail on either side for strapping and a ladder across the back of the cab for longer items to rest without damaging the roof.

However, the test truck had no internal points for strapping smaller items down.

Other spec details worth considering are the clumsy turning circle – at 12.6m, it is 80cm bigger than the L200 – and decent ground clearance.

Likes

Best build quality

Lots of driver assist systems included

External tie down lugs and ladder above cab

Good ground clearance

Gripes

Fuel economy pretty poor

Jittery on country roads

High clutch biting point

Clumsy turning circle

Rest of the range

The 2.4-litre engine is used across in all of Toyota's pickups.

The base spec is Active and these models are only available with a manual transmission, in single- and double-cab variants.

Next up is the Icon spec, with its double cab and colour-coded bumpers, and a smattering of chrome on mirrors and door handles, setting it apart from the base models. However, it comes in about £4,000 more expensive.

The top two models are the Invincible and Invincible X, with the latter getting the revised front grille and latest styling.

Extras here range from satnav to smart entry and push button start.

Fully kitted out, an Invincible X pushes past the £40,000 mark.

JOURNAL : Farmers Weekly

A farmer in Cornwall who hung dead rooks in a field says he was trying to protect his crops in the least disruptive way to nearby residents.

William Collins displayed the birds in his field near St Levan, Cornwall last Friday (17 January) as a deterrent to other rooks, but took them down after some members of the public complained.

(function(d,s,id){var js,fjs=d.getElementsByTagName(s)[0];if(d.getElementById(id))return;js=d.createElement(s);js.id=id;js.src='[*https://embed.ex.co/sdk.js*](https://embed.ex.co/sdk.js)';fjs.parentNode.insertBefore(js,fjs);}(document,'script','playbuzz-sdk'));

Out of consideration for his neighbours, the 66-year-old said he did not want to use audible bangers to scare off the rooks but it was vital he protected the limited amount of winter barley he had managed to drill after a prolonged spell of wet weather.

See also: Wild Justice launches fresh action against crow shooting laws

Speaking to Farmers Weekly, Mr Collins said: “We didn’t want to upset anybody at all, but I can’t sit back and let my crops be destroyed.

“Once the crops are established it’s fine, but when the grain hasn’t rooted the birds are able to take it out of the ground. If we had managed to drill in October we wouldn’t have a problem but the rooks are very hungry at this time of year.

“This is a practice that goes back centuries but times are changing and we have to be sensitive, I suppose.”

He added: “We don’t grow crops to feed wild animals or birds and we don’t want to be doing this but our time is precious.”

Bird scaring

Mr Collins, who started farming in the area when he was 14 and now covers about 202ha, said if any of his neighbours could do some manual bird scaring on his land it would “help us no end”, but he would have to use audible bangers if the problem continued.

He said he removed the dead rooks from the field on Monday evening (20 January) after speaking to the land owner, St Aubyn Estates.

JOURNAL : Farmers Weekly

There are just two months left in which to take advantage of a government scheme encouraging businesses to invest in energy efficient equipment.

The Energy Technology List (ETL) covers a set of energy-saving items such as biomass boilers, electric motors and lighting which qualify for full tax relief through the Enhanced Capital Allowance (ECA) tax scheme.

It was established to encourage investment in energy efficient equipment which is often more expensive to buy than less efficient alternatives. ETL products have to meet specific energy criteria.

The scheme is scheduled to close on 31 March 2020.

See also: Challenging your council tax band can recoup thousands

What kit is eligible?

There are about 14,000 items on the ETL, ranging from air conditioning systems, boilers, biomass equipment, lighting and refrigeration equipment, through to pipework insulation and solar thermal systems.

For a product to qualify for an ECA, it must be on the ETL on the day of purchase.

You can search for eligible products by technology type, manufacturer, product name and model number at the ETL website.

Plant or equipment that has already benefited from other support such as the Renewable Heat Incentive or Feed in Tariff is ineligible for the ECA.

Who manages the list and when is it updated?

The Carbon Trust manages the ETL for the Department for Business, Energy and Industrial Strategy (BEIS), and updates it with new products on the first and 15th of each month.

Note that products can be removed from the list. Products removed since 1 April 2017 will appear on the list with a note of their removal  date.

How can farmers benefit?

Any business that pays income or corporation tax can write off the entire cost of any eligible equipment against taxable profits in the year of purchase.

Matthew Appleyard, a tax adviser at accountant Duncan & Toplis, says allowing costs to be written off in this way, rather than on a reducing balance basis over multiple years, means investments in energy-saving plant or machinery can be made where they might otherwise have been too expensive.

For example, a sole trading farmer who makes an annual profit of £50,000 and buys an ETL-listed heat recovery unit for their dairy farm or refrigeration unit for a packhouse, paying £20,000, could see a tax saving of £5,800 in that tax year.

However, Mr Appleyard notes that with the current Annual Investment Allowance (AIA) being £1m, many farmers and other small and medium-sized businesses have recently found they do not need to claim ECA to receive the same tax benefits.

What if the business made a loss?

This varies depending on how the farm business operates.

Loss-making partnerships or sole traders can still claim ECAs, although doing so increases their losses. “These will be automatically carried forward to set against the first available trading profit or against other income, depending on individual circumstances,” says Mr Appleyard.

A farm business operating as a limited company can surrender all or part of the loss attributable to the investment in assets qualifying for ECAs, in exchange for a repayable tax credit (currently worth 19% of the loss surrendered).

A first-year tax credit is not taxable income and could benefit cashflow, but Mr Appleyard says this relief is also being withdrawn from 31 March 2020 in line with the withdrawal of ECAs and First-Year Allowances.

How does the ETL work with other allowances?

Claiming ECAs does not affect other tax relief. The 100% allowance available for ETL items is separate from the AIA, so a farmer who has already used their full AIA against other plant and machinery can still claim the ECA on qualifying equipment.

Can I claim for something already installed?

This depends when the equipment was bought, as individuals have only limited time to amend their tax returns to claim an ECA.

“Farmers who believe they may have a claim should speak to their professional advisers for further assistance,” Mr Appleyard says.

Find out more

General ETL and ECA information:

E Carbon Trust

E Energy Technology List (ETL)

E Government Energy Technology List (ETL): information for purchasers

ETL product list:

E Find ETL Products

JOURNAL : Farmers Weekly

Sales of Welsh food and drink hit a record last year, at £7.5bn.

This was up from £6.8bn in 2018 and means the Welsh Government's target of increasing sales to £7bn by 2020 was achieved a year early.

Sales have grown 30% since 2014, with Welsh lamb, beef and pork and other meat products accounting for more than £1.2bn of the 2019 total.

The drinks sector also recorded a turnover of more than £1bn.

See also: 4 food trends that will affect farming

Dairy was one of the next biggest contributors, with a turnover of £611m.

Drinks include a thriving mineral water sector, along with a variety of beer, cider, wine and spirit brands.

Promoting meat

Meanwhile, Hybu Cig Cymru (HCC) has announced it is taking part in a major promotional campaign in February and March, which will showcase Welsh lamb and beef to consumers in south-east England.

As part of Wales Week London, Welsh food will be showcased at events in Paddington Station, 10 Downing Street and the British Academy of Film and Television Arts, as well as at leading London restaurants run by renowned Welsh chefs Bryn Williams and Tom Simmons.

“London has been an important market for some time for Welsh lamb and Welsh beef,” said HCC’s market development manager, Rhys Llywelyn.

“But partnering with Wales Week London and Wales Week Worldwide will bring an extra dimension to our work.”

Wales Week London will run from 22 February to 8 March and will celebrate and promote everything that is great about Wales.

JOURNAL : Farmers Weekly

According to Defra ***statistics***, there were 38 pig premises under TB restriction in 2018, with 122 pigs tested for the disease.

Although this is low compared to TB in cattle, for those pig farmers affected it causes considerable financial upset and heartache.

Here we cover the rules governing TB in pigs, compensation payments for affected herds and ask vets how to cope with the disease.

See also: UK pig farm using EID to track piglets from birth

Jump to:

TB Rules

What happens if you get a breakdown?

Movement restrictions and options for trading

Compensation

Vet advice

Case Study: Sally Lugg, Primrose Herd

TB Rules

Pigs rarely show any clinical signs of TB and usually the infection is only recognised at slaughter, when all animals are assessed under UK legislation in routine post-mortem inspections.

If lesions are found in the head then only the head will be condemned, but if lesions are found in more than one part of the carcass the whole animal is classed as unfit for consumption.

There is no routine TB test for live pigs – they are usually only tested after an infection has been confirmed, although testing can be requested by the owner.

The tuberculin skin test is used, as it is for cattle, but as it is not designed for pigs it may lack sensitivity. There are signs producers can look out for.

Symptoms of TB include:

breathing problems

loss of appetite and condition and no improvement after antibiotic treatment.

Veterinary advice should be sought if symptoms occur.

Infection is thought to be transmitted orally, either through contact with wildlife, ingestion of untreated milk or consumption of feed contaminated by wildlife.

TB is not easily spread through pigs because it is latent in the animal's lymph nodes until more advanced lung disease occurs, especially in commercial situations due to their shorter lifespan.

Those that keep pigs to an older age could increase the risk of infection spreading.

What happens if you get a breakdown?

The Animal and Plant Health Agency (Apha) has powers to remove and slaughter any livestock that test positive for TB.

Currently there are no statutory surveillance or control programmes in place for pigs, and herd testing is done on a voluntary basis.

If a pig herd has a high prevalence of TB, the owner may decide to depopulate the herd – this is usually achieved by culling breeding stock and finishing the rearing pigs on another unit.

Following this, and essential biosecurity measures being taken, the herd can be repopulated. However, this may be financially impractical for some.

Movement restrictions and options for trading

Producers must restrict livestock movements until Apha is sure the herd is clear of TB following two negative 60-day tests.

All movements from a TB-restricted farm must be to a secure finishing unit or to slaughter. This can only take place once a preliminary biosecurity assessment has been carried out, and an Apha vet has deemed the risk of the disease spreading to be very low.

Compensation

Farmers can get statutory payments from Defra for each animal removed if they test positive for TB.

Category

Compensation paid per head (£)

Animals weighing less than 25kg (suckler)

30

Animals weighing between 25kg and 35kg (weaner)

40

Animals weighing more than 35kg (grower or finisher)

90

Breeding females (gilt or sow)

250

Breeding males

350

Vet advice

Compared to cattle, bovine TB in pigs is a relatively small issue but, for the small numbers of pig herds that do become affected, it can be a big problem.

There are several practices farmers can introduce to help prevent infection.

“Try to keep wildlife like badgers away from pigs and their food stores – as infection can be established by direct or indirect contact,” says Richard Pearson, director at the George Veterinary Group in Wiltshire.

“I don’t recall any pig bovine TB cases where there has been significant evidence of cattle contact as the source of infection; most pig farms do not have cattle.”

TB mainly affects the lymph nodes of the pig’s head or chest. Affected pigs are usually completely clinically normal and problems are usually disclosed at meat inspection.

The disease is more prevalent in the South and West of the country – reflecting TB pressure in the local environment – but pig cases are still extremely rare, with around 20 to 30 individual cases per year.

Managing TB in outdoor herds can be challenging, he adds.

“Over 40% of UK sows are farmed outside and it can be hard to keep badgers out.”

However, new feeding systems are beneficial. Most farmers have switched from broadcast spinning to long troughs or farrow feeders, resulting in less wastage and food on the pasture which attracts wildlife.

But there is a need for clarity over how pig producers can tackle the disease, says Mr Pearson.

“There is a pressing need for TB exit strategies as currently it is very difficult, expensive and protracted to resolve problems once a herd is under restriction.

"With diseases like bovine TB that can affect multiple species the current drive towards a more holistic approach at a farm and regional level must be good news.

"Current work by Apha to develop alternative testing strategies for pigs is also to be welcomed.”

Case study

Sally Lugg, Primrose Herd, Redruth, Cornwall

The Lugg family have been battling TB restrictions in their traditional Large Black herd for nearly 10 years.

“In 2010 we sent a sow to slaughter with some finished pigs. We never considered TB would be an issue until a few days later,” explains Mrs Lugg.

“We were given the option of having all the pigs slaughtered or having them tested. I refused both and we reached an impasse – it’s been that way ever since.”

Although Apha said the herd could go clear following two negative 60-day tests, Mrs Lugg felt it would be very stressful for their free-range pigs as they are not easy to handle. She also worried it would affect pregnant sows.

The family have campaigned alongside their MP George Eustice and their vet to have the restrictions lifted, since it is nearly 10 years since their first and only case of TB.

“We have never had another case and we have sent 4,500 pigs to the slaughterhouse since – all of the pigs we had in 2010 are gone,” says Mrs Lugg.

“Our Apha vet even offered to conduct a post-mortem on the cull sows and boars, but Animal Health still said no.”

The restrictions mean the Luggs cannot buy or sell any adults for breeding.

“We have one of the rarest lines and it’s of no benefit to the breed. It upsets me that we can’t sell our pigs - I cried when I saw the first litter after going down with TB.”

However, they have adapted their business to survive, selling all their meat direct to the customer. But the emotional impacts are considerable.

“It’s very upsetting, it’s devastating really,” says Mrs Lugg.

“We used to show at the Royal Cornwall Show. Showing was part of our children’s childhood and we made lifelong friendships through it – it was all shattered.”

JOURNAL : Farmers Weekly

Dairy farmers supplying cheesemaker Saputo Dairy UK will be banned from shooting healthy bull calves from October 2021, the processor has said.

The company is supplied by 330 farmers within 80 miles of Davidstow in Cornwall, which operate as producer organisation Dairy Crest Direct.

The Cathedral City manufacturer was known as Dairy Crest until its £975m buyout in February 2019 by Canadian dairy giant Saputo.

See also: Tips on reducing feed waste on your dairy

The company said: “We are working closely with Dairy Crest Direct [DCD] to gather information on best practice so we can use this transitionary period to help our farmers manage the challenge and seek appropriate solutions”.

DCD chairman Stephen Bone said: “We have outlined a timeline. There are still a lot of details that we will be working on to try to alleviate any potential problems on farm.”

The main issue producers are concerned about is what will happen if their farm is placed under TB standstill once the new rule comes into effect, Mr Bone said, meaning calves could not leave the holding.

Saputo UK is the third-largest milk buyer, after Arla and Muller, to take steps to phase out the practice of shooting healthy but unprofitable calves.

It is still selectively recruiting additional farmers to its roster, as well as encouraging existing suppliers to increase production following a £85m investment in 2018 to expand its processing capacity.

JOURNAL : Farmers Weekly

Two men were treated in hospital for injuries after a cow escaped from Welshpool Livestock Market.

Both the air ambulance and ambulance service attended the market at Buttington Cross, Welshpool, to treat two patients.

According to local reports, two farmers were injured after a heifer burst through a ring enclosure gate and entered the public stand at the market.

See also: 5 new livestock gadgets for farming in 2020

A Welsh Ambulance Service spokesperson said: “We were called on Monday (13 January) at approximately 09.24 to reports of two patients needing medical attention at Welshpool Livestock Market, Welshpool.

“We responded with two emergency ambulances and the crew were supported by Wales Air Ambulance. Two patients were taken by road to Royal Shrewsbury Hospital.”

Farmers Weekly has contacted Welshpool Livestock Market to request a comment.

HSE 'made aware'

A spokesman for the Health and Safety Executive said it had been made aware of the incident and was waiting to receive more details before deciding whether to launch an investigation.

Every year, a number of people working with livestock, such as farmworkers, auction mart staff and veterinary staff, are killed or injured by cattle whilst undertaking livestock activities.

JOURNAL : Farmers Weekly

Prime minister Boris Johnson has promised Ugandan farmers they will have the opportunity to export their beef to the UK after Brexit.

Speaking at the UK-Africa Investment Summit 2020, Mr Johnson said: “I have just told president Yoweri Kaguta Museveni that his beef cattle will have an honoured place on the tables of post-Brexit Britain.

“The United Kingdom is aiming at building a partnership that benefits all African countries.”

See also: General election: What Tory win means for farming

President Museveni tweeted his delight at hearing the pledge.

“I am glad that in his speech, the prime minister indicated that our products, including Uganda's beef, would find its way on to the dining tables of post-Brexit Britain,” he said.

“Our position has always been balanced trade that benefits all parties.”

Mr Johnson said that as the UK exited the EU it was setting its sights and energy on Africa, with plans to invest in infrastructure development and open up trade markets.

As part of the deal, Mr Johnson also said that “families across Angola will be tucking into delicious chicken from Northern Ireland”.

However, British farmers have reacted angrily to the PM’s Ugandan beef pledge and questioned why the government would allow beef produced to lower standards to be imported here, undercutting their businesses after Brexit.

Farmers ‘packing up’

Kent beef farmer Douglas Ledger said: “I’m gutted. Nothing seems to be about the domestic market. It’s all about trade and what they can get.

“Our margins are disappearing completely. Many small beef farmers around here are packing up. Politicians are totally out of touch with the prices on the home market.

“All we want is to earn a reasonable living for the amount of work we put in.”

Mr Ledger, who farms 300 head of cattle between Dover and Canterbury, said importing foreign beef would be bad for the environment because of the emissions related to transportation.

Warwickshire beef farmer and AHDB Beef & Lamb chairman Adam Quinney said: “With a calving index of 58% and a calf loss of 30%, I should imagine the carbon footprint of Ugandan beef is terrible. I thought Mr Johnson was interested in tackling climate change.

“They are not big producers (about one-fifth of our production). But the question is, what are their standards of production, traceability and welfare at slaughter”

The NFU is lobbying MPs to include a provision within the ***Agriculture*** Bill to require that all food imported into the UK is produced to at least equivalent food production standards as those required of producers in the UK.

JOURNAL : Farmers Weekly

Reducing the number of ruminants and increased tree planting on farmland are key to meeting the UK’s “net zero” carbon ambitions, says the Committee on Climate Change (CCC).

Launching its latest report, Land Use: Policies for a Net Zero UK, committee chairman Lord Deben said the time for discussion was over and the time for delivery had arrived, backed by legislation if necessary.

“Changing the way we use our land is critical to delivering the UK’s net zero target,” he said.

See also: The cost of extreme weather for UK farmers

“Doing so can provide new revenue opportunities for farmers, better air quality and improved biodiversity.

"But major changes are required and action from government is needed quickly.”

According to the report, ***agriculture*** currently accounts for 12% of greenhouse gas emissions in the UK, but this can be reduced by almost two-thirds if the right actions are taken.

Specifically, it suggests:

Reduce consumption of beef, lamb and dairy by at least 20% per person, and food waste by a similar 20%

Increase tree planting by 100m trees/year, lifting UK forestry cover from 13% to 18% by 2050

Encourage low-carbon farming practices – such as “controlled-release” fertilisers, improved livestock health and new diets for cattle

Restore at least 50% of upland peat by “rewetting” them, and banning extraction and heather burning

Expand bioenergy crops to about 23,000ha/year, including miscanthus and short rotation coppice

The result of all this would be that about 20% of land would be taken out of traditional ***agricultural*** production and moved into long-term, natural carbon storage, said Chris Stark, CCC chief executive.

But this would not necessarily mean a reduction in food production, he told a briefing on Wednesday (22 January), so long as there was an improvement in productivity and a change in diet “reducing consumption of the most carbon-intensive food – beef, lamb and dairy”.

Cut methane

This drop in meat and dairy consumption was needed to reduce methane emissions, said Mr Stark, and so contain the rise in global temperatures.

Even though UK grass-fed beef was less damaging than other global systems, it still needed to play its part.

“But it’s very important that we don’t then replace that with the importation of higher greenhouse-gas-intensity meat from abroad,” he said.

“We will need a strong trade policy to make that happen.”

Achieving a 20% reducing red meat consumption should be done by steering people towards the right diet choice, rather than legislating, such as better labelling and improving plant-based offerings in schools and hospitals.

“The main message here is eat a little less meat, but know that you can go for the high-quality produce that we have here in the UK, which has lower greenhouse gas emissions than imported meat,” said Mr Stark.

Carbon credits

As for tree planting, the CCC is suggesting a system of Feed-in Tariffs, similar to those used with renewable energy, or a carbon trading scheme, where farmers can sell carbon credits.

This could be funded by a levy on greenhouse gas emitting industries, such as oil extraction or aviation.

Overall, the CCC estimates that all its recommendations would cost about £1.4bn/year, but would yield net benefits to society of more than £4bn.

How have people reacted?

Minette Batters, NFU

“When talking about changing diets, plant-based products do not always necessarily have a lower impact on the environment. It all depends on where and how the ingredients have been produced, the environmental pressures involved, the environmental management associated with that country’s ***agricultural*** system, as well as how far the product has travelled. Sixty-five percent of British land is only suitable for grazing livestock and we have the right climate to produce high-quality red meat and dairy. Therefore, it makes sense that, when talking about environmental impact, the public continues to support British livestock production.”

Andrew McCornick, NFU Scotland

“The industry already plays a hugely significant role in efforts to reduce emissions, through sequestering carbon and the generation of renewable energy. At farm level, positive uptake of efficiency measures around livestock and crop production, soil testing, ***nutrient*** management, energy crops and the integration of woodlands into farming will all have a greater role to play, alongside the continued provision of safe, healthy, local food."

 Jo Lewis, Soil Association

“While the committee is right to say that our diets need to change and to highlight the crucial role that public settings such as schools and hospitals can play, it should go further to recommend a reduction in soya-fed meat that is driving deforestation. We need ‘less but better’ meat, sourced from organic and agroecological farms, and an end to intensively farmed meat.”

Vicki Hird, Sustain

“The dietary recommendation to reduce beef and lamb consumption could lead simply to a damaging switch to chicken and pork, without consideration for what these animals are being fed and how they are reared. We need to see more focus on genuinely agroecological and mixed farming, diversifying production, nature restoration and sustainable diets.”

JOURNAL : Farmers Weekly

The eagerly anticipated ***Agriculture*** Bill has been published – for a second time – but this time with a cast-iron guarantee of becoming an act of parliament, without the need for troublesome amendments.

Such is the power of the new Boris Johnson government, with its 80-seat majority, that it really is a case of “what you see is what you get”.

But what exactly does it contain and what might it mean for farmers in England, to whom it mostly applies?

See also: George Eustice on government’s farming policy ambitions

The actual document comes to 94 pages – somewhat longer than the 62-page original, which fell when parliament was prorogued last September amid all the Brexit shenanigans.

It is largely “enabling” legislation, saying that the government “may” do certain things, rather than it “will” do certain things – though the accompanying briefing notes confirm the government’s intentions.

These set out three broad aims:

To become more collaborative in developing a new support system

To become less bureaucratic

To promote the important contribution of farmers to the environment and food

What's changing?

Phasing out direct payments

The centrepiece of the new policy will be the phasing out of direct payments to English farmers from 2021 to 2027, to be replaced with a new “public money for public goods” system.

Defra has already stated that the Basic Payment Scheme (BPS) for 2020 will stay the same, and the overall budget for ***agriculture*** will not change until the end of the current parliament in 2024.

In the first year of BPS cuts (2021), the biggest reductions will be applied to the higher payment bands, as follows:

Payment band

Maximum reduction

Up to £30,000

5%

£30,000-£50,000

10%

£50,000-£150,000

20%

£150,000 or more

25%

So, for a BPS claim worth £40,000, the bill will provide for a 5% reduction on the first £30,000 and a 10% reduction on the next £10,000, taking it to £37,500.

“We’ll set the reduction percentages for later years by taking into account our detailed plans for future schemes and wider decisions about government spending,” says Defra.

Key points of the ***Agriculture*** Bill

Seven-year transition

Progressive cuts to direct payments

Direct payments delinked from any requirement to farm

Farmers to be paid for environmental management

Funds available to help increase productivity

Farmers to get more clout in the supply chain

Direct government intervention allowed under “exceptional” market conditions

Rewards for improved animal welfare

Wales and Northern Ireland may continue with BPS beyond 2020

Delinking

The new ***Agriculture*** Bill also confirms plans to “delink” direct payments from the requirement to farm the land, regardless of whether the recipient chooses to continue farming or not.

This could start as soon as 2021, though further consultations will be held with industry.

Delinked payments could be used in a number of ways – for example, to invest in improving productivity, to diversify the business or to retire from farming.

“This should help to provide more opportunities for new entrants, and existing farmers wishing to expand, or to buy or rent land,” says Defra.

It is also looking at the option of offering farmers a one-off lump sum in place of any further direct payments – again subject to consultation.

Rural development

The government has committed to fund all Rural Development Programme projects commencing before the end of 2020, and these will run for the lifetime of their agreement.

Countryside Stewardship agreements will continue to be available in the first few years of the ***agricultural*** transition period and, for a time, will overlap with the planned new Environmental Land Management (ELM) scheme

“No one in a Countryside Stewardship agreement will be unfairly disadvantaged when we transition to new arrangements under ELM,” says Defra.

It is also looking for ways in which the proposed UK Shared Prosperity Fund (set to replace EU structural funding, currently worth about £2.1bn), can support the rural economy.

What’s new in this bill?

Defra insists that the new bill is an improvement on the original, published in September 2018, and takes into account some of the feedback from those working in the ***agricultural*** sector. In particular:

Food security The government will report every five years on food security, with a focus on global availability and resilience of the supply chain, with policies adapted if necessary. Budgets must also “have regard to the need to encourage the production of food”.

Multi-annual budget The government to produce a multi-annual budget, rather than just an annual one, initially for seven years covering the transition period, then for “no shorter than five years”. This will provide greater certainty.

Soil quality Soil is specifically named in the bill, so the government can provide financial assistance to farmers for protecting or improving its quality.

Animal traceability The bill gives powers to improve the ***collection*** and management of information relating to the identification, movement and health of animals.

Organics Organic regulations may be tailored so the UK can continue to trade organic produce across the world.

Supply chain

Defra says it wants to give farmers better access to ***data***, enabling them to make more informed, market-driven decisions, and equipping them in their negotiations with processors and retailers.

“We also plan to publish, maintain, and enforce statutory codes of practice, which will help farmers to be confident that they are receiving fair treatment in their business dealings," it adds.

The bill also provides for a new UK producer organisation system that will facilitate greater collaboration between primary producers.

Future support arrangements

Environmental Land Management scheme

The centrepiece of the government’s new “public money for public goods” approach, as set out in the ***Agriculture*** Bill, will be its ELM scheme

Pilots are already under way, with the aim to launch the scheme proper in 2024.

It insists the new approach isn’t a subsidy. “Those who are awarded ELM agreements will be paid public money in return for providing environmental benefits.”

The main areas farmers will be expected to deliver on include clean air, reductions in environmental hazards and pollution, thriving plants and wildlife, clean water, enhanced landscapes and measures to minimise the effects of climate change.

Exceptional market circumstances

The bill also enables the government to intervene where there is “severe disturbance in ***agricultural*** markets” (for example, arising from disease outbreaks or extreme weather events) with a significant effect on producer prices.

Such financial assistance may take the form of a grant, loan or guarantee, or “any other form”, including the use of intervention buying or private storage aid for a defined period.

Animal welfare

Publicly funded schemes for English farmers will also be developed to reward animal welfare enhancements, above a legal baseline.

This might include new animal welfare grants, to help pay for investment in equipment, infrastructure, technology or training and innovation.

“We are also exploring a ‘payment by results’ scheme, under which we will reward farmers with ongoing payments if they sign up to and achieve animal welfare enhancements above the baseline,” says Defra.

There may also be improvements in labelling, to help consumers identify higher animal welfare standards.

Investment and R&D

The bill enables the government to help farmers invest in equipment, technology and infrastructure – for example, to improve productivity, manage the environment sustainably and provide other public goods.

Public money may also be used to support research and development projects that facilitate more efficient, sustainable food production.

“This will build on the £90m Transforming Food Production initiative, which will support a technology- and ***data***-driven transformation in UK ***agriculture*** as we leave the EU,” it says.

What people have said about it

“Farmers across the country will still want to see legislation underpinning the government’s assurances that they will not allow the imports of food produced to standards that would be illegal here through future trade deals.” Minette Batters, NFU

“I am glad to see that the bill will provide a mechanism to reform the sharing out of the red meat levy across Great Britain.” John Davies, NFU Cymru

“It is of concern that the new bill includes clauses that could see the UK government impose unwanted policies on Scottish farmers in areas that are clearly devolved, such as livestock traceability and organics.” Fergus Ewing, Scottish government

“It’s great to see ministers putting soil protection at the fore of the new ***Agriculture*** Bill - something soil scientists have spent years pushing for.” Prof Duncan Cameron, University of Sheffield

“It is reassuring to see that the new bill encourages innovation and diversification, and aims to create opportunities for new entrants to break into the industry.” David Goodwin, National Federation of Young Farmers Clubs

“We are very pleased to see the government maintain the commitments on regulating the supply chain in order to drive out unfair practices which harm farmers.” Vicki Hird, Sustain

JOURNAL : Farmers Weekly

Exploiting satellite intelligence, weighing cattle with a camera and a debate on low- versus high-input farm systems are just some of the must-sees at Dairy-Tech 2020.

The Royal Association of British Dairy Farmers’ (RABDF) event at Stoneleigh Park, Warwickshire, on 5 February has become a key date in the farming calendar.

Event details

Date: Wednesday 5 February

Time: 8am-5:30pm

Venue: Stoneleigh Park, Warwickshire CV8 2LZ

Tickets: Free for RABDF members and under-16s with proof of age. Prices for non-members are £17 when booked in advance at dairy-tech.uk or £20 at the gate. Concessions are available for students.

Contact: [*office@rabdf.co.uk*](mailto:office@rabdf.co.uk) or 02476 639 317

RABDF managing director Matt Knight said feedback from last year’s 6,000 visitors showed that 90% planned to return in 2020.

Mr Knight says the event, specifically devised to focus on innovation, technology and new concepts, has already attracted more than 300 exhibitors, 76 speakers and 55 new products to this year’s show.

The aim is to help make UK dairy businesses mores sustainable and competitive by showcasing new thinking and ideas, he explains.

As well as ground-breaking concepts such as the use of satellite mapping, biological solutions to reduce emissions and robots, visitors will be able to hear from experts on a range of topics including: environmental issues, obtaining net zero, the nutritional value of milk and dairy vision for 2030.

Dairy-Tech is divided into four key areas:

Science, technology and innovation Hall 1, hosts the Innovation Hub – a short presentation seminar packed full of dynamic and tech-focused speakers

Business efficiencies Hall 2, includes the Dairy Hub – with high-profile speakers on key topics

Practical Hall 3, includes the Skills Studio – the one-stop-shop for students and new entrants and those looking to develop their skills

Machinery and innovation hall – new for 2020, showcases the latest tractors and kit available along with live demonstrations including foot-trimming and thermal imaging.

Hub must-sees

Sessions across both hubs will aim to answer questions on how innovation and artificial intelligence will contribute to dairy businesses in the future, what best practice can do to reduce slurry emissions, the role of genetics in health and sustainability, and the key drivers for efficiency.

Dairy Hub

The Dairy Hub will offer advice, political insight, guidance, knowledge and take-home messages for current on-farm issues.

Cumbria farmer Robert Craig and Dave Craven from Grosvenor Farms will debate the pros and cons of low- versus high-input systems.

The dairy farmers – Mr Craig, a grass-based milk producer, and Mr Craven, a higher input, high genetic breeding, proponent – will also highlight the green credentials of their systems and what measures they have undertaken to reduce carbon emissions.

Sessions start at 9am.

Innovation Hub

The Innovation Hub covers a huge range of front-line issues with advances in nutrition, improving fertiliser use and a look at upcoming technical innovations.

One of the key innovations on show is Rezatec’s satellite-based grass management system. Grass SAT monitors more than 20 different datasets, including weather, soil, satellite information and management inputs.

The program makes 100s of complex calculations many times a day, to provide valuable information on soil properties, grass characteristics grass growth rates and the wedge available in kg/ha of dry matter.

Sessions start at 9:30am.

Skills must-sees

After a popular launch last year, the Skills Studio returns to Hall 3 in 2020.

The studio is a one-stop-shop for students, new entrants and anyone looking to develop their skills.

It will feature a CV clinic, an interactive jobs board, an in-depth look into apprenticeships and presentations of prestigious RABDF student awards.

There will be a Q&A with the Cream Awards Young Farmer finalists, business planning and succession planning sessions, as well as a student competition with a cash prize.

Sessions start at 9am.

Animal health must-sees

Workshops

New for this year is a series of animal health workshops, sponsored by Boehringer Ingelheim.

Experts will cover TB, calf health and mastitis.

Sarah Tomlinson, technical board director at the TB Advisory Service, will focus on how a dairy farm is affected by a TB breakdown.

Ms Tomlinson will explain how the impact can be reduced, the extra costs involved in protecting a herd and what long-term solutions are available to build resilience.

First session 10am.

Foot-trimming demonstrations

Cattle lameness is among the most significant welfare and productivity issues faced by UK dairy farmers and the event will again host foot-trimming demonstrations, sponsored by VetPartners.

The demos will showcase the use of Miracle-Tech’s thermal imaging to detect lameness problems that are invisible to the human eye.

Specialist vets will be on hand, alongside the foot-trimmer, to identify and outline the cause, treatments and preventative measures available to combat lameness.

Health & Wellbeing

Another new venture for 2020 is the Health & Wellbeing zone, offering a welcoming drop-in area for anyone wishing to discuss concerns about their business, money, family life, physical or mental health with qualified volunteers.

Machinery and Innovation Hall

The event’s brand new Machinery and Innovation Hall will host test-drive demo slots throughout the day, giving visitors a chance to "try before you buy" opportunity.

The slots will be staggered across specific time slots in an exclusive area of the event and include Kubota, Armatrac, Case, IAE and King Feeders.

Award winners must-sees

Gold Cup

The NMR/RABDF Gold Cup competition will reach its final stage when the winning farm business is crowned on the NMR stand.

The shortlisted businesses include a range of farm sizes and types from cross-bred herds, an organic system, summer-grazed and year-round housed herds.

The finalists are:

Becci Berry, Brimstone Farm, Coleshill, Swindon, Wiltshire

Elizabeth Birkett, Rookhaye Farm, Bowerchalke, Salisbury, Wiltshire

Firm of Bryce Sloan, Darnlaw Farm, Auchinleck, Ayrshire

The Harvey family, Drum Farm, Beeswing, Dumfries

Stowell Farms, West Stowell, Marlborough, Wiltshire

Andrew King, Barrington Organic Partnership, Barrington, Ilminster, Somerset

Winners announced on NMR stand at 4:10pm.

The Royal Dairy Innovation Award

The award recognises the most practical, relevant product or service that is, or likely to be, the most significant innovation for the future of dairying from a Dairy-Tech 2020 exhibitor.

Three companies make up the shortlist:

Herdwatch – smartphone-based livestock management system

Miracle Tech/Agroninja – Beefie digital image cattle weighing system

Zoetis – Clarifide Plus genomic testing system, including health traits

Winners will be announced at 3.55pm in the Innovation Hub.

Personalised itinerary service and Dairy Pro points

Seminars and workshops at Dairy-Tech are eligible for Dairy Pro points.

Registered Dairy Pro members can ***collect*** points, which will be recorded against their personal and business profiles.

To become a member, register at the AHDB stand.

All pre-booked tickets are eligible for Dairy-Tech’s personalised itinerary service as long as registrations are submitted by 31 January 2020.

The itineraries are in place to ensure visitors use their time efficiently and earmark relevant seminars and exhibitors.

Itineraries will be emailed out ahead of the event.

For more information, visit the Dairy-Tech website.

Dairy-Tech app

The free Dairy-Tech app has been created to provide visitor information, floorplans, exhibitor lists, hub schedules and a summary of all new product launches.

There will be reminder notifications sent out via the app for all the main hub sessions, and the opportunity to vote for the best stand.

Download the Elements Events Portal from the App Store and enter event code: dairytech2020

JOURNAL : Farmers Weekly

In 2011 the launch of A2 milk was hailed a breakthrough for consumers who suffered an allergic reaction to ordinary milk.

Researchers in New Zealand had found that cows produced milk with two types of beta-casein protein, either A1 or A2.

While the A1 protein triggered digestive problems in some, the A2 type showed a much-reduced effect.

Further research showed that roughly 50% of cows had the genetic make-up to produce A2 milk.

See also: What is A2 milk?

Recognising the marketing opportunity of a non-allergenic milk, the NZ researchers commercialised a DNA test to identify A2 cows and formed the A2 Milk Corporation.

Branded A2 milk arrived on UK supermarket shelves in September 2012 and the product quickly developed a loyal following.

Contracts to supply Robert Wiseman with A2 milk were offered in 2012 and initial demand and growth forecasts translated into a 2.5p/litre premium.

This threw a potential lifeline to producers in the grip of that year’s price crisis and about a dozen converted to producing A2 milk.

Many sold off non-A2 cows, which accounted for half their herds, and bought in replacements at a premium.

See also: Switch to A2 milk still paying off after four years

Initially it appeared a shrewd move, with UK retail sales in 1,000 outlets passing £1m within 12 months.

Muller then took over Robert Wiseman Dairies and a joint venture between Muller-Wiseman and the A2 Milk Corporation promised greater investment in the UK market.

Under the joint venture, Muller-Wiseman procured, processed and distributed the milk, but the A2 Milk Corporation took over product marketing and sales. This decision proved pivotal.

While countries such as the US, China and Australia saw solid growth – A2 milk captured 8% of the Australian market – UK customers proved more of a challenge.

Marketing a new premium product on shelves dominated by cheap fresh milk amid burgeoning sales of plant-based alternatives was difficult for the relatively small A2 Milk Corporation.

Sales growth failed to match early rates and last summer the renamed A2 Milk Company announced it was quitting the UK to focus on other markets.

It blamed “category conditions which meant that developing a scalable premium-priced, fresh milk, proposition was increasingly challenging”.

The decision to quit had followed a strategic, global review, an A2 spokeswoman told Farmers Weekly.

With just 600 employees worldwide, it made sense to focus on the fastest-growing markets.

The UK supplier relationships forged had been very important, the spokeswoman said.

“This decision does not preclude us from pursuing markets for liquid milk or other products in the UK in the future,” she said.

Case study

One farmer who converted to A2 milk production in 2012 was Shropshire-based Neale Sadler.

In 2012 the 2.5p/litre premium offered for A2 milk produced at his Bridge Farm near Shrewsbury represented a significant incentive in a turbulent market.

The bonus was paid on all milk produced by bought-in cows for two years, with a 1p/litre premium for milk produced by existing A2 cows in a supplier’s herd.

A £300-a-cow subsidy was included in the deal as an incentive to sign up and to help offset the cost of replacements.

DNA tests revealed that 57% of the farm’s 75 cows did not carry the A2 protein trait and these were sold off.

The herd took time to rebuild, but the initial dip in overall milk production post-conversion was cushioned by the bonus and an increase in yield per cow.

However, beyond the first two years, the bonus was paid only on the proportion of milk which went into the A2-branded product.

With sales failing to match the early growth, that proportion amounted to 20% of Bridge Farm’s milk. The remaining 80% attracted the standard Muller price.

Mr Sadler said he had no regrets about the venture because it was a product he believed in.

His own health had improved, with a persistent eczema problem clearing up after switching to drinking A2 milk.

However, sales outside the UK, particularly in China where the product underpins baby milk powder, have boomed, said Mr Sadler, who has closely followed the A2 Milk Company’s fortunes.

“The decision to quit the UK is down to that huge uptake in Asia and the company has had to refocus on meeting that demand,” he said.

Our market was small by comparison and was a victim of the global success, he added.

JOURNAL : Farmers Weekly

A mid-Wales beef finisher is capturing an additional 0.4kg daily liveweight gain (DLWG) a head since making improvements to housing.

The slatted shed was built before the Hammond family took on the tenancy at Gaufron Farm, Howey, in Powys.

But by investing in new ventilation, flooring and water and feed troughs they have created accommodation that matches the performance of modern housing without the expense of new infrastructure.

The combination of changes has increased average growth rates a head from 1.1kg/day to 1.5kg/day for the 290 days the cattle are on the farm.

Stuart Hammond, who farms with his mother, Sharon, uncle, Malcolm, and brother, Edward, finishes 400 cattle annually.

He says: “Margins in this job are tight, so we have to save as much as we can and get as much performance as possible.”

Debbie James visited Gaufron Farm where Mr Hammond gave her a guided tour of the shed.

See also: What’s in your shed? Inside a state-of-the-art beef shed

Farm facts

Farming 384ha of which 243ha are owned and 141ha rented

400 cattle finished annually

120 Aberdeen Angus and Aberdeen Angus x Stabiliser cows

Bulls from the suckler herd sold as stores to a specialist bull finisher at 10 months; best heifer calves are retained as herd replacements and the remainder finished for Dunbia

Lambing 1,700 New Zealand Romney ewes and 600 ewe lambs outdoors from 1 April

Lambs sold to Waitrose

850,000 broilers produced annually for Avara Foods

6MW biomass boiler producing energy to heat the poultry unit and the Quackers indoor play centre – a farm diversification

55kW solar panels.

What are the shed’s fundamentals?

An apex building with concrete sidewalls topped with two-inch spaced Yorkshire boarding.

The 12-bay, slatted shed can accommodate 240 cattle from 16 weeks to finishing.

Slurry drops into underground tanks which are pumped out with an umbilical system twice a year.

The shed was here when we took on the tenancy 26 years ago but there is a lot we have done to update the original infrastructure.

What is your priciest investment?

In 2017, with help from our landlord, we fitted mats on top of the slats at a cost of £33,000. It has made a huge difference to animal behaviour.

The floor was very polished in places where the slats had become worn and the cattle hated it. They would stand still for a month after they arrived from straw bedded housing. We were also getting a fair bit of digital dermatitis and other joint issues.

Fitting the mats has been one of the best investment we have made. The cattle are more comfortable; they will quite happily play in the pens now, whereas before they were almost too frightened to stand up.

From day one, growth rates increased by 200g a day.

The mats are slightly curved so the urine runs off them and this keeps the cattle dry.

We clip the cattle for slaughter in the winter because there is more moisture in the air, but in the summer they are as clean as a whistle.

How is the shed ventilated?

We removed a ridge cap from every other bay – before we did this the air was stale and we had issues with pneumonia and this affected performance and profitability.

Making that small change to the roof has allowed the stale air to escape quickly.

But we felt there was more we could do to improve ventilation, so two years ago, on the back of advice from Dunbia, we installed two fans with wind tunnels running down the centre of each half of the shed.

The holes in the tunnel force fresh air down into the cattle pens. When you stand in the pens you can feel the air moving. The aim is to change the air in the shed every five minutes.

Each unit cost £700 per fan and wind tunnel and the running cost is £1/day. We never turn them off, they are on 24/7, 365 days a yeard.

Our antibiotic usage is down to 2.3mg/PCU and is continuing to drop because cattle are healthy when they arrive and we are managing them well.

What is your favourite feature?

Three years ago we replaced our static water troughs with wall-mounted tipping troughs. We installed six at £280 each.

Because the cattle always have a bit of feed on their mouths when they drink it ends up at the bottom of the trough and with the static models it was a lot of work to clean this out.

The tipping troughs rotate 180 degrees and dump the water into the slats which means they are really simple to clean; we clean them with a hand brush once a week, one every day.

What is your best buy?

In the past few weeks we have installed a few feed troughs in the feed passage and are in the process of installing these for every pen so that we don’t have to push up the feed.

I’ve worked out that it had been costing us £3,500 a year to push up the feed at either end of the day.

The troughs are made by a local blacksmith, from 3mm steel sheet, and cost us £250 each.

I think they may allow us to get away with feeding every other day.

What has been the simplest improvement?

We were having issues with starlings getting into the shed. They were eating around 15% of the starch when we were feeding grain in the ration and we were concerned about the disease risk.

I made doors to go at either end of the shed, one-inch mesh attached to a metal box frame.

We rarely get starlings in the shed now and the doors are flush with the floor so they keep badgers out too.

They are hinged in the middle so when they are opened the bottom half folds up against the wall.

About the finishing system

The Hammonds finish cattle for the Dunbia integrated beef programme. Calves are sourced from dairy herds aligned to the programme and arrive at 16 weeks.

They are reared at their home farm, Newmead Farm, for six weeks and then transferred to Gaufron aged 22 weeks.

Calves are vaccinated for pneumonia on their source farms.

“The beauty of the integrated system is that we know the history of every calf,” adds Mr Hammond.

When calves arrive at Newmead they are vaccinated for clostridia. They received the same ration they had on the previous farm so that they don’t get a growth check from nutritional stress on top of the stress of the move.

This also prevents the calves’ immunity being compromised.

Animals weighing up to 400kg liveweight receive 2.4% of their bodyweight as dry matter daily.

The grower rations comprises 700kg ground maize, 200kg distillers, 50kg soya and 45kg of Inzar premix per tonne. This is fed alongside ad-lib with straw, which they get from arrival up to 400kg liveweight.

Once cattle reach 400kg liveweight DM intakes reduce to 2.04% of bodyweight. Ground maize per tonne is reduced to 674kg and distillers to 250kg and 13kg of protected fat is added to the ration.

Target slaughter weight is 600kg liveweight, when cattle are 13-14 months.

**Load-Date:** February 5, 2020

**End of Document**



[***Potentials and pitfalls of transient in vitro reporter bioassays: interference by vector geometry and cytotoxicity in recombinant zebrafish cell lines***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:693X-JCV1-F129-P0HW-00000-00&context=1516831)

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**Body**

Introduction

Legislation on the manufacturing of chemicals to protect human health and the environment from adverse effects, such as the REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) directive or TSCA (Toxic Substances Control Act) reauthorization, have increased the demand in animal toxicity testing (Goldberg ; Hartung ). This scenario seems contradictory to the ***collective*** attempt to minimalize animal testing within the context of 3Rs (Russell and Burch ) and beyond (Lillicrap et al. ). Therefore, international regulatory agencies and stakeholders of the scientific community (NRC, EPA, ECVAM) have established new frameworks (e.g. “21st-century toxicology”) (NRC ; EURL-ECVAM ; Halder et al. ; US EPA ) which are promoting or demanding alternatives to in vivo tests.

Reporter gene assays in transfected mammalian cells for analyzing specific toxicity-related modes of action are valuable tools for research in many fields of toxicology (Zacharewski ; Ankley et al. ; Mueller ; Leusch and Snyder ) and an essential step stone in the adverse outcome pathway (AOP) concept (Ankley et al. ). However, this type of alternative approaches, focusing on molecular initiating events in important toxicity pathways, are still underrepresented within aquatic toxicology. Development of in vitro assays using fish cells has been proposed as a promising strategy to reduce and replace the use of fish in aquatic toxicity testing (Ankley et al. ; Halder et al. ; Worth et al. ). Such assays would allow high-throughput screening, application of omics technologies, and modeling approaches to risk assessment, such as conducted in ToxCast using mammalian cells (Judson et al. ). Notably, some fish cell cultures and fish embryo tests have emerged as useful alternative approaches in environmental toxicology (Garcia et al. ).

The European Water Framework Directive (WFD) (European Commission ) aims to achieve a good ecological and chemical status of surface water, mostly via chemical analysis of priority substances. Nevertheless, a multitude of anthropogenic substances and mixture effects are not assessed by this approach. To bridge the gap between chemical analysis and biomonitoring and also account for the unknown, the addition of a triad consisting of advanced chemical analysis (e.g., non-target screening), effect-based tools (bioanalysis/bioassays), and effect-directed analysis has been discussed (Altenburger et al. ) and has recently been recommended for the upcoming WFD revision (Brack et al. , , ). Originally, the WFD already lists a few in vivo bioassays as complementary methods (European Commission ), and suitable in vitro assays for the potential WFD revision were suggested (Wernersson et al. ). Most of the proposed effect-based tools are based on either mammalian cells or bacteria. To maximize the ecologic relevance for aquatic organisms, it is highly prioritized to develop effect-based tools, such as in vitro bioassays, based on fish cells (Lillicrap et al. ).

As a step towards this direction, we previously developed a transient reporter gene assay for analysis of oxidative stress in D. rerio fibroblast (ZF4) and liver (ZFL) cell lines (Lungu-Mitea et al. ), by measuring induction of the nuclear factor erythroid 2-related factor 2 (Nrf2), a major upstream regulator of ROS detoxification and metabolization (Itoh et al. ). The same principle assay design can be used for other molecular initiating events, allowing the investigation of diverse toxicity pathways in fish cells. With this approach, the use of in vitro assays based on fish cells has the potential to reduce the number of test animals.

However, it is noteworthy that the widespread assumption that either transient or stable transgene integration into a host preserves the genotypic, epigenetic, and phenotypic traits of the latter is not universally valid. Instead, transgenesis itself (via the used vectors, transfection reagents, gene cassettes for antibiotics, and patterns of expression) and experimental conditions (squelching, knockouts, chemical exposures, and culture conditions) are inflicting systemic stress. This may lead to an impact on the biological system beyond the function of the manipulated gene and thus to nonspecific effects (reviewed in Stepanenko and Heng ). Within toxicology, transgenic cell models are often used to monitor certain receptor activation, e.g., in the context of stress response and detoxification. For example, glucocorticoid receptor (GR)-based reporter assays of the pRL and pGL vector series were reported being problematic in the context of DNA transfection (Kushner et al. ; Dougherty and Sanders ), due to influencing the activity of major transcription factors and thereby competing with other receptor pathways for common response elements (Martino et al. ). Therefore, designing plasmid vectors to be applied in studies of steroid binding, cellular metabolism, and cellular stress defense pathways may be accompanied by certain challenges.

A detailed assessment of the previously named Nrf2 reporter assay seemed plausible, given that the oxidative stress response is potentially affected by cellular metabolism and the overall stress defense. Additionally, designing reporter gene assays for measuring oxidative stress can be problematic in the context of cytotoxicity, given that the role and effect of ROS changes include the whole range from physiological to pathological functions (Sharma et al. ). Noteworthy, a general induction of detoxifying mechanism at exposure concentrations close to those causing cytotoxicity was identified and termed the “cytotoxic burst” (Judson et al. ). Such induction of toxicity pathways is considered nonspecific, especially in terms of receptor-mediated toxicity. Given that rather small increases in ROS concentration are changing the response from signal transduction to induction of oxidative stress, and further apoptosis or necrosis (Redza-Dutordoir and Averill-Bates ), oxidative stress has to be assessed differently than receptor-mediated toxicity (Escher et al. , ).

We hypothesize that the specific combination of used reporter and normalization vectors, in regard to inherent gene-regulatory units and plasmid geometry, has a crucial effect on cellular homeostasis and will influence the potency and reliability of transient reporter gene assays. To increase the sensitivity and reliability of the previously established transient Nrf2-responsive reporter gene assay, we performed an in-depth investigation of various parameters potentially influencing the induction of activity and the cytotoxicity of chemicals. Besides the primary Firefly luciferase reporter vector, a panel of Renilla luciferase normalization vectors was used in co-transfection, bearing different plasmid geometries (backbones and constitutive promoters). The results should be taken into consideration for the future design of reporter gene bioassays, their potency, and, beyond, their regulatory acceptance.

Materials and methods

Cell culture

Zebrafish fibroblast cell line ZF4

Embryonic zebrafish fibroblast cell line ZF4 (Driever and Rangini ) (CVCL\_3275) was cultured in Dulbecco’s modified Eagle's medium/Ham’s ***Nutrient*** Mixture F-12 (DMEM:F12) containing phenol red (Gibco, Paisley, UK), supplemented with 10% (v/v) fetal bovine serum (Gibco, Paisley, UK), 1% (v/v) penicillin–streptomycin 100 U/mL (Gibco, Paisley, UK), 2.5 mM L-glutamine (Lonza, Basel, Swiss), 15 mM HEPES (Gibco, Paisley, UK), 0.5 mM sodium pyruvate (Sigma-Aldrich, Steinheim, Germany), and 1200 mg/L sodium bicarbonate (Gibco, Paisley, UK). The cells were cultured in a humidified environment at 28 °C and with 5% CO2. The cells were passaged weekly in a 1:10 ratio, using phosphate-buffered saline (PBS; at pH 7.4) (Medicago, Uppsala, Sweden) for washing and 0.25% (w/v) trypsin (Sigma-Aldrich, Steinheim, Germany) for detachment.

Zebrafish hepatocyte cell line ZFL

Zebrafish liver cell line ZFL (Ghosh et al. ; Eide et al. ) (CVCL\_3276) was cultured in a medium consisting of 50% (v/v) Leibovitz’s L-15 (Sigma-Aldrich, Steinheim, Germany), 35% (v/v) Dulbecco’s modified Eagle's medium (Gibco, Paisley, UK), 15% (v/v) Ham’s ***Nutrient*** Mixture F-12 (Gibco, Paisley, UK), and phenol red. Additionally, 150 mg/L sodium bicarbonate (Gibco, Paisley, UK), 15 mM HEPES (Gibco, Paisley, UK), 10 µg/mL bovine insulin (Sigma-Aldrich, Steinheim, Germany), 50 ng/mL mouse EGF (Sigma-Aldrich, Steinheim, Germany), and 5% (v/v) fetal bovine serum (Gibco, Paisley, UK) were supplemented. The cells were cultured in a humidified environment at 28 °C and atmospheric CO2. The cells were passaged weekly in a 1:20 ratio, using PBS (pH 7.4) (Medicago, Uppsala, Sweden) for washing and 0.25% (w/v) trypsin-EDTA (Sigma-Aldrich, Steinheim, Germany) for detachment.

Plasmids

The pGL4.37[luc2P/ARE/Hygro] plasmid was acquired from Promega (Madison, USA). The pGL4.37[luc2P/ARE/Hygro] vector consists of a pGL4 backbone including an ampicillin resistance gene, a gene for hygromycin resistance, and four copies of a Nrf2-sensitive antioxidant response element (ARE) driving transcription of the Firefly luciferase reporter gene luc2P (Photinus pyralis). Firefly luciferase was used as the primary reporter. Plasmids of the pRL series (Fig. S1 and Table S1) were acquired from Promega, Madison, USA. All plasmids consist of a pRL backbone including the cDNA (Rluc) encoding Renilla luciferase reporter gene (Renilla reniformis) and a specific constitutive promoter sequence (pRL-null: minimal promotor; pRL-TK: herpes simplex virus thymidine kinase promoter; pRL-SV40: simian virus 40 promotor; pRL-CMV: cytomegalovirus promotor). Plasmids of the pGL4.7x series (Fig. S1 and Table S1) were acquired from Promega, Madison, USA. All plasmids consist of a pGL4 backbone including the cDNA (hRluc) encoding modified, “humanized” Renilla luciferase reporter gene (Renilla reniformis) and a specific constitutive promotor sequence (pGL4.70: minimal promoter; pGL4.74: herpes simplex virus thymidine kinase promoter; pGL4.73: simian virus 40 promoter; pGL4.75: cytomegalovirus promoter). Renilla luciferases were used as control/normalization signals in the following dual reporter gene assays (DLR).

Chemicals

The following known Nrf2 inducers were used for exposure studies: metazachlor (Met.) (CAS 67129-08-2), 99.5% purity (Dr. Ehrenstorfer GmbH, Augsburg, Germany); sulforaphane (SFN) (CAS 4478-93-7), 90% purity (Sigma-Aldrich, Steinheim, Germany); tertbutylhydroquinone (tBHQ) (CAS 1948-33-0), 97% purity (Sigma-Aldrich, St. Louis, USA). 20 mM stock solutions of metazachlor and 100 µM tBHQ were prepared in 99% (v/v) EtOH and stored at − 20 °C. A 50 mM stock of SFN in 99% (v/v) EtOH was prepared and stored at − 80 °C.

Handling, platting, transfection, and exposure

ZF4 and ZFL cells were seeded either into white, clear-bottom 96-well plates (Corning, New York, USA; for DLR experiments and ATP-viability assays), black, clear-bottom 96-well plates (Thermo Scientific Nunc., Roskilde, Denmark; for EdU-viability assay), or transparent 96-well plates (Corning, New York, USA; for MTS and BCA-viability assays) at a density of 2.5 × 105 cells/mL for ZF4 and 1.5 × 105 cells/mL for ZFL, in 100 µL/well. After 24 h of incubation, cells reached a confluency of about 80%.

Transfection was carried out in a 2 µg transfection reagent to 1 µg DNA ratio using FHD (Promega, Madison, USA) for ZF4, and XHP (Roche, Mannheim, Germany) for ZFL. Transfection optimization experiments were reported priorly (Lungu-Mitea et al. ). Transfection reaction was conducted as a co-transfection, using the pGL4.37[luc2P/ARE/Hygro] plasmid and specific plasmids of the pRLx and pGL4.7x series in a 10:1 reporter to control ratio (0.9 µg reporter plasmid, 0.1 µg control plasmid) for DLR experiments and viability assays in the specific combinations pGL4.37+pRL null/pGL4.70. To account for potential artifacts of co-transfection, ZF4 cells were also transfected solely with pGL4.37, pRL CMV, and pGL4.70, using 1 µg of plasmid per reaction.

After 24 h of post-transfection incubation, cells were exposed to Nrf2 inducers. Prepared stock solutions were further diluted using the cell type-specific nutrition medium supplemented with 5‰ (v/v) EtOH as a solvent. Seeded cells on 96-well plates were exposed in quadruplicate to increasing nominal concentrations (0.1 µM, 1 µM, 10 µM, 100 µM) of Nrf2 inducers tBHQ, SFN, and metazachlor for primary experiments, and to narrower titration steps for in-depth analysis (metazachlor: 7.8-250 µM; SFN: 0.31-10 µM; tBHQ: 3.12-100 µM) in 100 µL/well. Thereby, nominal concentrations of viability tests were always plated in triplicate. Double quadruplicates of 5‰ EtOH solvent–nutrition medium were used as controls. Passive lysis buffer (PLB; Promega, Madison, USA) and 10% (v/v) DMSO-containing exposure medium (Sigma-Aldrich, Steinheim, Germany) were used as positive controls in the viability tests.

Dual reporter gene assay

Following exposure, cells were lysed in 20 µL PLB and quantitative Nrf2-dependent luminescence was measured via Dual-Luciferase® Reporter Assay (DLR) (Promega, Madison, USA), according to the manufacturer’s protocol using an auto-injecting Infinite M1000 microplate reader (Tecan, Männedorf, Switzerland), following a flash luminescence protocol. The luciferase activity was expressed as fold change compared to the non-treated controls, both as normalized Firefly/Renilla readouts and single luciferase read-outs.

Cell viability testing

To determine cytotoxic concentrations of the used compounds within the exposure range, cell viability was examined using various assays, covering diverse endpoints of cellular stress. Initial viability tests were conducted in parallel to the DLR experiments, using non-transfected cells, both for ZF4 and ZFL cell lines. Therefore, an MTS-based assay (see below) was applied. For further in-depth viability analyses, ZF4 cells were exposed to metazachlor in the range of 7.8–250 µM. To show the potential impact of transfection on viability, cells were either not transfected or transfected with pGL4.37 and pRL null or pGL4.70 plasmids, respectively.

MTS assay

MTS-based [3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium] CellTiter 96® AQueous One Solution Cell Proliferation Assay (Promega, Madison, USA) was conducted in accordance with the manufacturer's protocol. Following exposure, 17% (v/v) MTS reagent was added to wells. After 2 h of incubation at 28 °C and a specific CO2 atmosphere, formazan product turnover absorbance was measured at 490 nm using an Infinite M1000 microplate reader (Tecan, Männedorf, Switzerland). A mean blank control (in triplicate; no cells, nutrition medium plus substrate only) was subtracted from all raw values. Relative effects on cell viability were calculated in relation to the vehicle controls.

ATP/LDH-multiplex assay

The CellTiter-Glo® Luminescent Cell Viability Assay (Promega, Madison, USA) for quantification of ATP present in viable cells and the CytoTox-ONE™ Homogeneous Membrane Integrity Assay (Promega, Madison, USA) for the measurement of lactate dehydrogenase (LDH) release from cells with damaged membranes were multiplexed according to the manufacturer's protocol and prior publications (Farfan et al. ), with minor alterations. After exposure, plates were shaken for 2 min on an orbital shaker and 50 µL of every well was transferred to black 96-well plates (Thermo Scientific Nunc., Roskilde, Denmark), already containing 50 µL/well CytoTox-ONE™ resazurin substrate mix (50% (v/v)). Following 10 min of incubation at room temperature (RT) on an orbital shaker in darkness, 25 µL/well stop solution was added. In parallel, 50 µL/well Ultra-Glo™ Recombinant Luciferase substrate (50% (v/v)) was added to the original 96-well plates and incubated for 1 h at RT on an orbital shaker in darkness. Fluorescence (560 nm ex./590 nm em.) or luminescence (1 s integration time for glow luminescence), for LDH or ATP measurement, respectively, was recorded on an Infinite M1000 microplate reader (Tecan, Männedorf, Switzerland). A mean blank control (in triplicate; no cells, nutrition medium plus substrate only) was subtracted from all raw values. Relative effects on cell viability were calculated in relation to the vehicle control for the ATP assay and in relation to the lysis positive control for the LDH assay.

BCA assay

Bicinchoninic Acid Protein Assay (BCA, Sigma-Aldrich, St. Louis, USA) was conducted following the manufacturer's protocol with minor alterations. After exposure, the medium was discharged and cells of every well were lysed in 20 µL PLB at RT for 15 min on an orbital shaker. 180 µL of BCA reagent was added to every well, and plates were agitated shortly and incubated for 20 min at 60 °C. After cooling down for 15 min at RT, absorbance was measured at 562 nm using an Infinite M1000 microplate reader (Tecan, Männedorf, Switzerland). A mean blank control (in triplicate; no cells, nutrition medium plus substrate only) was subtracted from all raw values. The effects were calculated in relation to the vehicle control.

EdU assay

The Click-iT® EdU Microplate Assay was used for the determination of cell proliferation. The EdU (5-ethynyl-2'-deoxyuridine) substrate contains a nucleoside analog of thymidine and is incorporated into DNA during active DNA synthesis which can be detected fluorometrically. Handling and exposure of cells were conducted as described above with the difference that 1 µM EdU was additionally supplemented to the exposure medium. The following steps were exactly performed according to the manufacturer’s protocol. Fluorescence (568 nm ex./585 nm em.) was read on an Infinite M1000 microplate reader (Tecan, Männedorf, Switzerland). A mean blank control (in triplicate; no cells, nutrition medium plus substrate only) was subtracted from all raw values. The response in cell proliferation was normalized to the vehicle control.

Statistical analyses

Results from the DLR assays and the viability assays were processed using R and GraphPad Prism 8 (GraphPad Software, La Jolla, USA). Graphs and illustrations were designed using GraphPad Prism 8. For both approaches, ***data*** of three or four experiments (experimental unit n = 3–4), performed in either triplicate (viability assays) or quadruplicate (DLR) for each concentration, were pooled, giving a total population size for every exposure group of 9–16 (observational unit N = 9–16). Background (blanks) was subtracted and ***data*** were normalized against the vehicle control, giving fold induction as a final output. Normality was tested by Shapiro–Wilk and Kolmogorov–Smirnov tests (both significance level alpha = 0.05) and analyzed graphically by normal qq plot. Non-normal ***data*** were log transformed and re-analyzed. Given normality, statistical significance of the concentration-effect factor (transformed output ***data***) was assessed via a mixed-effects model two-way ANOVA (Lazic ), followed by Dunnett’s post hoc test (for comparison vs. control) or Tukey’s post hoc test (for comparison in between groups). Thereby, transformed output ***data*** were considered as a fixed factor, whereas experiments were considered as a random factor within the model, to account for inter-experimental variation. A P value < 0.05 was considered statistically significant (Figs. , , ). Residuals were graphically analyzed by quantile–quantile plot (actual vs. predicted residuals), homoscedasticity plot (absolute residuals vs. fitted), and residual plot (residuals vs. fitted) to ensure ANOVA criteria were met. For the statistical analysis of the transfection setup effects (mean column effects) means of single experiments were pooled (experimental unit n = observational unit N = 3–4) and significant differences between mean column effects were analyzed via two-way ANOVA followed by Holm–Sidak’s post hoc test (Fig. and Table ). An assessment of residuals was conducted as stated previously. Beyond statistical significance, for all viability tests, a threshold of 80% as compared to the negative control (corresponding 0.8) was determined as biologically significant and marked with a dotted line within all respective graphs.

Effects on luminescence measured in the zebrafish cell lines ZFL and ZF4 treated with selected nominal concentrations of sulforaphane (a; SFN), tertbutylhydroquinone (b; tBHQ), and metazachlor (c). Luminescence corresponds to quantitative Nrf2 activation measured via DLR assay in cells co-transfected with pGL4.37 and the specifically depicted normalization vectors. Normalized values are depicted as white bars for ZFL and striped bars for ZF4. Each bar represents the mean (experimental units n = 3; observational units N = 12) including SD. Asterisks indicate significance between different cell lines for identical transfection setups, tested in a two-way ANOVA mixed model with Tukey’s post hoc test (ns P > 0.05; \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001). Lowercase letters indicate statistically significant differences between transfection setups in the ZFL cell line (P < 0.05). Uppercase letters indicate a statistically significant difference between transfection setups in the ZF4 cell line (P < 0.05). Numerical means are illustrated in Tab. S2

Effects on luminescence measured in the zebrafish cell lines ZFL and ZF4 treated with 250 µM metazachlor. Luminescence corresponds to quantitative Nrf2 activation measured via DLR assay in cells co-transfected with pGL4.37 and the specifically depicted normalization vectors of the pRLx (a) and pGL4.7x (b) series. Normalized values are depicted as white bars for ZFL and striped bars for ZF4. Each bar represents the mean (experimental units n = 3; observational units N = 12) including SD. Asterisks indicate significance between different cell lines for identical transfection setups, tested in a two-way ANOVA mixed model with Tukey’s post hoc test (ns P > 0.05; \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001). Lowercase letters indicate statistically significant differences between transfection setups in the ZFL cell line (P < 0.05). Uppercase letters indicate a statistically significant difference between transfection setups in the ZF4 cell line (P < 0.05). Numerical means are illustrated in Tab. S3

Effects on luminescence measured in the zebrafish cell line ZF4 treated with metazachlor. Luminescence corresponds to quantitative Nrf2 activation measured via DLR assay in cells co-transfected with pGL4.37 (a–f) and the normalization vectors pRL-CMV (a–c) and pGL4.70 (d–f). To uncover co-transfection artifacts, the specific plasmids were also solely transfected (g–i). Normalized values are depicted as white bars, Firefly luciferase read-outs as gray bars with vertical stripes, and Renilla luciferase read-outs as gray bars with horizontal stripes. Each bar represents the mean (experimental units n = 3–4; observational units N = 10–16) including SD. Numerical means are depicted on top of bars. Asterisks indicate significance tested in a two-way ANOVA mixed model with Dunnett's post hoc test (\*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001)

Effects on various viability end points (dots connected by lines) measured in the zebrafish cell line ZF4 treated with metazachlor (Met.). End points quantified are NAPDH metabolism via the MTS assay (a), ATP turnover (b) and LDH release (c) via the ATP/LDH multiplex assay, total protein amount via the BCA assay (d), and cell proliferation via the EdU assay (e). A solvent control was used as negative control (NC). Cellular lysis buffer (PC-lysis) and 10% (v/v) of DMSO in nutrition medium (PC-DMSO) were used as positive controls. Initial values were normalized to the NC or PC (c), respectively. A threshold value of 0.8 or 0.2 (for LDH) was considered biologically relevant/significant (dotted red line). Each point represents the mean (experimental units n = 3–4; observational units N = 9–12). Asterisks indicate significance of main transfection effect tested via two-way ANOVA, followed by Holm–Sidak’s post hoc test (ns P > 0.05; \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001). For every end point, firstly, non-transfected cells were exposed (light gray dots), and, secondly, cells were co-transfected with pGL4.37 and normalization vectors of increasing size, pRL null (3320 nt; dark gray dots) and pGL4.70 (3522 nt; black dots). For details and further ***statistics***, see also Fig. S15 and Tab. S6

Two-way ANOVA results of overall main effect (transfection setup) of exposure patterns depicted in Fig. (ns P > 0.05; \*P < 0.05, \*\*P < 0.01, \*\*\*P < 0.001)

| **Holm?Sidak?s test** | **Mean diff.** | **Significance** | **Adjusted *p* value** | **Output** |
| --- | --- | --- | --- | --- |
| A vs. D | ? 0.3292 | \*\*\* | < 0.0001 | Normalized |
| G vs. E | 0.0818 | ns | 0.1417 | Firefly Lum. |
| G vs. B | 0.0629 | ns | 0.2394 |  |
| B vs E. | ? 0.0190 | ns | 0.6422 |  |
| I vs. H | ? 0.0521 | ns | 0.3603 | Renilla Lum. |
| I vs. F | ? 0.2244 | \*\*\* | < 0.0001 |  |
| I vs. C | 0.0597 | ns | 0.3603 |  |
| H vs. F | ? 0.1724 | \*\* | 0.0017 |  |
| H vs. C | 0.1118 | ns | 0.0544 |  |
| F vs. C | 0.2841 | \*\*\* | < 0.0001 |  |

Results and discussion

Previously, we described a reporter gene assay to measure oxidative stress via Nrf2 induction in transiently transfected zebrafish cell lines (Lungu-Mitea et al. ), which could be a tool for aquatic organism-centered bioassay screening of environmental samples. Today, most effect-based screening activities rely on mammalian or bacterial reporter-gene assays (Macova et al. ; Escher et al. ; Wernersson et al. ; Neale et al. , ; Rosenmai et al. ); using cells from aquatic organisms would, therefore, increase the relevance of the results. However, a multitude of cis- and trans-acting effects potentially alternate the outcome of transient transcription (Stepanenko and Heng ). In this study, we have used transiently transfected zebrafish cell lines to test different combinations of an Nrf2-responsive Firefly luciferase reporter with eight Renilla luciferase normalization vectors (Fig. S1 and Tab. S1). We monitored various endpoints of cytotoxicity to investigate how luciferase induction and reporter activity are impacted by the plasmid geometry (gene-regulatory elements/promoters and backbones), and how cytotoxicity further affects the outcome.

Impact of constitutive promoters of the normalization vector on luciferase induction

To investigate if the constitutive promoter of the normalization vector impacts the luciferase induction, ZFL and ZF4 cells were transfected with a Firefly luciferase reporter fused to an Nrf2-induced ARE enhancer (pGL4.37[luc2P/ARE/Hygro]) in combination with different pRLx Renilla luciferase normalization vectors, containing the CMV, SV40, TK, and null (minP) constitutive promoters of different strength (Fig. S1 and Tab. S1). These promoters were shown to be active in various fish cell lines (Isa and Shima ; Inoue et al. ; Friedenreich and Schartl ; Liu et al. ; Bearzotti et al. ; Bétancourt et al. ; Ruiz et al. ; Martinez-Lopez et al. ). Transiently transfected cells were first exposed to increasing nominal concentrations (0.1, 1, 10, and 100 µM) of known Nrf2 inducers sulforaphane (SFN), tertbutylhydroquinone (tBHQ), and metazachlor (Met.). We observed major differences in signal induction between the cell lines depending on which constitutive promoter was used (Fig. ), at all concentrations of Nrf2 inducers. Concentration–response patterns for each cell line are presented in Fig. S3 (ZFL) and S4 (ZF4). For both cell lines, the general trend of potency of induction was TK ≤ null < SV40 < CMV. Cell viability of non-transfected cells measured by the MTS assay is presented in Fig. S5. Non-cytotoxic concentrations inducing the highest activity (Fig. S3 and S4) were selected for further statistical examination and are presented as follows. In Fig. , the statistical significance between the applied transfection scenarios at one selected concentration is indicated by uppercase letters for ZF4 and lowercase letters for ZFL. Induction was generally higher in the ZF4 cell line (Fig. ; Tab. S2), with the exception of tBHQ at 100 µM in ZFL using the CMV promoter (Fig. b). Normalized luciferase signal induction, in dependency of the used constructs for transfection, differed significantly between cell lines in at least one exposure scenario (pR-null: Fig. b+c; pRL-TK: Fig. –c; pRL-SV40: Fig. a; pRL-CMV; Fig. a). Interestingly, patterns of induction potency after exposure to known Nrf2 inducers resemble the Renilla background signal illustrated in Fig. S2C+D. Hence, potency might be influenced by promoters in use.

One could expect less overall interference by secondary factors for weaker promoters, thus giving stronger signals after normalization to transfection conditions. Unexpectedly, we observed the opposite. Nevertheless, higher interference by backbone-only co-transfected, “empty” vectors was reported (Hofman et al. ), e.g., via minP transactivation by basic helix-loop-helix (bHLH) transcription factors Hand1 and Hand2 (Hong et al. ). Except for TK, the promoter strengths that were reported in mammalian cell lines could also be confirmed here in zebrafish cell lines (for RLU (raw luminescence unit) values within solvent controls see Fig. S2 and Tab. S4), indicating sufficient evolutionary conservation of transcription factors. Spurious expression deriving from Renilla normalization plasmids has previously been reported for all promoters tested here (reviewed in Shifera and Hardin ) within different cellular models. Especially the TK-promoter element seems to be notorious for spurious up- and downregulation by secondary factors (Shifera and Hardin ). In accordance with this, in the ZF4 cell line, both TK-containing plasmids pRL-TK and pGL4.74 show elevated Firefly background RLUs within the controls when compared to the other promoters (Fig. S2F). Thus, using TK promoters might induce the Nrf2 response independently of oxidative stress or chemical exposure and further lower the total inducibility. Cryptic binding sites of various steroid/thyroid/retinoid superfamily nuclear receptors were identified on either the plasmid backbones, promoter sequences, or the Renilla luciferase gene sequence itself of the TK promoter-containing vectors (Everett and Crabb ; Ibrahim et al. ; Zhang et al. ). Especially, interference with common transcription factors was repeatedly reported for TK-bearing plasmids (by specific protein-1 (sp1) (Osborne and Tonissen ), Nurr1 (Matuszyk et al. ), GATA-4/6 (Ho and Strauss ), and muscle-specific transcription factor (skNAC) (Sims et al. ), among others). Given that many of the named factors are involved in cellular development, homeostasis, and response to stress, a spurious expression of the pRL-TK vector under circumstances of cellular stress seems plausible. A similar case of spurious Renilla luciferase induction was reported for an androgen-responsive reporter assay (Mulholland et al. ), in dependency of the used promoters, the co-transfected transgenes, and the used cell line. Here, the authors postulated that the effect is unlikely to originate at the transcript or protein level of Renilla luciferase, but a result of the specific plasmids in use.

Impact of vector backbones on luciferase induction

To investigate if the vector backbone alters the luciferase induction, we compared the effects of metazachlor on cells transfected with plasmids based on two different backbones, given that metazachlor displays the best dynamic exposure range of the used Nrf2-inducing compounds and no cytotoxicity-related non-monotonic concentration–response patterns were recorded. It has been suggested to use vectors with identical backbones in co-transfection, to decrease possible trans-effects of transcription co-factors (Nejepinska et al. ). Vectors of the pGL4.7x series bearing the same constitutive promoters as the pRLx series (see Fig. S1 and Tab. S1) were co-transfected with pGL4.37 in parallel to the pRLx series in both ZFL (Fig. S6 and Fig. S7) and ZF4 (Fig. S8 and Fig. S9) cell lines and exposed to increasing nominal concentrations (7.8, 15.7, 31.25, 62.5, 125, and 250 µM) of metazachlor. Viability in non-transfected cells (Fig. S14) was measured in parallel as above, using the MTS assay. For the pRLx series, patterns are comparable to the results discussed in section 3.1. In terms of induced luminescence, the potency of induction is TK ≤ null < SV40 < CMV (Fig. a). The pattern observed in the pGL4.7x series was different from the pattern observed in the pRLx series for both ZFL and ZF4 (Fig. b), with null < CMV < TK < SV40 for ZFL and null ≤ CMV < SV40 < TK for ZF4. When looking at Renilla RLUs (Fig. S2c+d), it becomes apparent that basic induction differs in the pattern (null < TK < SV40 < CMV) and strength, even statistically for every transfection setup. Nevertheless, induction patterns are not conserved throughout exposure (Fig. b), as opposed to the pRLx series. Further, it seems that co-transfection with the pRLx series results in generally stronger signals than with the pGL4.7x series (Fig. ), except for pGL4.74. Also, ZF4 shows generally higher induction than ZFL (Fig. and Tab. S3), differing significantly for pRL-null, pGL4.70, pGL4.73, and pGL4.74. A possible explanation could be the basic Firefly RLUs, which are more constant for ZFL (Fig. S2e) but also generally higher (Tab. S5), if omitting artificially upregulated activity of the TK promoter-bearing vectors. Lowest basic Firefly RLUs were recorded for ZF4, especially in the transfection setups including pRL-CMV, pGL4.70, and pGL4.75, with the TK-bearing constructs differing even statistically significant (Fig. S2f), as already discussed above. Additionally, setups that gave high basic Firefly RLUs (pRL-TK, pRL-SV40, and pGL4.74 for ZF4) also depicted irregularly high Renilla induction patterns within higher metazachlor exposure concentrations (Fig. S8f+i). Hence, the general overall basic induction of the signal within the ZFL line might also lead to a generally lower total inducibility of the normalized results.

Out of all the combinations tested, co-transfection with pRL-CMV and pGL4.70 in ZF4 cells is depicted here (Fig. a–f) in more detail, since these resulted in the most opposing reporter activity within one cell line and did not show artificial upregulation or high standard deviation in Firefly RLUs, such as TK- and SV-40-bearing vectors. ZF4 showed a more pronounced response regarding induction, and comparably low basic Firefly RLUs within the solvent controls. Remarkably, the normalized induction increases almost tenfold when comparing the two normalization plasmids pRL-CMV (107.1) and pGL4.70 (14), which is also statistically significant as an overall effect (Table ). Non-normalized values for Firefly (Fig. b+e; Fig. S6–S9) and Renilla (Fig. c+f; Fig. S6–S9) measurements are also plotted as induced luminescence to investigate the different setups more accurately. The Firefly induction is generally higher for ZF4 with a maximum fold increase of around 15 in the highest effect concentrations when co-transfected with pRLx vectors and around 10 with pGL4.7x vectors (Fig. S8+9). For ZFL, Firefly induction only reaches a maximum of up to approximately fivefold and differences between the backbone series are not as pronounced as in ZF4 (pattern ZF4\_pRLx > ZF4\_pGL4.7x > ZFL\_pRLx ≥ ZFL\_pGL4.7x) (Fig. S6+7). Hence, the ***data*** correspond to the observations made above. Regarding the Renilla measurements, it may be hypothesized that the stronger basic RLU induction has a negative impact on the maximum induction of Firefly (Fig. S2d), as particularly encountered for pGL4.75 (Fig. b; Fig. S2d; Table S4; Fig. S7j–l), thus impeding a dynamic response in reaction to the stressor. Nevertheless, as described above, using weak promoters does not necessarily result in the strongest overall signals. Figure shows the normalized reporter activity (panel a and d) for the two setups which gave the most perpendicular signals, as well as the Firefly (panels b and e) and Renilla (panels C and F) measurements separately. For Firefly, patterns are comparable between the two setups with induction not differing statistically (Table ). However, the patterns for Renilla activity differ statistically (Table ) between the two setups. Whereas pRL-CMV (Fig. c) shows a decreasing Renilla activity with increasing metazachlor concentrations, pGL4.70 (Fig. f) remains stable with increasing metazachlor concentrations. We conclude that the reduction in Renilla values in the pGL4.37+pRL-CMV setup was the main reason for the observed differences in sensitivity after normalization. When transfecting only single vectors, Firefly patterns and mean induction remain comparable to co-transfected setups (Fig. g compared to 3b and 3e) and also do not differ statistically (Table ). Interestingly, the Renilla read-out patterns and values for pRL-CMV are quite comparable between single (Fig. h) and co-transfection (Fig. c). On the other hand, for pGL4.70 (Fig. i), patterns between single and co-transfection differ statistically, showing a concentration-dependent decrease in Renilla activity with increasing metazachlor concentrations (Table ). It may be concluded that co-transfection itself alternates the transcription and translation of the used constructs and may impact the normalized result. To prove that the encountered patterns are not specifically due to metazachlor exposure, but a general outcome in response to stressors and Nrf2 inducers, the same experimental setups were applied once for SFN and tBHQ in the ZF4 cell line (see Fig. S10–S13), with similar results.

The introduction of foreign, potent transcriptional activators into eukaryotic cells was reported to suppress the transcript of a co-transfected gene. This phenomenon is termed “squelching” (Natesan et al. ) and describes the competition between gene-regulatory elements for general transcription factors, coactivators, and the general transcription/translation machinery (Simon et al. ). Given that these resources are limited within a single cell, this competition may lead to overall reduced transcription levels. Thereby, squelching is primarily encountered for episomal target genes, but obsolete for genes within the cellular chromatin. The total amount of artificially introduced expression vectors may exceed the capacity of the cellular transcriptional/translational machinery, and therefore competition of the reporter construct and the co-transfected normalization construct may appear in a size- and potency-dependent manner (Hofman et al. ; Hu et al. ). Nevertheless, the extent of squelching was also reported to be cell line dependent (Adam et al. ), due to different physiological prerequisites of tissue origin, given that networks of cellular regulation are cell type and even cell cycle stage specific (Dumont et al. ). The squelching phenomenon could describe many effects encountered here. The pGL4.7x gave a generally lower reporter signal and generally higher Renilla RLU values after co-transfection than the pRLx series. pGL4 vectors are of the newest generation and codon optimized for better transcription (Paguio et al. ). The reporter vector pGL4.37 is also based on these backbones. When comparing overall Firefly luciferase induction patterns for ZF4 co-transfected with pRLx (Fig. S8) to pGL4.7x (Fig. S9), a general higher induction is visible. Additionally, for ZF4, Firefly induction decreases with increasing strength of promoters on the normalization vectors. Whereas this effect is only marginal for the pRLx series, it is evident for pGL4.7x, with induction values dropping from approximately tenfold maximal induction for pGL4.70 to maximal fivefold induction for pGL4.75 (Fig. S9b+k). Regarding ZFL, Firefly induction is neither impacted by the used backbone nor by used constitutive promoters, but generally lower than for ZF4, as mentioned above. This may have physiological reasons due to tissue origin or result from an alternate transfection protocol and will be discussed later. Potential explanations for these observed effects could be that using the same backbone for normalization in combination with a stronger constitutive promoter may occupy resources of the overall transcription/translation machinery and lead to lower induction of the reporter gene.

Alternatively, differences in reporter gene induction may be explained by varying backbone geometry and additional regulatory elements. Former reports conducted in the carp epithelial cell line (EPC) claimed that the presence of functional introns is highly beneficial for transgene expression, especially when compared to mammalian counterparts (Friedenreich and Schartl ; Bétancourt et al. ). The pRLx series is still bearing such functional introns, whereas these have been obliterated in the pGL4x series (see also Fig. S1) (Paguio et al. ), given that constructs are mainly optimized for mammalian transgenesis. Therefore, the induction of Renilla normalization reporter on the pRLx series may respond more dynamically to stressors and thus give better results.

Potential link between cytotoxicity and effects on the normalization vector

As we concluded from the previous section, variation in normalized reporter gene activity was mainly caused by differences in Renilla luciferase activity of the normalization plasmid. These differences may be caused by increasing cytotoxicity, which is not entirely reflected by the cell viability assay in use. The MTS assay only measures one end point for cell viability. So, to get a broader picture of cytotoxicity, we applied additional assays targeting different biological endpoints of cell viability.

MTS viability tests with non-transfected cells conducted in parallel to the DLR assays showed cytotoxicity by significance or threshold definition at 250 µM metazachlor for ZFL and 125 and 250 µM metazachlor for ZF4 (Fig. S14a+b). The cytotoxicity of the highest metazachlor exposures could also be observed as a decrease in the Firefly activity in the ZFL cells (Fig. S6 and Fig. S7; panels b, e, h, k). Similarly, we observed a decrease in the Firefly activity after exposure to high concentrations of SFN in ZF4 (Fig. S10 and Fig. S11; panels b, e, h, k), which is probably due to cytotoxicity. However, Firefly values were decreasing already at concentrations that do not induce cytotoxicity, as indicated by the MTS assay (Fig. S14d).

A possible explanation for this is that the MTS viability test, which is based on NADPH turnover, might not be sensitive enough in general or in specific for the ZFL line to detect the cytotoxicity causing the decrease in Renilla activity. MTS results have previously been reported as being misleading (reviewed in Stepanenko and Dmitrenko ), and potential artifacts can be caused by various nutrition medium components, such as serum, antioxidants, or vitamins (Zhang and Cox ; Huang et al. ; Funk et al. ). Beyond that, interference by oxidative stress is possible. NADPH is involved in many response pathways regarding oxidative stress (Hayes and Dinkova-Kostova ), so decreasing levels in the presence of radicals may result in interference with the MTS assay. As a response to oxidative stress, glutathione S-transferase is induced. The latter was reported to reduce MTS substrate in vitro, leading to high background levels (York et al. ). Given the perspective that potential oxidative stress should be examined here, relying solely on MTS viability ***data*** would be critical. Therefore, a battery of viability assays, covering diverse endpoints of cellular stress (Fig. ; Fig. S15; Tab. S6), was applied to ZF4 cells exposed to identical concentrations as in the DLR assays. This was done mainly to test the combined effect of co-transfection and exposure, to account for induced stress correctly, to investigate patterns of Renilla luciferase normalization readouts in co-transfection setups, and to back postulations made above. Noteworthy, cytotoxicity tests that are standardly conducted in parallel to reporter gene assays use non-transfected cells due to handling and economic reasons. To prove if the standard approach is scientifically correct, exposure was applied to non-transfected cells, and cells co-transfected with the pGL4.37 reporter vector and pRL null/pGL4.70 normalization vectors, bearing different backbone lengths (3320 nt. and 3522 nt, respectively).

When comparing the effects of metazachlor on cell viability of non-transfected ZF4 with the effects on transfected cells, we found that, in general, metazachlor induced cytotoxicity at lower concentrations in the transfected cells compared to the non-transfected cells (Fig. ), which is the case for all measured endpoints except ATP (Fig. b). Further, the overall effect of transfection on cell viability was statistically significant for all assays except for the ATP assay. Thereby, the transfection setup using the larger pGL4.70 construct in co-transfection was statistically significantly different from non-transfected cells for the LDH, BCA, and EdU assays (Fig. c–e), and even statistically significant for both transfection setups for the MTS assay (Fig. a). Interestingly, mitochondria-dependent metabolic assays, such as MTS and ATP (Fig. a+b; Fig. S15a–f; Tab. S6), showed lower sensitivity to metazachlor than assays of alternate endpoints. We found that the BCA (Fig. d; Fig. S15j–l) and EdU assays (Fig. e; Fig. S15m–o) were the most sensitive. Notably, the decrease in Renilla activity is partly more severe than the decrease in relative viability even for the most sensitive endpoints (e.g., Fig. S8l compared to Fig. S15l+o). Interference with luciferase turnover may occur at a lower level of biological organization, most likely during transcription or translation. Therefore, deregulation of cellular homeostasis may be initiated at lower concentrations than measured in the viability endpoints. Thus, Renilla luciferase turnover may be regarded as a more sensitive endpoint of cellular stress than the standard viability tests at use.

Notably, it was reported that transfection induces immune response (Jacobsen et al. ), since it partly mimics a viral infection by the production of foreign RNA (Terenzi et al. ). Also, luciferases were reported to be inhibited by IFNs in a vector mass-specific manner via post-transcriptional mechanisms (Ghazawi et al. ). As depicted here, the vector size-specific induction of increased cellular stress in co-transfection may, therefore, potentiate the final response to a stressor. Interestingly, anti-proliferative effects of IFNs treatment were reported to be underestimated by tetrazolium-based viability assays, such as the MTS (Jabbar et al. ; Marionnet et al. ), also potentially explaining the lower sensitivity encountered here.

Impact of transfection conditions and tissue origin on luciferase induction

As described above in regard to Firefly induction, besides potentially inhibitory effects of the pGL4.7x series, basic Nrf2 activity is higher or at least more stable for the ZFL cell line (Fig. S2a+e), thus possibly leading to lower inducibility. Especially, if artificially upregulated constructs (TK promoter bearing vectors) or constructs with high standard deviation in vehicle control Firefly RLUs (pRL-SV40) are omitted, it becomes evident that for the ZFL cell line basic Firefly RLUs are statistically higher than their ZF4 counterparts (Tab. S5). Tissue origin may be a plausible reason, since nose, gill, and liver have previously been identified as Nrf2 and downstream gene induction hot-spots in zebrafish (Nakajima et al. ). A possible alternate explanation is the different transfection reagents used. FHD (used for ZF4) was shown to be a potent reagent and induces only minimal amounts of toxicity, stress, and immune response (Jacobsen et al. ; Yalvac et al. ; Kim and Eberwine ; Yamano et al. ; Antczak et al. ; Lungu-Mitea et al. ). To our knowledge, no evaluation of these parameters has ever been conducted regarding the XHP reagent (used for ZFL). Cellular stress and induction of foreign DNA via transfection will initiate an immune response, interferon release, and activation of PKC and MAPK pathways. All these have been reported to interfere with cellular metabolism (Smith ; Jacobsen et al. ), transfection/translation homeostasis (Simon et al. ), or the used transfection vectors per se (Terenzi et al. ; Shifera and Hardin , ). Beyond that, Nrf2 might not only be activated by oxidative stress-triggered release from its inhibitor Keap1, but also via phosphorylation by MAPK and PKC pathways (Bryan et al. ). Increased stress and immune response scenario induced by transfection would, therefore, lead to a higher Nrf2 activity within the solvent control as well, without any exposure to stressors, thus preventing a more dynamic response. We encountered this phenomenon by recording generally higher Firefly RLUs in the ZFL cell line for constructs that are not artificially upregulated (Fig. S2e and Tab. S5). Additionally, interferons, namely interferon alpha (IFNα) and interferon beta (IFNβ), were reported to inhibit Renilla luciferase expression from the pRL-TK vector (Ghazawi et al. ). According to this, the pRL-TK vector showed the lowest Renilla RLUs in both cell lines (Fig. S2c+d), and Firefly RLUs were highly up-regulated for TK-bearing plasmids in the ZF4 cell line (Fig. S2f). However, since we did not specifically look into an immune system response and potential activation of the MAPK and PKC pathways, these statements remain tentative and need to be backed in future studies.

Luciferase induction is dependent on multiple experimental parameters

Potential sources of artifacts and spurious expression of reporters are genome integration and potential lesions (Smith ), squelching and resource limitations of transcriptional and translational machinery (Natesan et al. ; Simon et al. ), posttranscriptional interference via RNAi (Nejepinska et al. ), and immune response inhibition of transgene translation initiation by protein kinase C (PKC) and interferons (IFNs) due to non-native DNA (Nejepinska et al. ). Additionally, it has been reported that luciferase reporters tend to be inhibited by small molecules, either directly via competition for required substrate, or indirectly via enzyme denaturation or photonic processes (Auld et al. ), further by enzyme stabilization and signal overestimation (Auld et al. ; Thorne et al. ), or by compound aggregation (Thorne et al. ). In this study, we observed differences in signal induction when using varying vector geometries, such as used regulatory elements and vector size, cell line tissue or species origin, applied transfection methods, and signal normalization. Our results indicate that co-transfection itself can alternate the transcription and translation of the used constructs and may lead to potential inhibition or spurious overexpression within a specific cellular system under stress. Therefore, phenotypic responses after transfection are not only a result of single above-stated elements, but also a combination of various mechanisms. Hence, the complex setup of established reporter assays implies numerous influencing factors. Thus, results need to be assessed and interpreted cautiously. As a result, precautionary measures need to be taken in plasmid vector design, such as applied here, with rigorous viability testing of diverse endpoints, to display weak points (“pitfalls”) and potentials in regulatory frameworks.

Conclusion

As postulated, our results indicate that plasmid geometry and gene-regulatory units have an effect on the potential outcome and potency of the reporter gene assay after co-transfection. We showed that promoter strength, as previously reported for mammalian cell lines, could be confirmed in zebrafish cell lines, except for the pRL-TK vector, indicating sufficient conservation of transcription factors. Thereby, TK-bearing plasmids seemed to be spuriously regulated in the cell lines used in this study. Further, differences in normalized luciferase signal induction were a result of the applied normalization vectors, specifically their constitutive promotors and backbones. The ZF4 cell line gave a stronger response to Nrf2-regulated oxidative stress than the ZFL cell line. Possible explanations for this difference in sensitivity could either be because of tissue specificity or transfection conditions. Also, co-transfection with the pRLx series resulted in generally stronger signals than with the pGL4.7x series. pRLx induction patterns were conserved throughout the exposure, whereas for pGL4.7x, they were not. Out of all combinations tested, in the ZF4 cell line, the Nrf2-responsive Firefly reporter vector pGL4.37, together with the Renilla normalization vector pRL-CMV, gave the strongest normalized reporter activity, which was up to tenfold higher than weaker combinations recorded. Within the same cellular context, Firefly inductions were stable across treatments, both for single and dual transfections. Thus, the Renilla values and specific normalization led to different outcomes in sensitivity. By applying a battery of viability test, covering diverse end points of cellular stress, we were able to prove that the transfection procedure itself increases cellular stress in a vector size-dependent manner. Further, these results affirmed that the most potent combination of co-transfected reporter and normalization vectors was, in fact, not the result of spurious inhibition, but a realistic depiction of actual Nrf2 signal induction in the context of increasing cellular stress and cell death. Nevertheless, it must be mentioned that co-transfection itself can alter the cellular environment, which can influence the biological pathway studied. Given that the final signal measured will always be a result of combined mechanisms, it is important to take precautionary decisions in plasmid vector design, to display weak points of the artificial system, and overcome intrinsic faults of the methodology. Thereby, reporter gene assays can be a potent tool for high-throughput screening of environmental samples, and these may acquire regulatory acceptance if designed, assessed, and applied properly.

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[***Don’t open the floodgates to a nuisance claim; Simon Blackburn and Venetia Taylor look at where landowner responsibilities lie in relation to flood***](https://advance.lexis.com/api/document?collection=news&id=urn:contentItem:5YY5-63X1-DYX4-702C-00000-00&context=1516831)

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**Body**

February 2020 was the UK’s wettest February on record, with many areas experiencing more than twice the average rainfall for that month. There is widespread concern that this change heralds a permanent shift in patterns of rainfall and that the country needs to prepare itself for intense storms and prolonged rainfall each year, resulting in flooding on a scale that has not previously been reasonably expected.

This is a notoriously complex area of law because lines of responsibility must be drawn, even though the ultimate cause of damage cannot be put at the door of any person or entity: the rain has to fall somewhere. There is some interplay between the common law and statute; broadly the effect of this is that neighbours can hold each other accountable for their action or inaction in the law of nuisance, but statutory bodies governed by regulatory regimes operate largely outside of this system.

The law treats floodwater as a “common enemy”: it attempts to find pragmatic solutions to the problem of balancing the competing interests of neighbouring landowners. Courts have described the task as a “daunting multifactorial assessment” in which the obligations of statutory bodies, the duties of neighbours to each other and the self-interest of the private landowner jostle together against the common enemy which cannot itself be held to account.

Rights and responsibility of landowners

Landowners are responsible for the maintenance and protection of their own land and may construct flood defences to achieve this. In Arscott v Coal Authority [2004] EWCA Civ 892; [2004] PLSCS 171, Royce J stated that “an owner or occupier of land is entitled to use or develop his land so as to prevent flood waters coming onto his land you are entitled to protect yourself against the common enemy’s incursions”.

The common enemy of floodwater is one of a class of natural nuisances, and the legal rights of private landowners to protect themselves against natural occurrences are governed by the law of nuisance. The entitlement of every landowner to protect his land against the common enemy is balanced by an obligation not to cause nuisance to his neighbour by doing so. The remedies offered by the courts are damages and/or an injunction to stop the offending activity.

The law distinguishes between “natural nuisance” and an “unnatural” use of the land. In Rylands v Fletcher [1868] UKHL 1, for example, damage was caused by the creation of an “unnatural” reservoir, which burst and caused damage to a nearby mine. The defendant was found guilty of commissioning a nuisance because the water would not have been there other than for his intervention. There is now, of course, a whole statutory regime surrounding the construction, use and maintenance of “large raised reservoirs”, which subject was brought to the fore by the near collapse of the dam at Toddbrook Reservoir.

Obligation to act

Where natural nuisance is concerned, the original common law position was that a landowner could not be liable for inaction. This position has been modified by the courts so that the landowner must now take “reasonable measures” to prevent natural occurrences on his land from causing damage to neighbouring property. The sorts of measures envisaged are mundane, such as keeping drains clear of blockages. The landowner is not obliged to undertake extensive procedures or ones that are not cost-effective or reasonable in his own circumstances.

Furthermore, the duty only arises at all when the landowner becomes (or should have become) aware that a hazard exists. In Sedleigh-Denfield v O’Callaghan [1940] AC 880, the landowners were held liable for an escape of water which they could have prevented by taking the “simple and obvious step” of fixing a drain cover.

Plan ahead

The rights of landowners to protect their land have been further modified by the courts in a somewhat arbitrary way, so that a landowner is only entitled to defend his land against a theoretical future risk, not a present or imminent one. In Arscott, Royce J stated that “if the incursion upon your land has already happened or is about to happen, you may not export it to your neighbour. This is a pragmatic drawing of the line there is a great difference between a right for a landowner to protect his property against a common enemy, and a right to pass such an enemy on to the land of a neighbour”.

So, flood defences that are created in anticipation of future floods can lawfully impact on a neighbour in a way that would not be lawful if the flood were imminent or present.

This is indeed a pragmatic drawing of the line but the message to landowners is clear:  flood defences that necessarily route water onto neighbouring land should be constructed well in advance.

Deals with the devil

The Environment Agency has certain powers to make agreements with landowners to use land for flood storage. In these circumstances the landowners would be compensated, usually by way of upfront payment.

Watercourses

The same legal principles apply to riparian owners, that is, anyone whose property contains or abuts a watercourse. Riparian owners are entitled to protect their property from flooding by, for example, heightening the banks on their land, even if this diverts flood water onto a neighbour’s land (although permits and permissions might be required, depending on the circumstances). Balancing these rights are obligations to keep the watercourse clear of obstruction and maintain the bed and banks, so that the natural flow of water is maintained.

Responsibility of statutory bodies

The Environment Agency in England and Natural Resources Wales have general supervisory roles. They do have powers to remove obstructions and maintain flood defences, but are under no statutory obligation to do so. Their remit is to identify and assess methods of reducing flood risk and put in place those which pass their cost-benefit analyses. Their priorities might only rarely coincide with those of private landowners, whose concerns are immediate, local and personal.

Local authorities are responsible for flood risk management in their area. This involves issuing land drainage consents and planning permissions that are consistent with their flood management plans. They keep registers of flood risks and lead community recovery.

The Highways Agency is responsible for maintaining highways only; it must keep drains and culverts clear of blockages and ensure trunk roads do not become flooded.

There is usually no recourse against statutory bodies in common law as they are governed instead by regulatory regimes. In Marcic v Thames Water Utilities Ltd [2003] UKHL 66, Mr Marcic attempted to bring a case against Thames Water in negligence when the inadequate capacity of its systems resulted in flooding to his garden. The court decided that Thames Water was not liable in common law, because it was governed instead by a regulatory regime whose purpose was to balance private and public interests.

Rounding up

Flood damage is a natural nuisance and one that cannot be put at the door of an individual or entity. However, landowners do have a duty to take reasonable steps to prevent natural occurrences on their land from causing damage to neighbouring properties.

Top tips for landowners

Dos

Protect your land – you are entitled to and it is nobody else’s responsibility to do so

Maintain flood defences year-round in preparation for winter flooding

Take reasonable steps to prevent damage to your neighbour’s land

Don’ts

Wait until your property is on the brink of flooding before acting

Simply divert water onto your neighbour’s land

Simon Blackburn is a partner and Venetia Taylor is a solicitor at Payne Hicks Beach

JOURNAL : Farmers Weekly

Kuhn's Mergemaxx burst onto the scene at Agritechnica 2017, offering farmers an alternative method for rowing up crops in front of foragers and balers.

One of the first to put in an order was Norfolk contractor Dick Barnes, who swapped a twin rotor rake for a 9.5m Mergemaxx.

The machine is now going into its second season with the busy contracting outfit, so we asked Mr Barnes how it has fitted in and if he has any regrets about buying one.

Farm facts: D H Barnes, Forncett St Peter, Norfolk

Contracting, plus 100ha home farm

1,200ha grass for dairy and beef herds

200ha whole crop

1,000ha maize harvesting

520ha maize drilling

40,000 square bales

800ha sugar beet

What did you have before?

We had a Kuhn twin rotor 9.5m rake that was a good machine and served us well, but due to our flinty soil, there were quite a few stones creeping into the swath.

This was not only having a negative impact on the quality of the crop, but the annual bill for wearing forager parts was alarmingly high.

See also: Video: Abimac front rake helps solve contractor’s labour shortage

The flints were really tearing the internals to bits. We were going through multiple sets of knives per season along with shear bars and spout liners.

Why did you look at a merger?

The land we farm and contract on is a 25-mile radius around Forncett St Peter in south Norfolk, so we encounter everything from light land full of flints to reclaimed marsh on the Norfolk Broads. Our main aim was to stop pulling stones into the swath.

I’d been on the search for an alternative to a rake for around three years, and after seeing the Mergermaxx at Agritechnica in 2017, I put in my order.

Kuhn didn’t think there would be much interest from the UK and my eagerness must have caught them out as I didn’t actually get the machine until early 2019.

Did you look at anything else?

Yes, we looked at a four-rotor rake before buying the merger. We wanted something bigger than our twin-rotor to make meatier swaths on the lighter second and third cuts, as the chopper was working below its capacity.

However, the extra rotors meant the length of the machine increased quite a bit and we felt this would have been awkward when travelling along some of the narrow lanes.

Though the merger hasn’t got a steering axle like the four-rotor rake, we don’t feel it needs it. The beds are 3.5m long so, including the drawbar, it's far shorter than a big rake.

How was the first season?

We carried out a lot of work for energy companies last year, so the merger was kept busy. This season we have dropped a bit of that work to focus more on beef and dairy farms.

The biggest thing we have benefitted from is the merger’s versatility. We can easily bring 9.5m of crop into one row on heavy 6t/ha first cuts, which is more than enough for the Claas Jaguar 970.

For lighter second and third cuts, as well as lucerne crops, we can bring the width down to 7.5m to form a continuous belt and throw one pass from each side into a 3m row, effectively raking 18m into one swath.

We also merge straw in front of balers at harvest and shutting it down to a 7.5m row seems to work well.

Does it take some getting used to?

The only time you have to be on your game is the short works as the merger moves grass sideways rather than just out the back.

I’m the main driver and I sometimes have to think about how the land work will meet with the headland to avoid having odd strips. It doesn’t take long for it to become second nature, though.

We contract nearly 300ha of marshland on the Norfolk Broads which is very undulating. We mow and merge through dry ditches and the suspension system on the merger seems to cope with it fine.

It is a little heavier than the rake, but is mounted on the lower link arms and we’ve yet to find the extra bulk an issue.

See also: How rolling road test can help keep trailer brakes shipshape

We still have a rake for times when we need the merger in two places, such as straw baling and later silage cuts.

How does output compare to a rake?

Tractors burn a bit more fuel running the merger, as they have to power the belts and pickup reels. That said, our John Deere 6155 is more than adequate and we could probably get away with 120hp.

The extra fuel use is offset by the increased output. We can happily glide along at up to 8ha/hour with the merger, whereas the 9.5m rake would be flat out at 4ha/hour.

It's most noticeable in lurcerne – the merger will fly along at 12kph and doesn’t miss a leaf as the reels act just like a forager, while the rake would have to plod along at 6kph to pick it all up.

We’ve noticed that drying times of the swaths are a little more uniform. The windrow is slightly fluffier due to the grass being laid down from above, rather than forced together from either side.

And, because the rows aren’t as tight, the air can pass through them better.

Have forager repairs reduced?

In the first cut of grass we saved a set and a half of blades, which equates to nearly £7,000 in parts. Throw in labour and downtime and the merger is already saving us money. Running one chopper, we can’t afford downtime when the weather is good.

Being able to keep the forager fully fed by making bigger rows has also meant the merger can comfortably stay in front of the chopping team.

What are maintenance and wearing parts like?

Maintenance is similar to a rake, with skids and pick up tines the main items. We had it in the workshop this winter and after 1,500ha we only needed a couple of skid covers and 9 pickup tines.

One gripe is that there are a few awkward grease points on the belts, but luckily these are only 50-hour intervals.

Kuhn added a few modifications this year to stop grass build-up between the belts and tines. The crop had a tendency to drag on the tines and not make it onto the belts, particularly in damper crops, but they fitted a plate in the gap so hopefully this won’t be an issue this year.

LIkes and gripes

Likes

E Multiple merging widths depending on crop

E Vastly reduced forager repairs and downtime

E Cleaner crops and increased output

Gripes

E Awkward greasing points on belts

E Modification needed to stop wet crop bridging

E High purchase price

Specifications

Make

Kuhn

Model

Mergemaxx 950

Width

9.5m centre swath or 7.5m side discharge

Average speed

12-15kph

Crops merged

Grass, wheat and barley straw, lucerne

Output

8ha/hr

List price

£72,619

JOURNAL : Farmers Weekly

Abstraction licence holders who are experiencing cashflow problems because of coronavirus are being offered the opportunity to set up a payment plan with the Environment Agency (EA).

Farmers with water abstraction licences typically expect to receive their annual bill, or the first-part charge if they have a two-part tariff billing agreement, in April.

However, the agency is writing to customers offering changes to payment terms if they are experiencing problems paying their bills on time because of the lockdown.

See also: How irrigation is changing on an AHDB potato demo farm

Other amendments to normal rules include a delay on the winter or all-year abstraction returns, which are usually requested at the end of March.

Growers still need to make sure they are complying with the terms of their abstraction licences, but will not be asked to supply details of their abstractions during the period 1 April 2019 to 31 March 2020 until later in the year.

The EA will write to them to formally notify them of the new arrangements, although growers who already are registered to submit details of their abstractions online can continue to do so.

Paul Hammett, NFU water specialist, said farmers who were able to submit their returns online were likely to carry on as normal and use the digital service to get the job done while it was fresh in their minds.

“But I think the important thing is that for those who are struggling, it is an important signal from the Environment Agency that it is trying to be helpful where it can.”

Irrigation prospects

Meanwhile, the EA has revised its irrigation prospects forecasts to take account of the lack of rainfall in April throughout England.

Prospects in many areas remain “good”, but in the North West and North East of England they are now ”moderate”.

Yorkshire, East Anglia and the South East are classified as “moderate to good”.

Good status means that water levels are average or above average and supplies are expected to be safe.

Moderate prospects mean that water levels are low and so some controls on surface water abstraction are possible by midsummer if the weather is hot and dry. Controls on abstraction from groundwater are also possible in small, sensitive groundwater areas.

Mr Hammett said the irrigation season had started early for some after a dry April.

According to Met Office ***data***, this April was the sunniest on record for the UK.

Rain in the last week of the month increased the rainfall totals in many places, but overall the UK still received only 40% of average April rainfall.

It was the third driest April on record for Scotland.

“Fortunately, as a result of widespread heavy winter rainfall which was a problem for many farms, reservoirs are full and there is generally good water availability from both groundwater and surface water sources,” Mr Hammett said.

“Farmers are closely following predictions of possible hot, dry spells in the weeks ahead and what they could mean for water availability as the irrigation season builds.”

Advice on annual returns

Completing an annual abstraction returns is about more than just filling in a form, according to water resource specialist Envireau Water.

The company, which has experience of working with businesses across the ***agricultural*** and horticultural sectors, says the process should also involve forward planning.

It offers the following advice:

Quality-check all returns ***data*** to ensure consistency with licence conditions.

Know the history of your abstraction and think strategically about your future requirements.

If you have over-abstracted, then you will need to prepare a clear justification of why and create a plan for bringing abstraction back within your licensed limits. In some cases, it may be necessary to apply for additional volumes.

If there has been under-abstraction for many years, then the “use it or lose it” approach may be an issue, so anyone with a time-related licence needs to be prepared to justify retaining existing volumes at licence renewal.

JOURNAL : Farmers Weekly

The EU could set a target of one-quarter of ***agricultural*** land in Europe to be farmed organically by 2030, with an additional goal of reducing the use of chemical pesticides by 50%.

The plan to increase the amount of organic farming in Europe is understood to be included in the latest draft of the EU’s Biodiversity Strategy to 2030, scheduled to be published later this month.

The proposal to reduce the use of pesticides and nitrogen, while increasing the use of integrated pest management methods, has been included in a draft of a Farm to Fork (F2F) strategy, which will sit alongside the biodiversity strategy.

See also: Switch to organic farming would increase greenhouse gas

According to Brussels insiders, the latest draft text of the plans suggests that transformative change is “urgently required” to reverse the trend of biodiversity losses.

It says organic farming is the “best-known and best-regulated agro-ecological practice”, but acknowledges there would also be a need for measures to increase demand for organic produce through a commission action plan.

The document also suggests that at least 10% of the ***agricultural*** area in use should be restored as high-diversity landscapes.

Organic progress

 Although there has been strong growth in organic farming in Europe over the past decade, the extent of the sector varies considerably across EU regions, so such a target would be a significant change.

Across the whole of the EU-28 in 2018, organic farming accounted for just 7.5% of the total used ***agricultural*** area, or 13.4m hectares.

According to ***Eurostat***, the total organic area in the EU rose by 25% between 2012 and 2017.

The highest share of organic farming was reported in the Salzburg region of Austria, where about half (52%) of the total  ***agricultural*** area was used for organic farming in 2016 (the latest year for which regional ***data*** are available).

There were a further seven regions where organic farming accounted for upwards of one-quarter of total used ***agricultural*** area: Severozápad in the Czech Republic (30%), Norra Mellansverige in Sweden (29%), Calabria in Italy (29%), Mellersta Norrland in Sweden (28%), Burgenland in Austria (27%), Sicilia in Italy (26%), and Moravskoslezsko in the Czech Republic (25%).

Latest UK figures show that organic farming represents less than 3% of the total farmed area on ***agricultural*** holdings.

Next steps

Publication of the F2F and Biodiversity Strategy has already been pushed back because of the Covid-19 pandemic.

The most likely dates for publication at present are 20 or 29 May.

JOURNAL : Farmers Weekly

Growers are set to focus more on profit when managing their wheat variety choices, as they adapt to the post-Brexit landscape, according to the results from an exclusive Farmers Weekly survey.

As farmers respond to reductions in direct subsidy payments through the Basic Payment Scheme and make changes to their businesses, margin performance is expected to drive the demand for easy-to-manage varieties that require fewer inputs.

Some 48% of survey respondents expect that future variety choices will reflect their financial contribution to the farm’s bottom line, with 39% saying they will increasingly be looking for varieties that need minimal intervention .

About the survey

The Farmers Weekly wheat variety survey had 587 respondents. Of these, 41% were owner occupiers, 38% were tenanted farms, 9% were farm managers and 12% were farm workers.

The average farm size was 346ha and the average area of wheat grown was 210 ha.

Representing all regions of the UK, the survey explored growers’ attitudes to choosing wheat varieties, both now and in the future.

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See also: Tips on getting the most from clubroot-resistant OSR varieties

Main survey findings

Agronomist advice and the AHDB Recommended List are the two most important sources of information

Greater focus on profit/margin post Brexit

Final decisions on variety choice typically take place in July

Two-thirds of respondents plan to start winter wheat drilling in October 2020

Seed from 2019 remains on two out of three farms

Opinion is evenly split on considering varieties not on the Recommended List

Given this finding, it is not surprising that two-thirds of participants expect varietal disease resistance to become even more important to them over the next few years.

Loss of chemistry and highly dynamic pathogen populations are also behind the move to more-resistant varieties; a trend that started a few years ago and is now expected to accelerate.

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However, for one-third of respondents, growing less wheat is on the cards in the post-Brexit period, while another 17% intend to target specialist/niche markets and look for new contract opportunities.

Variety characteristics

Growers give greatest prominence to yield and disease resistance when choosing their wheat varieties – reflecting that recent variety introductions can offer both.

More than three-quarters of our survey participants ranked them as very important, with local markets, harvest date and grain quality also considered important. Factors such as plant height and speed of development were less prominent.

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Septoria resistance was very important to 76% of the respondents – with a closer look at the responses show that a variety’s Septoria rating was more important to larger farms and to those situated in the south of the country.

In the north, a variety’s regional performance was a more important consideration than in other areas, while sowing date suitability was given greater focus in the Midlands.

In the last three years, there has been a significant change in the way that varieties are considered. Disease resistance has come to the fore, with the loss of chlorothalonil prompting greater interest in septoria scores.

Information sources

Agronomist advice and the AHDB Recommended List are the two most important sources of information on varieties, according to the survey results.

Some 82% of respondents mentioned their agronomist’s advice as a key source, putting it just ahead of the Recommended List. Previous experience with the variety, local trials and asking other farmers were also highly rated.

Local trials results were mentioned more by growers in East Anglia and the Midlands, while industry events such as technical events and shows were given greater importance by growers in the South East and South West.

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Farming publications are doing their bit too; some 56% of the survey respondents saw them as an important source of information for choosing their varieties.

In contrast, websites and social media were held in lower regard, due to uncertainty about the integrity of the posts. Other sources of information mentioned by farmers included end users and independent agronomy organisations.

The future

Plant breeding is expected to continue to deliver the progress that growers have got used to.

Asked about the traits that will be important to them in the future, 59% of our survey respondents would like to be able to select varieties on the basis of growth habit.

Other important future selection criteria were waterlogging/drought-tolerance, nitrogen-fixation and root-development characteristics.

In contrast, hybrid wheat was only mentioned by 9%. Despite its success in other crop species, it seems as though hybridisation will be a much harder sell in wheat.

The role of the Recommended List

While growers value the AHDB Recommended List as a trusted source of independent information on varieties and how they can be expected to perform, the survey suggests it is not held in such high regard as it used to be.

No longer the most important source of information on winter wheat varieties – coming behind agronomist’s advice - there is also far greater reliance being put on local trials results and other farmers' experience.

Expansion of the Recommended List in recent years means there are currently 35 recommended winter wheat varieties – a number considered to be far too many.

Likened to a brochure by one participant, there was a feeling that it had lost its focus and was not as useful as before.

Our survey also revealed a willingness to grow varieties that aren’t on the Recommended List. By that, respondents meant both older varieties that have come off the list, as well as those that hadn’t made the grade.

It was a fairly even split: some 54% of our survey respondents said they would consider growing a variety that wasn’t recommended, compared with 46% that said they wouldn’t (see graph).

Within that, younger farmers were more likely to go "against the grain" and opt for varieties they felt had something different to offer than their older counterparts.

The reasons given for that were matching varieties to local growing conditions, the narrow criteria for recommendation and constraints imposed by a national testing system.

For information on these varieties, growers said they were reliant on neighbouring farmers, local merchants and the ***agricultural*** press.

However, of the 46% who wouldn’t consider varieties that weren’t on the Recommended List, there was a familiar feel to their reasons.

Independent information, proven performance and confidence in a variety were important, as was a reluctance to take on any more risk.

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Autumn 2020

Two-thirds of our survey respondents plan to start drilling their winter wheat in October this year – which, for a significant proportion (42%), is earlier than usual.

After such a wet autumn and winter in 2109, it is not surprising to see that the weather is one of the most cited reasons for this (see graphs 4a and 4b).

Pest and disease pressure is also up there as a key reason for the choice of October as a start date – with greater use of cultural control measures being made to help manage the threat of barley yellow dwarf virus, septoria and other issues.

Not surprisingly, blackgrass control remains a reason for delaying drilling into October, with a greater proportion of larger farms mentioning it as a key factor.

Overall, some 67% of our participants will start drilling in October, compared with 27% planning a September start and only 2% willing to delay until November.

The desire to start a bit earlier this autumn is understandable, as growers look to get their rotations back on track and restore farm profitability.

It is also interesting to note that two in three of our survey respondents still have seed of winter wheat varieties remaining on their farm following the disruption to drilling plans caused by autumn/winter 2019.

Where they intend to buy new seed, growers are most likely to make their final decision in July.

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Sponsor's message

KWS UK has been providing growers with innovative new varieties to meet varied end-market needs for over 25 years. We use a range of technologies to ensure improved consistency in crop performance to benefit all; merchant, farmer, processor and ultimately end-user customer. Higher yields, superior disease and pest resistance and improved performance in adverse conditions are all key criteria we seek to establish in our product portfolio.”

Thanks to KWS whose sponsorship made it possible to conduct the wheat variety survey. Farmers Weekly had full editorial control of this feature.

JOURNAL : Farmers Weekly

Apprenticeships are mutually beneficial arrangements between an employer and an employee that allow practical skills to be built up alongside an educational programme.

Employers enjoy being able to mould young workers to best fit their business and passing on their knowledge, while ensuring key assets stay in the ***agriculture*** sector.

Apprentices can measure their progress in a real life environment and combine a paid job with a qualification.

See also: Coronavirus: How employers can get help with statutory sick pay

What is an apprenticeship?

An apprenticeship is a practical training programme alongside a full-time job, which allows participants aged 16 or over to earn as they learn.

It combines day-to-day work in the sector of the apprentice’s choosing with evidence-based assessment and leads to different levels of qualification.

In ***agriculture***, this covers an increasingly wide area of skills and levels, which could range from stockperson or a management course to a science and surveying degree.

The individual programme is employer-led and should result in a fully-competent apprentice who also has good people and employability skills, such as accurate timekeeping and a strong work ethic.

What apprenticeships are available?

Different courses and levels are available from training departments, educational facilities and organisations such as the AHDB, which offers Level 2 and Level 3 apprenticeships in ***agriculture***.

Bridgwater & Taunton College runs Level 2, 3 and 4 apprenticeships, as Mark Nash, trainer and assessor explains.

The Level 2 stockperson is a 12- to 18-month programme for a general farmworker role in a beef, sheep, dairy or pig enterprise.

Pros and cons of apprenticeships

Benefits

E Provide skilled workers for the future

E Increase staff loyalty and retention

E Free-up existing employees' time

E Can revitalise a company

E Apprentice is learning in real-life situations while earning a wage and seeing the highs and lows of ***agriculture***

Pitfalls

E Takes a committed, tenacious person to be able to learn on the job while studying, to stick to a long-term plan and stay motivated when their peers may be having the university experience

E Remember you are dealing with young people so expect bumps along the way

Source: Clare Keegan and Mark Nash

Requirements include English and maths at GCSE grade 2 or above, or functional skills at level 1.

The Level 3 advanced apprenticeship is geared towards students with a little more responsibility on the farm, such as rearing calves or setting up the drill and drilling crops, in addition to a level of basic record keeping.

English and maths requirements here are GCSE grade 4 or above, or functional skills at level 2.

The Level 4 is run over 30 months and is aimed at students coming into ***agricultural*** management who have more responsibility on farm.

This could include interacting with the vet, nutritionist, agronomist or bank manager, to make some managerial decisions.

At Bridgwater & Taunton, students also get to compete in groups to tender for a farm and present their projects to a team of bank managers for scrutiny.

Harper Adams University delivers degree apprenticeships up to Level 7, which is a five-year course.

Course options include: food and drink advanced engineer degree apprenticeship; chartered surveyor (rural) degree apprenticeship; and food industry technical professional degree apprenticeship.

How does it work?

At all apprenticeship levels, the students come in to college once a week on a day-release basis, says Mr Nash.

This theory learning also covers part of the mandatory 20% off-the-job training.

Employers commit to providing or organising about 10% of this, which can be in the form of training new skills, regular staff meetings, vet talks or farm walks.

“We try to support the employers with the ongoing process of keeping apprentices on track,” says Mr Nash.

“We also want to ensure the apprentices are being involved in the full aspect of business and not just being left with menial jobs.”

The college’s apprenticeships are generally assessment-based rather than exam-based.

Students are observed by their employers and college trainer assessors throughout their course and gather evidence to store on an electronic portfolio.

The final examiner has access to this portfolio, and when the apprentice is ready, they are put forward for an assessment through Lantra, which includes three practical tasks, an online test and a professional discussion.

At Harper Adams, the degree apprenticeships run for multiple years with blocks on and off campus.

These are assessed through exams, assignments and work-based projects.

What are the employer and apprentice’s obligations?

Clare Keegan, business development manager at Harper Adams, says obligations include: a contract for the life of the apprenticeship; commitment statements; regular reviews; and the employer must be committed to developing the right person for a specific job.

Apprentices should be treated like any other employee and are subject to the same regulations such as working time, health and safety, equality laws, and they should be given at least 20 days’ annual paid holiday a year, as well as bank holidays.

How much do apprentices get paid?

Apprentices must be paid at least the minimum wage by the employer.

This starts at £4.15/hour for apprentices and increases depending on age and progress through course.

Are there any funding opportunities?

Employers with a pay bill of more than £3m/year must pay the apprenticeship levy, and will receive funds to spend on training and assessing apprentices.

Those who do not pay the levy, pay 5% towards the cost of training and assessing the apprentice.

The government will pay the remainder, up to the funding band maximum, directly to the training organisation.

Incentive payments are available in certain circumstances, such as employing a 16-18 year old, employing fewer than 50 staff, or working in specific sectors.

How can I get involved?

Employers can contact their nearest ***agricultural*** college if they are interested in taking on an apprentice.

Potential apprentices can look on the National Apprenticeship Service website for jobs in their area or they can apply to do an apprenticeship and the facility will then assist them to find a job.

Apprenticeships can also be completed on family farms, if appropriate.

Case study: Michael and Tony Ball

Brothers Michael and Tony Ball are AHDB Strategic Dairy Farmers in Derbyshire and have worked with apprentice George Ball (no relation) since 2013.

Farm facts

Coton Wood Farm

304ha

500 cows

All year round system

Eight robot milkers

Supplying Freshways

49ha of winter wheat

20ha of miscanthus

George, whose family are also in farming, was studying a GCSE in ***agriculture*** locally, which involved one day a week spent on farm.

This was run by Dart Training, an organisation that also offered apprenticeships.

When George left school, he was keen to start working on a farm, so Michael and Tony offered him a full-time job and he moved on to an apprenticeship.

While working at Coton Wood Farm, George has completed Level 2 and Level 3 diplomas in work-based ***agriculture***, and a Level 4 Higher Level apprenticeship in ***agricultural*** business management.

George, who also built up a flock of about 100 ewes on rented land, said: “The best part for me was the hands-on approach.

“I really enjoyed being able to follow the progress of things you have done throughout the days, weeks, seasons and years, and I think being able to see and do what you’re being taught is a good way of learning.

“The worst bit is it can be quite challenging to do a full-time job and keep up with coursework and have a social life away from the farm, which is probably the main thing you miss out on by not going to college or university.”

Tony, who also employs another Level 3 apprentice, said: “For us, the main benefit is that you are employing someone at the start of their career, who – hopefully – comes with no preconceived ideas of how things should be done, so we can mould them into our way of working and it makes it easier for them to work to our standards.

“The one drawback is the time and supervisory input required at the outset with someone who has little experience.”

The team have worked so well together that they are planning to continue doing so by way of a joint venture.

Tony and Michael are in the process of buying another farm with the intention of milking a new autumn block calving herd this summer, and George will be running this unit under a contract farming agreement.

George said: “I am looking forward to getting to realise my dream of milking my own cows and putting my own ideas into practice.

“Coton Wood Farm has undergone a lot of changes over the past seven years, going from a 200-cow dairy unit with a parlour to a 500-cow unit with eight robots milking the cows, which was great for me while doing the apprenticeships, as it gave me the chance to see the latest technology in the industry.”

George would recommend apprenticeships to anyone who wants to get stuck in, earn as they learn, achieve qualifications and gain hands-on experience.

JOURNAL : Farmers Weekly

Farm leaders have urged people exercising in the countryside to follow the rules to protect themselves and farmers who are helping to feed the nation during the coronavirus pandemic.

With farmers turning livestock out and using machinery in fields and farmyards, there are reminders that many of the rural areas people are visiting during the lockdown are working environments.

The Country Land and Business Association (CLA) has asked people to stay on the footpaths near farms to reduce the risk of accidents.

See also: Coronavirus: Game shooting season faces uncertainty

CLA president Mark Bridgeman said: “We urge members of the public to be vigilant and aware in the vicinity of livestock and large machinery, when taking their daily exercise.

“For those walking with young children, please ensure they are kept close to you.”

The CLA has asked people to keep dogs under control near livestock and to close gates and not block farm entrances, many of which are used regularly.

Dog attacks

The Farmers’ Union of Wales (FUW) has also urged walkers to keep dogs on a lead after reports of attacks on livestock, something the union said is “avoidable and unnecessary”.

Ian Lloyd, the FUW’s animal health and welfare committee chairman, said livestock worrying was yet another stress for farmers already working flat out in difficult circumstances.

“We are reminding those taking respite in the countryside to also remember our farmers, who are key workers producing our food at this very difficult time.

“Many family farms in Wales have been hit hard by the closure of restaurants, cafes and other service outlets during the current pandemic.”

The FUW said it will continue to push for tougher legislation around dog attacks on livestock, to help reduce the welfare and financial consequences for farmers.

Police fines

Meanwhile, North Yorkshire Police has revealed it issued 61 fines last week to people who were not following government guidance by making unnecessary journeys.

On Saturday 25 April, 17 fines were issued in the rural village Malham. In total, the force issued 31 fines on Saturday to people visiting from West Yorkshire, Lancashire, Cumbria and Kent.

A further 30 fines were issued on Sunday (26 April), with officers fining six people in Brotherton who had travelled to the small village to go off-road biking.

Advice for land managers

Keeping paths clear and waymarks and signs in good order and up to date will help people stick to the right routes and access points. Contact your local authority or National Park Authority to find out what help is available.

Where there is public access through a boundary feature, such as a fence or hedge, create a gap if you can – or use an accessible gate or, if absolutely necessary, a stile. When installing completely new gates and stiles, make sure you have the permission of the local authority.

Encourage people to respect your wishes by giving clear, polite guidance where it is needed. For example, telling visitors about your land management work helps them to avoid getting in your way.

Source: The Countryside Code

JOURNAL : Farmers Weekly

Farmers tend to gradually wind down their work as they reach old age, but no one told Devonshire farmer Alec Burrough.

Despite being classed as very high risk to coronavirus, the 86-year-old is working every day to keep Britain farming and help #FeedTheNation.

He is still using the same 54-year-old red Nuffield 10/60 tractor to carry out a range of daily tasks on the organic family dairy farm he moved to as a young boy in Cullompton, Devon.

He has been farming full-time for the past 71 years.

See also: Coronavirus: Prince praises farmers who #FeedTheNation

As one of the 1.5 million classed as “extremely vulnerable” by the UK government, this has not deterred him from carrying out the essential role he plays as a key worker during the crisis that has gripped Britain.

At a time when there is a shortage of farmworkers in the UK, Mr Burrough, an avid Farmers Weekly reader, is a true inspiration.

His list of daily jobs includes work in the yard, on the tractor in the fields and calf rearing.

Mr Burrough, who has suffered from chronic obstructive pulmonary disorder (COPD) for many years, said: “I’m just doing what I’ve always done and making sure people stay fed.

“People with a serious lung condition like mine are told to try to stay active, and I’m definitely doing that.

“If someone had told me I’d still be using the same Nuffield tractor to do my job 54 years on, I’d say that was a good investment.”

Hard work and frugality

Mr Burrough said his childhood spent farming during the Second World War instilled in him an appreciation of hard work, frugality and working together for the common good.

“During the war, we had to work together and make the most of everything we had,” he explained.

“We didn’t take anything for granted.

“I don’t understand how people throw things away so easily now, whereas I was always brought up to make the most of what I had – like my tractor.”

The older generations are capable of great things, as shown by NHS fundraising hero Captain Thomas Moore.

The 99-year-old war veteran has raised more than £27m by completing 100 laps of his garden before his 100th birthday

Mr Burrough will celebrate his 87th birthday in July.

He farms with his son Jonathan and daughter-in-law Louise, and has three grandchildren aged 7, 9 and 11.

JOURNAL : Farmers Weekly

A Welsh cattle farmer has died after being trapped against the wall by the bucket of a JCB machine, an inquest has heard.

Dewi Jones, 68, suffered crush injuries and died following the incident at Ty Celyn Farm, in Llanfwrog, Denbighshire, on Tuesday 21 April.

An inquest was opened and adjourned into Mr Jones’ death at Ruthin coroner’s court on Monday (27 April).

See also: Advice on first aid when there’s a farm accident

John Gittins, coroner for North Wales East and Central, was told Mr Jones had been moving hay with his brother into a heifer pen when he was trapped by the shovel of a JCB Bobcat.

Although he managed to wriggle free, he collapsed and an air ambulance was called to the scene.

A post-mortem examination gave the provisional cause of death as an abdominal bleed and liver laceration after blunt-force trauma.

HSE investigation

The Health and Safety Executive (HSE) is also investigating the circumstances surrounding Mr Jones’ death.

Farming continues to be the UK’s deadliest occupation. In 2018-19, 39 people suffered fatal injuries while working in ***agriculture***.

Fourteen of these deaths involved being struck by a moving vehicle, including tractors, trailers, telescopic handlers, farm vehicles, ATVs, and nearly half of the workers killed were aged 60 or over.

JOURNAL : Farmers Weekly

A farmer has died and his son was badly injured after they were attacked by a water buffalo in Monmouthshire.

Father-of-three Ralph Jump, 57, was pronounced dead at the farm in Gwehelog on Tuesday afternoon (5 May).

His 19-year-old son, who has not been named, was critically injured and his 22-year-old daughter, Isabel, suffered a serious leg injury.

See also: Coronavirus: Yellow Wellies issues mental health support for farmers

Mr Ralph’s son was flown by air ambulance to the University Hospital of Wales, in Cardiff, and his daughter was taken by land ambulance to the Royal Gwent Hospital for treatment. Her injuries are not thought to be critical.

We were called to a commercial address near Usk, after reports of a water buffalo attacking two men and a woman.

A 57-year-old man was sadly pronounced dead at the scene.

A 19-year-old man and a 22-year-old woman are receiving hospital treatment.

"-- [*https://t.co/dChRL3DZUe*](https://t.co/dChRL3DZUe) pic.twitter.com/2kNICJJvoj

Gwent Police (@gwentpolice) May 5, 2020

Paramedics received assistance from the National Police Air Service at the scene following the attack, which happened shortly before 3pm.

The water buffalo was humanely destroyed.

The attack took place at the premises of the Bufalina Soap Company, in Usk, a family business that manufactures handmade luxury soap from the milk of their herd of Mediterranean water buffalo in the Welsh Marshes.

Water buffalo are native to Asia, but a number of farms across the UK keep herds.

JOURNAL : Farmers Weekly

A Yorkshire arable farmer was left shocked after discovering fly-tipped waste on his land containing sensitive childcare details.

Tim Braithwaite, who farms in Sprotbrough, near Doncaster, found bags of toys strewn across the entrance to a field of winter barley over the weekend.

The bags contained folders that revealed sensitive records written by a childminder about children headed “Little Puffins Childcare”.

See also: What to do if you’re a victim of fly-tipping

Mr Braithwaite contacted South Yorkshire Police and Doncaster Council, which came and removed the rubbish within 24 hours without charge.

A former owner of the childcare company has since come forward and apologised over the incident.

The woman, who did not want to be named, said she contacted Doncaster-based firm L&C Rubbish Removals on Facebook and paid £40 for the rubbish to be ***collected***.

She told Sheffield newspaper The Star: “Their Facebook page says that these people are fully licensed, so I stupidly went ahead with this.

“I paid the £40 via bank transfer and the guys came to take away my rubbish.

“I had absolutely no idea of the fly-tipping incident until a friend sent me the link via Facebook.

“I closed my business in 2017 due to my daughter’s Illness, which sadly left her disabled.”

She added: “When I closed, I organised and cleared away any paperwork and I honestly did not know that there could be anything left in these files.

“I will pay any price for my mistake and I fully take any responsibility if there was actually any personal ***data*** within these files, which I think is unlikely due to previous organisations.”

'Major problem'

Mr Braithwaite told Farmers Weekly: “Fly-tipping is a major problem and it has been getting worse in this area since coronavirus has forced the closure of all the local tips.

“People should dispose of their rubbish only through legitimate sources. Fly-tipping wastes the valuable time of police, council officers and causes huge costs and inconvenience for farmers.”

An investigation involving police and the council is under way.

Farmers Weekly has contacted L&C Rubbish Removals for a comment. The company says on Facebook it is “fully insured, fully licensed, open seven days a week and cheaper than a skip”.

JOURNAL : Farmers Weekly

The dry weather in Aberdeenshire has continued throughout April, with the annual total to date amounting to only 33% of average. This allowed spring barley drilling to start early on 20 March – early for us – and with a great effort by the whole team we were able to drill 808ha in 23 days.

Now that the crop is established, we desperately need some decent rainfall. We had 6mm last night, and a few showers are forecast later in the week, but really we could do with an inch or so over a few days.

See also: Herts grower puts hoe to the test in narrow-row cereals

While the spring barley still has some moisture at seed depth and has not yet been impacted by the dry conditions, the wheat is certainly suffering. When a plant is pulled up, the soil just falls off the roots and any damper parts of the field show how pale and thin the majority of the crop is.

With the 2018 drought still fresh in my mind, I have held back some nitrogen for now on both the wheat and spring barley. The rainfall over the next 10 days will determine how much, if any, of this will be applied.

It has been a strange spell with lockdown for coronavirus.  During drilling, we were lucky to be relatively unaffected, being able to get on with our jobs with only minor changes to working practices.

One of these was that I often took my bike when moving the loader and seed trailer. Cycling back really showed up how bad many of our road surfaces are and also, despite the reduced amount of traffic, how many bottles and other rubbish is being thrown into the verges. If only some of the many extra walkers out and about would pick some of it up!

During this time it is also frustrating to see some supermarkets importing beef, particularly steaks, when local processors need to find new markets for these cuts. Is this a failure of the supply chain, or an excuse to drive the price down? Either way it is not helping the UK beef sector and drives farmer mistrust of retailers.

JOURNAL : Farmers Weekly

It has been a surreal month since I last wrote an article. Apart from the odd conference call, the diary is a complete whiteout which at least means I have knuckled down to farm work and kept busy.

Social distancing comes naturally to those of us spending long days in tractor cabs.

Forage maize has been planted in good time and is up in rows. We are trying to establish more maize using minimum tillage which definitely gives a more stable, resilient seed-bed.

Pewsey Vale scored big in the catchy game of "rain roulette" with two bouts of 40mm helping to evenly establish spring cropping, which now looks promising.

See also: Tips on getting the most from clubroot-resistant OSR varieties

On a personal level, to immense relief, all members of my family who had coronavirus symptoms have fully recovered and the farm team remain in good health.

For me the only lasting souvenir has been not recovering my sense of smell. This came in handy when we were clearing out the slurry pit!

Mistakes will always happen and unfortunately we had an incident recently when AdBlue was put in the wrong fuel tank causing significant engine damage to a tractor.

Please remind your teams to never top up this additive while the engine is running, and that even a tiny misplaced quantity in the fuel line will cause problems. Thanks to TH Whites for sorting us out.

The decimation of the wider economy by lockdown measures is truly horrifying and will have repercussions for a generation.

I can understand why some have asked whether the cure is worse than the disease. A primary concern for agribusiness is how on earth will this be paid for?

Beyond income and VAT taxation adjustments I would suggest this is a good time for families to have frank discussions about farm succession; changes to ***Agricultural*** Property Relief seem likely when the government weighs up radical land and property taxation options.

Time is running out for a post-Brexit trade deal with the EU. Simultaneously discussions continue for a free trade deal with the US for which the main danger is that ongoing food supply disruption is used as an excuse to flood markets with cheap imports, leaving our own production standards undermined.

With one voice the industry must apply maximum pressure to ensure this never happens.

JOURNAL : Farmers Weekly

Sleeping is cheating. There’s been little chance to nap here of late.

What a difference eight weeks makes. We have gone from “gripping” (draining) water off with a 14 tonne hoe, to maximum moisture retention.

Spring barley drilling started off like ‘riding on the skin of a rice pudding’, and has gone to rock hard dry conditions. The better land has emerged and rocketed away, the “strong” has emerged, but is struggling and is in need of a drink.

See also: Call to back British beef as retailers buy Polish mince

Maize drilling is well under way and to conserve moisture we are running the Watkins tri-till through the mucked stubble, followed by the power harrow, with the maize drill following in convoy.

All of us operate in the same block of land and then move onto the next. The key is not to get too far ahead, otherwise the moisture disappears in front of your eyes.

Half the acreage is down to grain maize and the other half down to our old favourite LG Ambition which I regard as a dual-purpose grain or forage crop.

Now I have to get my head around the beef monitor program. If we do a diet tweak, we can now see the implications in real time.

I liken it to looking in the bulk milk tank and seeing a response to the diet nearly immediately.

Now we know the baseline growth rate we can monitor the effects of the diet change. Obviously, you have to ignore the first couple of days because the cattle have to acclimatise to the different taste and texture of the feed, but we then need to be back on the rising curve of growth matching the previous ***data***.

The fat cattle job at the moment is hard work. We have had a 5-10p/kg reduction in the deadweight price due to the knock-on effects of Covid-19.

Saying that, the liveweight price has not dropped proportionally to the deadweight price, and I would suggest the local butchers are doing a right trade.

I hope the consumer doesn’t revert back to supermarket shopping and shows the local shops some loyalty when the current crisis is over.

Doug Dear is a Farmer Focus writer from Yorkshire. Read his biography.

JOURNAL : Farmers Weekly

I am feeling in a much better place than I have been for a number of months, finally being caught up. After a marathon effort we got a vastly increased spring cereal area into the ground in some surprisingly good conditions. I now look forward to what seems likely to be a later-than-normal harvest workload.

As luck would have it, youngest son managed to get back from New Zealand just as the coronavirus restrictions started to take hold and we were really getting going. Thinking it unwise for him to mix with others for a while, he got landed with the night shift. After all, his body clock was still on New Zealand time, which suited us all fine.

See also: Top tips on managing late disease in potatoes after diquat

Potato planting has proceeded apace, again into good conditions. Despite it appearing dry we are finding enough moisture at depth which has resulted in prompt and timely emergence.

Our pre-emergence herbicide programme remains largely unchanged although we are getting used to managing without diquat. I feel the greater learning opportunity will be when we come to haulm management later in the season.

I have access to an impressive haulm topping outfit through a local contractor, but I feel the cost will be considerably more than simply spraying a desiccant.

We have just added an additional tractor to the fleet, but in a different way. We have tended to buy in a fairly traditional way, but this is our first contract hire. I am keen to see how this compares with our usual route, given that we now have a relatively fixed cost per hour for maintenance, repairs and depreciation.

Having done the sums I felt that there is no right or wrong, cheaper or dearer way. It is more about what you want to achieve.

Depreciation costs are significant for our business and they are hard to calculate with any degree of certainty. The contract hire route does at least give some cost clarity right from the start, which will aid budgeting.

I am also pleased to see the fall in the price of fuel. Normally when we get to a busy period it seems to increase. We are unable to stockpile as we only have our regular tanks, but it is a small positive benefit.

JOURNAL : Farmers Weekly

Spring drilling was all wrapped up by early April – this year has already provided most of the drilling conditions possible going from very difficult to very easy in a relatively short time.

Crops have established well and on the whole are now benefiting from the minimal disturbance drilling method and the moisture it helped retain. Sugar beet is presently an unfortunate reminder on how spring cultivations in a year like this can be a bad move, with varying germination.

See also: How ethylene can help control sprouting in potato stores

While coronavirus is hindering progress with my mid-tier capital works, and making other jobs more complicated we have been very lucky that the impact has been minimal so far.

I cannot imagine being stuck at home for weeks without the usual freedom we all take for granted, and while the extra people out walking does bring some issues, it is also a huge opportunity for engagement and to show off what, why and how we do things.

Some simple signs explaining what crops are grown for, and what field margins, wild bird mixes and beetle banks are planted for, and the wildlife they are there to encourage and support will go a lot further in keeping people to footpaths and produce a positive result for farming all round in future; than ones that say only "Keep out".

There are always exceptions, but a lot of lost walkers are innocently ignorant. Footpath signs aren’t always visible, clear, or even present, and to untrained eyes a wide strip of grass around a field for a footpath looks the same as a field margin, especially if half has recently been cut as part of its management.

We need to give people a positive experience on the land we manage while everything else is upside down and not so great. As customers we support businesses that give us good service and a positive experience – the people walking the footpath are our customers and we keep asking for their support – maybe we need to earn it a bit more?

I found some small signs produced by CFE when it was the Campaign for the Farmed Environment that were designed to educate walkers about field margins and ground nesting birds.

Maybe industry organisations, such as the "new" Championing the Farmed Environment could help with some simple infographic style signs to help show people what different parts of the farmed landscape are for.

Matt Redman farms 370ha just north of Cambridge and operates a contracting business specialising in spraying and direct drilling. He also grows cereals on a small area of tenancy land and was Farm Sprayer Operator of the Year in 2014. Read more from Matt Redman.

JOURNAL : Farmers Weekly

We have been in a nationwide lockdown for four weeks, with only “essential services” allowed to operate.

We are fortunate in that we have been able to go about the normal farm programme while being supported by our associated service industries and processors.

It could be argued that had we closed the borders earlier, we may have preserved the operation of the domestic economy.

That said, it appears that a drastic lockdown is, thus far, seeing our case numbers fall quickly with our government now pursuing an “elimination” strategy. Covid19 is such a nasty bug, it would be very unwise to think we have beaten it yet.

See also: How to make sure you hit protein target for milling wheat

Tourism has been wiped off the map for the foreseeable future with an effect on the economy comparable to a complete collapse of the dairy industry.

Added to that, our hospitality sector is taking a hiding from the lockdown and will suffer both from an ongoing lack of tourists, but also from the reduction in domestic discretionary spending going forward.

There is no doubt grim times are ahead for many in New Zealand. Our economy has been shattered in the past six weeks.

Primary production is now, more than ever, the key source of foreign earnings for our wee country. The last few years it has been politically expedient to cast farmers and growers as public enemy number one.

Now it seems our politicians, business leaders and economists are giving us a smile and a wink, and a bit of a pat on the back.

Our own economic future is fragile as we are selling into world markets that themselves have taken a pummelling, so caution is needed.

But in the meantime, we are needed more than ever, both to produce safe, nutritious food to export, but also to support our friends in other sectors who are hurting.

Our builders, contractors, trucking firms, local retailers, everyone downstream that we deal with desperately need our help.

Now is our time to bring forward maintenance or development projects, or anything else we can find to get those guys and girls back to work and help them back onto their feet. Take care.

David Clark runs a 463ha fully irrigated mixed farm with his wife Jayne at Valetta, on New Zealand’s South Island. He grows 400ha of cereals, pulses, forage and vegetable seed crops, runs 1,000 Romney ewes and finishes 8,000 lambs annually.

JOURNAL : Farmers Weekly

It’s business as normal in very abnormal times. I could easily write this piece 10 times over full of sentiments of gratitude, despair and condolence and likely resonate with the majority of people in one way or another.

However, social media is awash with Covid-19 stories good and bad, so I’ll try to stick with ‘normal’ and hope you are all keeping safe.

We are well into our second grazing round on the farm, with pre-grazing covers of 2,500kg DM/ha to 2,700kg DM/ha. Grass growth last week was a shade under 50kg DM a day and above our demand for the farm.

See also: How to maintain butterfats during spring/summer grazing

As a result, concentrates have been eased back with a view to feeding 3kg a head a day and grass intakes of circa 15kg DM a day. The cows are loving the dry weather and high dry matter content of the grass and are exceptionally content, even when working to hit residuals and clean up fields.

Bulling activity is excellent. Large bulling groups are clear to be seen every day and production is running at about 2.1kg milk solids a day.

Most of our field work has been completed in good time, with some fodder beet going in for next winter.

Last year’s wintering ground has been worked down and reseeded and the dirty water has been spread on some of the grazing. Having soil tested the farm, the benefit of the dirty water is evident in the P and K levels, so we are trying to spread it on some different fields.

This meant running the umbilical across the yard. It was working fine until a lost articulated lorry arrived in a blind panic having been stuck on narrow lanes for an hour. The lorry dragged the five-inch pipe across the yard and out of the ramp ready for the next car to arrive to try and cross it and put a gash right through it.

Serving is less than two weeks away as I write. Preparation work is complete with metri-checking done.

Prostaglandin has been given to 30 cows to help them clean naturally and no antibiotics (Cefapirin) have been given. We are trying to limit antibiotics use generally and particularly that one, as it is a first-generation cephalosporin antibiotic.

Johnjo Roberts is a Farmer Focus writer on Anglesey. Read his biography.

JOURNAL : Farmers Weekly

We really are very lucky to work in the industry we do – producing food.

I know we all moan about the weather and the prices we get for our barley or beef or milk, but unlike many other industries the world can’t function without us, the food producers.

Life hasn’t even changed that much for most of us in the current crisis.

I know I am very fortunate to still be out and about delivering to shops and houses and as I pass so many businesses shut down with the coronavirus pandemic you can’t help but wonder about the poor people behind these businesses, who are either furloughed or who have already lost their jobs.

See also: OFC 2020: Expert to rebuff red meat claims and EAT-Lancet report

Many of these businesses may never open again.

Our little business is still very busy with home deliveries and we’ve seen a huge increase in footfall. We’ve been shipping orders all over the country, but we have hit a major snag this week as our insulated box supplier is struggling to get us more supplies.

We all know the world is going to be a very different place after this, but maybe there will be some good to come out of it.

Maybe people will realise they need to spend less time in their cars or on planes and more time at home with their families. Maybe they will realise it was the cars and planes destroying the planet and not the cows. Maybe people will continue to shop locally and maybe people will realise that they need to value our great British food producers.

Lambing has now finished and been successful. All sheep lambed outdoors in perfect weather conditions with most of the lambs still to experience what rain feels like.

I only assisted four ewes and had very few lamb losses. There have been a lot of cattle arriving over the last month. We’ve dropped from 300 ewes to 110 and increased cattle to more than 300 head.

Nearly all the cattle have been bought directly off-farm, mostly through our local co-op.

As usual, I think stores are too expensive relative to the fat price. Let’s hope we have a good BBQ season and prime prices rise.

Michael Shannon finishes 300 head of mostly Angus beef stores each year and runs 110 Scotch Mules on a 100ha forage-only enterprise near Biggar, Lanarkshire, as well as free-range turkeys for Christmas. Meat is sold through his online business and farm shop Damn Delicious, with surpluses sold deadweight.

JOURNAL : Farmers Weekly

“Hey, if you charged an entrance fee to the farm you could make a fortune. There are people everywhere!” This quip was from Georgina, one of our horse livery clients, as she returned from a hack round the farm. I think she was joking, but she is a financial adviser, so who knows?

I will not be setting up a turnstile, but we have started to engage more with the extra visitors by putting up some “lockdown learning logs”. These are laminated A4 information sheets which are tacked on to logs we have placed around the farm beside footpaths. They explain what we have just sown, what it is for, when it is harvested, what happens to the lambs.

See also: All you need to know about controlling wireworm in potatoes

Quite simple stuff, but judging by the feedback, it has gone down particularly well with parents who have young children to amuse and educate.

The Exlana ewes have all lambed now in perfect warm and sunny weather. Very few needed obstetric assistance and the lambs are growing on well in the diverse mix which includes Timothy, fescue, cocksfoot, red clover, sainfoin, plantain, chicory and yarrow.

I have given four surplus triplet lambs to a neighbour, Bertie, age 7, to kickstart his sheep enterprise. I am impressed to hear he is getting up at 5am to give them their first bottle of the day.

Hew has covered a lot of ground with the new Sly Boss drill, getting spring beans, barley, rye and linseed sown. We have been pleased at how the angled disc coulter got beans into hard ground at 3in deep. It is always an anxious time for the drill operator in the weeks following sowing to see how crops emerge, and in truth Hew probably didn’t need the extra pressure of me putting information sheets round the farm saying what crop was (hopefully) going to be in the field.

With six weeks without rain, emergence and growth has been slower than we would like, but fortunately, Hew seems to have inherited my broad shoulders and thick skin and, as I type, we have some welcome rain. Phew.

JOURNAL : Farmers Weekly

This past month has flown by. The weather has been amazing for lambing and first cut of silage.

As I write this, we are due to cut on 5 May. It looks to be a big crop and quality looks high, which will be the mainstay of our forage for the milking herd through winter.

We are onto the last handful of ewes to lamb, which has been brilliant. After the first cycle, there were only 36 multiples left to lamb out of 428, which is great going and should give us a consistent bunch of lambs in the autumn.

See also: 8 ways to prepare for a busy lambing season

The ewes have lambed very much unassisted, with very few issues and plenty of grass in front of them.

The milking herd are really performing now. We got back to predominantly 2019 first-cut silage and milk jumped up four litres in five days to 36.7 litres.

Milk quality took a slight nosedive, going from 4.1% fat down to 3.8%, but the total mixed ration has been adjusted and the quality seems to be rising again.

All landscaping is now complete around both the new sheds and the new slurry lagoon. We are just waiting for the grass seeds to grow.

We have been checking for a few weeks to see when the seeds will germinate, but because it has been so dry, the lack of moisture in the soil has delayed germination - they look to be coming now.

I hope everyone is staying safe in these uncertain times. I have the deepest sympathy for farmers supplying some processors severely affected by the milk crisis.

It must be heartbreaking to see their hard work literally going down the drain or being paid well below the cost of production.

Hopefully, some time soon, things will slowly start to open again, and everyone can get back to a slight bit of normality.

Farmers in general are lucky. We can carry on nearly as normal, whereas inner-city folk are stuck in a house or apartment with little or no garden or space.

I cannot imagine how that would feel.

Patrick Morris-Eyton is a Farmer Focus writer from Cumbria. Read his biography.

JOURNAL : Farmers Weekly

Bizarre is the only way I can describe Kansas ***agriculture*** at the moment.

Covid-19 has reached the meat packing industry and severe slaughter disruptions are starting to back animals up.

Simply put, there are no buyers at any price for finished animals.

See also: Coronavirus: Trump orders US abattoirs to stay open

The chief executive of Tyson Foods bought a full-page spread in The New York Times on 26 April.

In it he said: “In addition to meat shortages, this is a serious food waste issue. Farmers across the nation simply will not have anywhere to sell their livestock to be processed, when they could have fed the nation.

“Millions of animals – chickens, pigs, and cattle – will be depopulated because of the closure of our facilities. The food supply chain is breaking.”

There are many complicated issues regarding our supply chain and marketing, but I truly hope that our industry of 2021 looks different to the one of 2019.

It isn’t realistic that the next generation of producers (which I think I am part of) has any future in anything that looks like this.

We are doing what we can to weather the storm. Thank God for the rumen.

Summer grass growth is starting, so with some changes to stocking rates we don’t have to feed or sell a single animal until October. This gives us an advantage over chicken and pork producers.

Any other options we can take to cut costs, we are implementing. We usually AI every cow but will skip 150 older cows this year.

It isn’t so much about the cost of AI (which counts) but getting them to their summer pasture that doesn’t have facilities.

Our mineral programme isn’t as “high end” as last year and I also tried a new worming protocol where you don’t automatically treat every cow but leave the heavier conditioned and older cows. It will be repeated this year.

Our cows work hard for us in normal circumstances; this year we will have to ask them to work a little harder.

Meanwhile, there has been only one case of Covid-19 reported in our county. It was a healthy young man who has only lost his sense of smell – I’d like to find him and shake his hand.

Daniel Mushrush is a Farmer Focus writer from Kansas. Read his biography.

JOURNAL : Farmers Weekly

The past two weeks have been full on. In fact, I have been somewhat grateful for lockdown as it has meant there have been no distractions.

We have been able to take advantage of the brilliant weather conditions – which again seems hard to believe, given the winter we have had.

The slurry lagoon has been emptied and the sand dredged in record time. We then devised a plan to deal with our flooded maize ground that resembled a scene from the Second World War.

See also: Combines roll for severely delayed maize harvest

Two passes with a Sumo cultivator, followed by the roller and then straight in with a combination maize drill has worked nicely, and the last of that maize was sown on 27 April.

In my wisdom, I also decided that following the results of our grass samples and with a wet 10-day period forecast, it would be a good idea to take 40ha of first cut.

At the last minute the forecast changed, and we did first cut and maize over the same weekend.

The gamble paid off and, although the yields were on the low side, quality looks good and hopefully the aftermath will green over nicely. I am not a big tractor man, but I have to say, although I had limited sleep, I really enjoyed myself.

I would like to take this opportunity to thank our contracting teams – The Adams, Stevie Edwards and Pip Edwards – as well as our agronomist Ian Evans, for their hard work.

It is a rewarding time of year. Unfortunately, the news from Muller has been less rewarding.

In the space of three weeks we have been given a 1p/litre price rise (brilliant), followed three days later by a request to cut production by 3%, followed two weeks later by the 1p/litre price rise being rescinded.

It’s tough mentally to have to keep readjusting budgets and cutting costs with no indication of if, or when, the market may pick up.

I appreciate we are better off than some other producers, but I think the whole situation could have been handled better.

Let’s just hope this works in mitigating any long-term pain and that the rest of the year will not be as tough.

Read more about Shropshire farmer Henry Wilson.

JOURNAL : Farmers Weekly

I will ty to refrain from mentioning the dry weather, but we could certainly do with some rain very soon if the spring crops are going to come to anything.

Lambing has started with a bang. We have tried to group the ewes into a north and south district and split them between James our shepherd and myself.

James is looking after 800ish and I have 1,200ish about 25 minutes away.

See also: 13 tips for lambing outdoors

We have had one group of 160 ewes hit with a bad case of Campylobacter. The vet has advised to just ride it out and after lambing, disperse those ewes across the whole flock to get an immune response going before next year’s lambing.

Other steps we have taken have been to space out those ewes to try to avoid too much contact between them (more electric fencing) and pick up all afterbirth.

We are now into day 10 of lambing as I write and are certainly picking up fewer aborted lambs so we hope we are over the worst of it.

The Covid-19 situation hasn’t really affected us too much. Roads are empty and fuel is cheap which suits our style of lambing – but people are everywhere.

I appreciate everyone is trying to help, but when you see a picture of your sheep on a local resident’s Facebook page with the comment that it is “coughing, can’t find the farmer so should I call the RSPCA or a vet? Has it got corona?” it does make for stressful/comical reading.

It’s fortunate I can rely on Jo to log on and gently explain that it is probably going to be all right and to just leave it alone.

Grass is as good as we have ever had it. A pre-lambing rotation gave us a lot of early growth and Jo has planted a couple of herbal leys for the sheep in the arable rotation so we will be having Ben from Hyde Hall come in and throw up a few thousand metres of fencing for us there.

The hope is to try and get a few hundred lambs away early to stop so much pressure in finding food for ewes and lambs over winter if it rains.

See Rob and Jo Hodgkins’ biography

JOURNAL : Farmers Weekly

We’ve had no rain to speak of for six weeks. My default reaction was to moan incessantly, but that didn’t seem to do any good, either with the weather or my locked down family, so I’m now trying to think of how to react in the future.

More winter crops might be one way to go, but is the opposite of what we have been doing to combat grassweeds and we have been getting on well with cover crops for soil improvement, sheep grazing and stewardship payments.

See also: Why biopesticides will play a bigger role on arable farms

I also have solid fertiliser still on the surface a month after application and scorching from liquids, so another tactic might be to use some kind of delayed release fertiliser and apply the whole lot at the start of the season, but that might not be beneficial to plant or soil microbe health.

I was surprised when completing my annual Facts scheme exam to see urea fertiliser singled out as bad. The concern is volatilisation of ammonia and, while we do have to to minimise this, ammonium nitrate was touted as a better alternative. I don’t sell either, but maybe we should recognise that both have their pros and cons.

It is said that urea may lose 20% of its nitrogen via volatilisation, but if you look at the source of this information it appears this may only happen at 32C so perhaps is not too relevant in the UK?

Also, NIAB trials over many years find the same yields from both forms of fertiliser, so ammonium nitrate must be losing an equivalent amount, and scientific work estimates that N lost by leaching ranges from 40kg to 115kg of N/ha.

Added to this, ammonium nitrate can increase crops’ susceptibility to fungal attack and reduce their ability to uptake ***nutrients*** such as magnesium, manganese and zinc, especially on my chalky soils. As ever, a balance, rather than extremes may be the answer?

Andy Barr farms 700ha in a family partnership in Kent. See his biography.

JOURNAL : Farmers Weekly

With spring drilling done and dusted we have started inter-row hoeing our winter crops.

We focused on our winter beans first as they were particularly weedy. Most of the "weeds" are volunteer spring oats from harvest 2019 and so any that have escaped in the row will be harvested with the beans and then separated out on a gravity table after harvest. It’s this year’s unintended bi-cropping trial!

See also: Tips on getting the most from clubroot-resistant OSR varieties

We’ve also hoed all the winter wheat we managed to get in and started phase one of our living mulch trial which is my second attempt to develop an organic low till system. Our trial will run as follows:

In-between our 120mm crop bands we have 200mm of space where we have sown white clover at 7.5kg/ha comprising 80% AberAce wild white clover and 20% AberHerald which will remain in the ground for the rest of the rotation and possibly beyond.

The plan is then to strip-till the 120mm cropping rows and plant spring oats in early 2021 and so on. Lambs will be fattened on the clover to keep it in check before winter.

Organically I believe that we still need to be able to clean the crop rows as well as mineralise some of the ***nutrients*** we build up during the rotation to get our crops going, hence opting for strip-till rather than no-till.

I’m also concerned that having a living mulch across 100% of the field will compete for moisture and ***nutrients*** with my cash crop which I have seen in the past in thick under-sown leys.

I’ve got 10 months to find or make the machine to achieve that narrow 120mm strip.

We have the will so there must be a way.

JOURNAL : Farmers Weekly

As I write this the children have started lambing their Blue Texels again.

Unfortunately, a sub-fertile new ram left half their flock empty at scanning. Rather than running empty some later lambs will be a bonus.

Sadly, we have lost too many lambs with pneumonia and ewes with mastitis.

See also: Tips on tackling mastitis in sheep

The fantastic weather has had its drawbacks – largely the temperature difference between hot sun and frost. A high of 28C was recorded in one field while dosing lambs for nematodirus and that night the temperature dropped to -2C.

With all the sheep out at the beginning of April, all the sheds have been cleaned and manure spread on some maize ground – a first for us.

All the pens, buckets, bowls etc have been washed and dried. We were ready for a couple of farm visits that are now not going to happen.

The bulls have prepped up really well and are all behaving on the halter. All the work with the females over the years has rewarded us with cattle with lovely temperaments.

We don’t overfeed them, which means their feet and legs are good. On my foot-trimming round, I see a lot of young bulls that have been overdone, which is wrecking their feet.

No feet, no bull – it really is that simple.

All the lambs have had their second clostridial vaccine, so hopefully this will help to build their immunity going forward.

We put a preventative fly spray on all the ewes and rams. I haven't got time to deal with flystrike and it's not acceptable for our image.

The last hoggets and first January lambs sold well after a few weeks of market disruption. We didn't sell any last week due to another blip in prices, with more poor excuses from the processors.

British meat is selling on shop shelves. It might not all be fillet steak, but to ensure British farmers are still producing in five years a fair distribution of revenue is still essential.

We have had lots of walkers at the farm. Hopefully, they will really start appreciating what a beautiful place we live in and that it’s mostly created by farmers.

James and Belinda Kimber farm 850 commercial and pedigree sheep and 30 pedigree Simmental and Charolais cattle in Wiltshire across 95ha (45ha owned) with the help of their children, Josh, Izzy and Richard. James also runs a foot-trimming business and Belinda has a B&B.

JOURNAL : Farmers Weekly

The past few months have been pretty scary to say the least and really quite grounding for most of us, and I would like to thank all the frontline staff, especially those in the NHS, who take risks every day for the good and wellbeing of others. In times like these the real heroes come to the fore.

Being confined to the office or tractor cab is no real hardship so I’m going to keep my complaining to a minimum.

See also: Tips on getting the most from clubroot-resistant OSR varieties

The weather has almost been predictable – going from far too wet to far too dry in about three weeks.

We didn’t manage to get drilled up as one of our heaviest blocks of land had completely lost its structure and was basically three inches of concrete on top of six inches of cold wet clay and with no possibility of creating a decent seed-bed.

And as I’ve alluded to in the past, spring crops on heavy land are very unforgiving of poor seed-beds.

We did, however, manage to get 400ha of both spring barley and beans drilled, and on the whole I’m happy – although the beans are, ironically, desperate for rain.

I have to say lockdown has been a hugely productive time in the Challen household, all windows facing south have now been occupied by various plant pots and trays as veg and flower production is in full swing.

One of the stables has been converted to a gym, although I consider this a rumour as I still haven’t ventured in yet in fear that I may get challenged by young Master Challen to pump iron or cycle 50km.

The kitchen has been converted to a “For Farmers” office as Harriet is working from home and although additional quality time with the kids is great, without doubt the best bit has been the huge increase in home baking, with fresh cake nearly every day.

Every cloud has a silver lining. Finally I'd like to say I'm glad to see Boris back at the helm and wish him and his family well.

JOURNAL : Farmers Weekly

What a rollercoaster the past five weeks have been.

Having my three-year-old come to work with me every day has got to be one of the most fun and the most exasperating experiences.

I’m sure many of you can relate. Although it’s a juggling act, I am grateful to be spending this time with him and appreciate how lucky we are to have the farm during these crazy times.

It’s certainly become clear that we are all weathering the same storm, but in very different boats.

Thankfully, the pig business has not been adversely affected so far. In fact, we have seen an increase in demand from local outlets and the Standard Pig Price (SPP) reached 164p/kg for the first time since 2017.

See also: Coronavirus: Farms advised to use face masks

Retail has seen a big uplift in sausage and bacon sales (up 48% and 18%, respectively, for the week ending 12 April), to the detriment of fresh pork (total roasting joints down 63%).

AHDB has just launched another campaign to promote pulled pork; hopefully driving some more fresh sales and taking some of the burden from cold stores.

Unfortunately, our European counterparts aren’t doing so well, with Germany seeing a 9% in their pig price, which is at an equivalent 153p/kg.

This has had an effect on UK cull sow values and leaves open the possibility of cheaper continental imports sneaking their way back in.

On the flip side, the poultry business is seeing some pressures. We have three broiler breeder farms, supplying fertile hatching eggs.

Although retail of fresh chicken is up 10-15%, this is not enough to offset the decline in foodservice. This means that some flocks are being culled early and others brought into lay late, at huge cost to all in the supply chain.

With a new flock coming in next week, I am pretty nervous, to say the least.

In some more positive news, the National Pig Association’s farrowing crate survey unearthed that 43% of respondents would leave the industry if there was a ban, so they have been lobbying tirelessly on our behalf.

Defra ministers now want to work with us to phase out farrowing crates, rather than a complete ban, which is a welcome shift in mindset.

Sophie Hope is a Farmer Focus writer from near Cheltenham. Read her biography

JOURNAL : Farmers Weekly

Farmers have been advised to apply now for an ***agricultural*** dispensation for wide-vehicle movements, well before the harvest period begins.

The call was made by NFU Scotland (NFUS), which warned that the application process could face delays due to the effect of the Covid-19 pandemic on staffing levels.

The union said farmers should apply to Police Scotland’s Abnormal Loads team for dispensation or a renewal at least six weeks before the paperwork was needed.

See also: Farm vehicle use – are you insured?

Abnormal load dispensations are required if a vehicle or implement are more than 3m wide and/or any part projects more than 4m.

Any equipment that exceeds these dimensions or may exceed them with an implement attached should be included on the dispensation.

NFUS transport adviser Jamie Smart said: “There have been no derogations during the pandemic for moving ***agricultural*** wide vehicles on the roads, so it is important to obtain a dispensation from Police Scotland.

“Like all businesses, the abnormal loads office at Police Scotland are having to practise social distancing, which may slow down applications.”

Mr Smart advised farmers that they must carry a copy of the dispensation document in the relevant vehicle in case they are stopped by Police Scotland.

In England, farmers are also advised to contact police well in advance of needing to transport wide vehicles.

Vehicles affected include those more than 3m wide, travelling on roads with a speed limit of 40mph or less, or those travelling distances of five miles.

Alternatively, annual dispensation can be granted by most police forces, particularly at harvest time. The document must be kept in the vehicle at all times.

Farmers should contact their local force and notify them of the vehicle details and areas it will travel within.

Further information

Scotland

Dispensation forms are available via:

E The NFUS website

E Phone 0131 472 4000

E Email: [*info@nfus.org.uk*](mailto:info@nfus.org.uk)

Completed forms should be emailed to:

[*OSDAbormalLoadsScotland@scotland.pnn.police.uk*](mailto:OSDAbormalLoadsScotland@scotland.pnn.police.uk)

England

Advice on moving abnormal vehicles is available on the government’s website

JOURNAL : Farmers Weekly

Farmers should be reworking cashflow projections for the next 18 months in the run-up to Basic Payment Scheme (BPS) payment reductions, say advisers.

Volatility on the back of the coronavirus pandemic and lack of clarity on the UK’s EU exit terms also mean business planning needs more attention to identify cash crunch points, said Bradley Hurn, of consultant Brown & Co.

For many arable businesses, this will come in spring 2021, he said.

Those tendering for annual grazing or cropping ground or for longer-term lettings need to factor this into cashflow plans and tenders that BPS is going to start to fall from the 2021 payment.

“Some combinable cropping FBT [farm business tenancy] tenders have been at the £200/acre mark and that doesn’t stack up,” said Mr Hurn. “The tendency to spread that cost across the whole cropped acreage is not the way to justify it – that additional land has to contribute to profit.

“A lot of 2019 grain was sold before Christmas at £130-£140/t – not an exciting price, but the big yields mitigated the relatively low price to some extent.

“However, the big yields have not created a large enough cash surplus to help with the potentially poor harvest of this year.”

New crop budgets

Turning to new crop budgets, the large expected carryover of barley into the new crop year on 1 June, combined with a big rise in the spring barley area for 2020, mean growers should be budgeting on the basis of there being no malting premium, says Mr Hurn.

“Our gross margins for average Grade 3 land are worked on a flat price of £115/t for harvest movement of feed and malting barley.”

Harvest 2020 gross margins

Spring barley (malting and feed)

Spring wheat (feed)

Winter wheat (feed)

Yield (t/ha)

6.2

6.5

8

Price (£/t)

115

155

155

Output (£/ha)

713

1,007.5

1,240

Seed (£/ha)

75

75

75

Fertiliser (£/ha)

140

180

210

Spray (£/ha)

125

140

180

Sundry (£/ha)

10

10

10

Total variable costs (£/ha)

350

405

475

Gross margin (£/ha)

363

602.5

765

Source: Brown & Co

The new Environmental Land Management (ELM) scheme will take years to fully deploy, so lower BPS sums should also prompt a review of structures.

On many farms, such a review could lead to a joint venture. “We’re definitely doing more arable labour and machinery joint ventures than we were five years ago, and there is a lot of scope for more,” says Mr Hurn.

“It’s not for everyone, but there are still big savings to be made, reducing investment in kit, releasing management time and using labour more effectively.” Such a change can also give a business the skill, ambition and/or the confidence to try new crops or markets, he said.

Livestock plans

Livestock producers often rely on putting a large number of stock through an individual autumn sale, but they might want to be wary of doing so this year, said James Brown of the same firm.

“Trade has been very volatile and splitting between two or three sales might be advisable to mitigate the effect of a bad day and even out the cashflow,” he suggested.

Equally, depending on what progress the UK has made on its coronavirus journey, the autumn sales calendar may be disrupted.

Autumn sales calendar may change

“There is a risk that a lot of 12- to 18-month old cattle may be for sale at the same time in the autumn, partly through disrupted sales and partly because low prices may have encouraged producers to hold on to stock they would usually have sold.

“Buyers, in turn, may feel constrained if beef and sheep prices have not improved over the summer,” said Mr Brown.

Markets are also being affected by smaller abattoirs reducing or changing their killing days, which is affecting buyer numbers at auction.

“As with the store and breeding stock, perhaps consider taking smaller batches of finished lambs or cattle in more often to reduce risk and smooth cashflow, where possible.

“Some might want to plan a split lambing next year to catch the early market with part of the flock – it brings higher creep costs, but higher market prices.”

Work out payment plans

Smoothing cash outflow can also be addressed. Contractor’s charges are often one of stock farmers’ biggest single bills and their timing is often out of kilter with income from sheep or beef sales.

“We have found many contractors are willing to work out a payment plan,” says Mr Brown.

“You agree the likely bill for the year and split it into 12 equal instalments, or as many as you agree suits both parties’ cashflow, with any difference being made up in a balancing charge at the end of the year.”

With a big drop in the wheat area for 2020, feed wheat prices could rise and new-crop barley prices are under pressure. The gap between the two could make barley worth considering in rations as long as the nutrition is right.

The smaller wheat area may lead to higher straw values for harvest 2020. Some producers with cash flexibility have bought stocks now to carry over into the winter, said Mr Brown, who suggested budgeting for a rise of 25% in straw costs compared with 2019 levels.

Business review pointers

Is business structure correct? An arable or livestock joint venture could reduce risk, improve profitability, bring in new skills, release management time anA can start small.

Family labour Are time and costs being realistically accounted for? Is that labour being used to the best purpose - someone currently working on the farm may want to work elsewhere.

Are borrowings correctly structured? Review this and get advice.

Does the overdraft include a hardcore element that is always there? The business risk of interest rate changes and the "repayable on demand" aspect of overdraft borrowing can be reduced by putting that hardcore element onto a loan footing. This also imposes an element of repayment discipline.

Many of the banks are agreeing capital repayment holidays, but plans need to be in place straightaway for how these payments will be made in future, in addition to what will become due in the meantime. There will also be extra interest on the deferred amounts.

With banks heavily involved in administering government-backed coronavirus loans, lending decisions may well take longer than borrowers want them to.

How is the livestock market changing? Are breeds those most suited to the farm? A change to more traditional breeds can mean easier management and lower labour costs.

JOURNAL : Farmers Weekly

Lambing can be a challenging time, but it’s also one containing magical moments – especially when the younger generation get involved.

Thanks to all the Farmers Weekly readers who have found time to share their snaps in our Lambing 2020 gallery.

See also: More pics in our Lambing 2020 gallery

You’ve uploaded fantastic photos of your children, grandchildren and other relatives lending a hand and, in some instances, getting their first insight into this busy time of year.

Here’s our final round-up of your shots from this year, showing some of the joy and awe that kids feel when encountering – and working with – lambs.

Definitely some fantastic budding shepherds here, we reckon.

To share your photos, go to Lambing 2020 gallery

Feeding time

Bale break

Hang on tight

Lambing in style

Happy helpers

Siblings smiling

Passing on the wisdom

King of the castle

Super stockman

Homework

Twin triumph

Hold on tight

JOURNAL : Farmers Weekly

Vending machines selling milk, cheese, meat and other staples are helping to #feedthenation and keep people safe during the coronavirus lockdown.

At a time when person-to-person contact must be kept to a minimum, vending machines selling produce directly from farms are coming into their own, offering 24-hour service and card-only payments.

Dairy farmers Matthew and Coral Senior are working hard to supply organic milk directly to the local community in south Somerset via three 24-hour vending machines located at North Perrott Farm Shop, John Bright Country Store near Salwayash, Bridport, Dorset, and Odcombe Village Hall near Yeovil, Somerset.

See also: Map: Where to buy milk direct from farm

The service also has an environmental benefit, as customers are filling reusable glass bottles, creating less plastic waste.

Their Holy Cow Organic milk is simply pasteurised, cooled and ready to drink, so there is no heavy processing and no food miles. It costs £1.30 per litre and is never more than 48 hours old.

Social distancing

The machines are cleaned at least four times a day and customers are also offered hand sanitisers. Strict social distancing measures are in place, on a one-in, one-out basis.

“A lot of local shops have closed in our area, so we started the vending machines over 12 months ago to bring a little bit more to the community,” said Mr Senior.

“They have fallen on their feet since the coronavirus. People who have been self-isolating can just pop out and buy a few staples without having to travel very far.”

Fen Farm Dairy, in Bungay, Suffolk, has been operating vending machines at the farmgate since 2011.

Dairy farmer Jonny Crickmore said the machines have been a huge success and sales had trebled since the start of the coronavirus pandemic. He is now having to restock the machines often twice daily and also operates a one-in, one-out policy.

Raw milk coffee

Their raw milk coffee machine is brewing 24/7. “It’s completely self-service and there’s hand sanitiser for you to use. Plus our cups are totally compostable,” said Mr Crickmore.

The farm also sells raw milk and butter, its own Brie-style Baron Bigod cheese, produced from raw milk from the farm’s Montbeliarde cows, bread and meat.

Panic buying led to supermarket shortages of eggs, especially at the beginning of the coronavirus crisis. But farmers have been able to meet demand by selling eggs from the farm gate.

Gate Farm Eggs, based in Flowton, Ipswich, Suffolk, says their vending machines selling free range eggs are now in constant use.

Being open “from dusk until dawn” allows key workers to purchase eggs after shifts from a safe environment, which also poses no threat to staff.

“Demand for locally-produced, good quality free range eggs is on the increase and although our gate sales have always been high, the popularity of home-baking during lockdown has meant a soar in sales recently,” said Joe Watkins, from Gate Farm Eggs.

British Lion donates eggs to NHS workers

British Lion is donating eggs to the HelpNHSHeroes initiative which provides food boxes for health service workers.

HelpNHSHeroes has been trialled in pop-up shops at two NHS hospital sites, the Lister in Stevenage and the Royal Berkshire in Reading, selling boxes to workers.

Following the successful trial, there are plans to scale up to national distribution to more than 40 hospitals across the UK.

The boxes provide meals for a family of four for two days, and cover all nutritional needs, such as protein, carbohydrates and fruit and vegetables. They will be sold on a non-profit basis for £30.

NHS staff can place a food box order for ***collection*** at the end of their shift using a phone app. Meanwhile, shift workers completing back-to-back shifts are being offered free breakfasts as part of the scheme.

JOURNAL : Farmers Weekly

An Essex farming couple are keeping elderly and vulnerable people fed during the coronavirus lockdown – by using a tractor-trailer to deliver food to their doorsteps.

G & J Barron Farms, based at Pattocks Farm, Chappel, was asked by residents if it would open its farm shop – normally operating only at Christmas to sell turkeys – as the supermarkets were running short on supplies.

Arable and turkey farmers Ross and Sarah Barron considered the request but decided reopening the shop would risk spreading the virus to staff and locals, as it sits in the middle of the yard.

See also: Farmer, 86, working every day to #FeedTheNation

Instead, they decided to dust off their 1963 red vintage Massey tractor and trailer and start home deliveries of staple local foods, including meat, fruit and veg, eggs and honey.

Mrs Barron told Farmers Weekly: “We rear free range turkeys for Christmas and open a farm shop for three days selling everything you need for a Christmas dinner, including other meats, vegetables, etc.

“I said to my husband, why don’t we just put everything in a trailer and deliver it to locals round the villages? It has gone from there.

“We sell a range of foods from our farming neighbours, including free-range eggs, pork and strawberries.”

Mrs Barron takes the produce around the nearby villages of Great Tey, Little Tey and Aldham, just outside Colchester. Many of these villages no longer have local shops and they are home to a number of elderly residents.

Social distancing

Payment is by card, and orders are linked Mrs Barron's phone so that she can observe government guidelines on social distancing. Locals also have to use the hand sanitiser provided before they select their produce.

As well as providing a vital food delivery service, for some residents Mrs Barron may be the only person they see all week. She is able to box up produce and deliver to the doorstep for those who are isolating.

Street names where deliveries will be made are posted in advance on the farm’s Facebook site. Residents are asked to leave a shopping bag on the fence or gate to request the tractor to stop.

Mrs Barron said: “I am working 12- to 13-hour days, basically until the sun sets. It’s a lot of work, but it’s very rewarding. People are so happy to see you.

“They have asked me to continue after coronavirus. I may do something. I haven’t decided yet.”

Great Tey resident Charlie Saville told BBC Look East: “It’s a brilliant system. Really good. And hopefully, very supported by the village.”

JOURNAL : Farmers Weekly

Morrisons has launched a food box packed with British produce to help farmers struggling with the loss of the food service market.

The 10kg box includes meat, vegetables, milk and cheeses produced in the UK, and £1 from every sale will be donated to the Prince’s Countryside Fund (PCF), which is co-ordinating donations on behalf of Farming Help charities.

It follows other supermarket promotions to help farmers deal with the drop in demand for more premium produce, which would typically be destined for restaurants.

Claire Saunders, PCF director, thanked Morrisons for backing British farmers and providing much-needed support.

See also: Supermarkets step up steak promotions to help farmers

“This contribution will allow us to support farming groups across the UK - including the five Farming Help charities.

“It will also ensure that British farmers have the support they need through this difficult time to keep producing healthy, nutritious food for our tables.”

The box costs £45 and includes rib eye steaks and pork loin steaks.

David Potts, chief executive of Morrisons, said: “Being the biggest customer of British farming, we want to help farmers while also playing our full part in feeding the nation.

“Our farmers produce some of the world’s finest meats, vegetables and cheeses, which we want to offer to our customers.”

Steak promotions

Marks and Spencer launched a 100% British meat food box, which includes Aberdeen Angus casserole steak and rump steak.

Waitrose, Lidl and Aldi have all stepped up promotions on steak products to help beef farmers. Waitrose has offers on selected pre-packed and meat counter steaks in May and June.

The AHDB has launched a campaign which aims to inspire consumers to create restaurant-style meals at home, using high-quality cuts from British beef.

The levy board has been sharing easy recipes to try in the kitchen.

A kick of " from quick chilli butter and a whole lot of flavour from the steak. This delicious 20-minute steak with chilli butter is just one of the recipes we are sharing with our fans on Simply Beef and Lamb #MakeItSteak #SteakNight

Check it out ' [*https://t.co/8QZWh5yQqI*](https://t.co/8QZWh5yQqI) pic.twitter.com/NJrDCLs9t3

AHDB (@TheAHDB) May 9, 2020

JOURNAL : Farmers Weekly

Morrisons has announced a series of measures to say thank you to British farmers helping to #FeedTheNation during the coronavirus pandemic.

The Bradford-based supermarket chain is offering a 5% discount to its 2,700 farmer suppliers when they buy their own groceries.

The initiative aims to support its hardworking farmers and their families and will run until at least mid-July, when it will be reviewed.

See also: Coronavirus: Prince praises farmers who #FeedTheNation

Those eligible for the discount include livestock farmers supplying lamb, beef and pork, fruit and veg growers and egg farmers supplying Morrisons direct, and dairy farmers with a Morrisons contract.

The retailer will also open a summer “BBQ and Steak Bar” in its stores from Thursday 30 April – providing another fillip to struggling British farmers and promoting a wider selection of steaks, joints and seafood.

Morrisons chief executive David Potts said: “This is a difficult time for the nation and it’s a very difficult time for farmers.

“We’re the biggest supermarket customer for British farmers and they continue to provide very good quality British food in the face of very real challenges.

“We want to show our thanks for all their work in feeding the nation and encourage our customers to buy British food.”

Trade affected

Customer demand and industry prices for certain foods have fallen dramatically since the lockdown started – as one-third was destined for the restaurant and catering trade, which has temporarily closed.

Meat producers have been unable to sell certain products, including high quality steaks and joints that would have been destined for the restaurant trade.

Morrisons has 494 stores serving 12 million customers each week. It is British farming’s biggest supermarket customer and its own-brand fresh meat is 100% British.

Will Jackson, AHDB Beef & Lamb strategy director, said: “The summer BBQ and steak bar approach supports and neatly sits alongside other industry promotional activities including a social media campaign to encourage shoppers to enjoy #steaknight.

“As we move from spring into this summer, in particular shoppers may well be looking for a treat and what better than fantastic beef and lamb.”

JOURNAL : Farmers Weekly

Dairy processor First Milk has announced its member milk price will be held at the current level for June 2020.

It means the price for a liquid standard litre will remain at 26.75p/litre and its manufacturing standard litre will be 27.63p/litre.

Despite the price hold, the farmer-owned co-op’s vice-chairman, Jim Baird, warned of continuing uncertainty in dairy markets.

See also: Dairy farms to get up to £10,000 to offset coronavirus cost

Mr Baird said food service sector demand had fallen sharply since the coronavirus lockdown began.

“It remains hard to determine what the total impact of Covid-19 will be on dairy markets in the UK or globally in the months ahead,” he added.

First Milk’s price hold comes after Meadow Foods announced a price cut last week.

Meadow Foods told its suppliers on 30 April that the weakened market had forced it to cut prices for a standard litre by 1p/litre to 25p/litre in May for its Cheshire and surrounding milk fields, and by 2p/litre in Cumbria, Lancashire and south Wales to 22p/litre.

Chief executive Mark Chantler added that the June price would not be announced until later this month due to an uncertain market outlook.

“We will be leaving any price announcements until later in the month, to give us as much visibility of the market ahead as possible,” Mr Chantler said.

Gloomy dairy outlook

Looking ahead, AHDB Dairy suggested the EU milk price equivalent was expected to decline in the coming months in line with the downward trends in butter and skimmed milk powder pricing.

The sector board's senior analyst, Patty Clayton, said: "With stocks expected to build for these products, and global demand to remain subdued, these trends are likely to continue over a longer period."

Ms Clayton added that the coronavirus pandemic had caused a downturn in forecast production.

Suggested milk production across the EU-27 was likely to be lower than earlier predictions due to the pandemic, she said.

Milk production is projected to expand by a modest 0.4% in 2020, similar to 2019 increases.

This is less than previously forecast, as growth in yields could be limited by compound feed shortages, processor-driven milk reduction schemes and the potential drop in the size of the dairy herd, Ms Clayton explained.

JOURNAL : Farmers Weekly

When it’s a hot May day, too windy for spraying or that last dose of liquid fertiliser, there’s only one place to be: on the very top of the combine, wielding a weedy pressure washer.

It’s the perfect place for some solemn contemplation and reflection on the state of the farm.

In many ways, it’s like being the cartoon guru dispensing wisdom on the sharp peak of the mountain – not least because of the effort involved to get there: up the side steps, over the engine (still giving off a delicate aroma of toast after last year’s close-thing fire), and carefully on to the grain tank.

See also: Read more from Charlie Flindt

And then, giving thanks that you remembered to turn on the power before setting off on your Snowdonesque ascent, you get to work, making sure the low-pressure blast scythes through the black dust but leaves the paint untouched.

Enjoy this bit – once you start on the mechanicals, most of it comes back in your face.

Peer pressure

Pressure washing combines was thoroughly disapproved of in my youth – “you’ll get rust in the seams!” was the cry.

It was done with a hosepipe and a hand brush. Mind you, we had men back then, and three weeks to spare.

When the shoulders need a rest, it’s a great chance to survey much of the farm from an unusually lofty viewpoint.

To the south-east is the one field of oilseed rape to have survived – and I’m getting a bit fed up with it.

One week it’s a write-off, and I’m on the point of ploughing it in. Then, suddenly, it’s off again, flowering and getting off the floor.

On goes the last bit of fertiliser, and it promptly goes all goth teenager.

Tod the Cropdoctor agrees that it only justifies a cheap ’n’ cheerful mix of insecticide and fungicide – and it promptly explodes into life again.

To the east is my fertiliser tank, sitting empty, waiting for the last lorry load. It should, of course, be topped up and ready to use, but in the glorious chaos of the past six weeks, my sophisticated ordering system (don’t laugh) has gone to pieces.

Look to the west and you’ll see why; there’s good wheat, bad wheat, late wheat, early wheat – and often in the same field.

Trying to work out a detailed fertiliser policy for that lot – while trying to sow and spray the rest of the farm – has been a bit of a challenge.

As usual, I’ve been doing WICWIC farming – what I can, when I can. So far, the weather had been really kind, with regular bursts of hot rain letting the nitrogen get to work quickly – but then you blink, and it’s time for more.

To the north is the old Conder Bin storage barn, unused for decades.

Ten 50t capacity boxes, bolted together, with an intake pit, cleaner, and a Cyclone fan with heater banks, designed to dry the crop (and empty the bins) through the ventilated floor.

1970s style

I’m not sure I’d dare press the star-delta button now though. Dad put it up in the 1970s, after a bumper grass seed crop, but now it sits rather sadly waiting for something – anything – to be done with it.

A few months ago, I put out feelers for demolition and replacement. Ouch. “It’s the asbestos, you see.” Not this year.

With shoulders rested, it’s back to pressure washing.

It’s quite comforting to see the farm in its usual state: not brilliant, hardly spic-and- span, and certainly not good enough to drive visitors to ascend my New Holland-shaped mountain in search of farming wisdom and knowledge.

But it’ll do.

JOURNAL : Farmers Weekly

Sometimes the most significant stuff pops up in the most unlikely of places.

For instance, you’d hardly think that a Defra publication from December last year called Farming ***Statistics***: Final crop areas, yields, livestock populations and ***agricultural*** workforce at June 2019 – United Kingdom would cause a frenzy of excitement.

It’s hardly the latest Harry Potter, Harold Robbins or yet another of the Fifty Shades series – although I suppose it does detail the results of a damn good thrashing.

See also: Read more from Charlie Flindt

But for those of us who are into that sort of thing (analysing harvest yields, not a damn good thrashing) it contained some very important ***statistics***, and all helpfully and neatly laid out in a graph – it’s on page five of the PDF. It shows yields of wheat, barley and oats over 20 harvests.

The message is simple. Over two decades, yields have been creeping up nicely, then dipping for two harvests before surging back up to a new high last harvest.

It backs up exactly what I, and many other farmers, saw from the combine cab, and explains the initial and inevitable drop in prices just after harvest.

Harvest hoo-ha

What’s the significance – why is it so exciting? Well, it is me to me, anyway. You see, when I’m not arguing with vegans online, I’m arguing with “soil catastrophists”.

They are a very vocal brand of eco-warriors, and they spend their time bashing modern farming on the rather dubious claim that we spend our time destroying the very thing that makes our farming possible: our soil.

You’ll recognise their arguments: the soil is being washed away at an alarming rate, the soil has been rendered toxic or sterile by years of industrial farming, to the extent that only pouring on more chemicals will give a crop, and as a result, we only have five (or is it 10, or is it 15?) harvests left.

Making a positive counter-argument for modern chemical farming is easy, but it falls on deaf ears.

Somehow, having 36 years of hands-on farming experience and a respectable ***Agricultural*** Engineering degree (which included some proper technical soil science taught by proper, if barking mad, soil scientists) is trumped by reading The Guardian, watching Countryfile, and harvesting echo-chamber opinions at SW1 twatterati dinner parties.

Back to earth

I invite them out to my farm – all the soil is where it was when we arrived 60 years ago.

I try and tell them about Liebig’s Law – you don’t get good yields from poor soil, no matter what extra chemicals you “pour” on.

And I try telling them that we do indeed test, nurture, protect and cherish our soils, and they are actually in very good health.

And the “5/10/15 harvests left” prediction will be as accurate as the others eco-scares that get ceremonially ridiculed every “Earth Day”.

But the catastrophists will never take the word of a “chemical junkie farmer”.

Well, thank goodness for Defra (and there’s a phrase I never thought I’d use), and its factual and unemotional analysis of the state of UK arable farming, written and illustrated in the clearest and simplest terms.

Yields are on the up, and have been for two decades. We are looking after our soils.

Having said all that, there is a fourth line on the Defra graph: it shows the oilseed rape yield, and it bucked the trend quite dramatically last year.

There’s a wonderful irony there; a crop’s yield has plunged after farmers were forced to stop using a key chemical following active and vociferous green campaigning.

Good thing Defra is too diplomatic to point that out.

JOURNAL : Farmers Weekly

It’s slightly embarrassing to have to ask – and let’s keep this between ourselves, shall we? – but does anyone know where I can get hold of new steering wheel for my 2018 Massey 5713S? I need a new round one to replace one that, unfortunately, isn’t.

I would go to my dealer, but they’d probably produce the “Blimey, we don’t sell many of those!” line – and then ask how it happened. I could try bluffing and say it was a mysterious spontaneous breakage, and try yet another just-out-of-warranty claim.

The first problem with that plan is that I’m a terrible liar, and the second is that I have already drawn heavily from the deep well of just-out-of-warranty goodwill claims – it might be running dry.

See also: Read more Flindt on Friday

Insurance assessment

Even going to NFU Insurance for a claim could be rather humiliating. They’ll take one look at the details of the “incident” and write a nice formal letter consisting of two words, the second one being “off”. You wouldn’t blame them, and here’s why.

I bet this isn’t the only farm where odd jobs are being done that would normally get procrastinated into eternity. A couple of Saturdays ago, arable work was nicely up together – a genuine opportunity to lock the tractor barn and and what, exactly?

In my case, it’s eat. While other unfortunate folk are using their lockdowns for intensive yoga, interior decorating or buffing up their Swedish (as in the language, not the au pair), I’m scoffing. All that weight lost after the hip op, back on again.

The only solution is to unlock the barn and get back in the tractor. “I know”, I thought. “I’ll take the loader and grab, and push some of this winter’s fallen trees back off the tracks.”

I had a very jolly afternoon doing some “public good”, and making mental notes of the next supply of firewood. All that lovely ash – although the fact that so many of them are coming down is worrying.

I got the last one done, and headed home via the track next to Clump, closing up the grab as I went. The sky was blue, the birds were singing, the bluebells were out, the wheat looked lovely, spring had most definitely sprung most stunningly – and at that very moment, the tractor stopped dead.

I wasn’t closing the grab; I was pressing the wrong button on the joystick, and lowering an open and slightly downward-tilted grab to the dirt. Result: 10kph to 0kph in a scary millisecond.

Seventeen stone of finest Hampshire beef (that’s me, by the way) failed to stop. I don’t remember much about it – just a strange bewilderment.

Hobnob airbag

My left thumb hurt like heck, as did my teeth, and my lower ribs felt like they’d been hit by an iron bar. I gave them a good poke (as props do after losing a scrum), thinking, “no, not hospital, not now, please!” All seemed sore, but intact.

Once I’d gathered my senses, I realised that the “iron bar” was the steering wheel, and it had acted as a mini-crumple zone. It was now a very odd shape.

Thank goodness, too, for all the cheese, ginger beer and Hobnobs; the perfect inbuilt “airbag”, protecting my ribs. And the next thing I did? Check, of course, that no one had seen me do it.

It’s not the sort of tale to tell the dealer or the insurance company – a tale of complacency and idiocy at the tractor wheel, which once was round, but now isn’t. So, if you’ve got a spare one, pop it in the post.

JOURNAL : Farmers Weekly

Wheat consumption for flour production could drop by about 152,000t between April and June despite a surge in home baking brought on by the coronavirus lockdown, the AHDB has said.

The estimated figure would put consumption about 13% down on five-year averages for the market, according to AHDB senior analyst James Webster.

With uncertainty remaining about how long the lockdown will remain, he used a range of consumption reductions between 5% and 15%, and varied the lockdown end date between May and June.

See also: How to make sure you hit protein target for milling wheat

"Overall wheat consumption for milling is likely to be down between 36,000t and 171,000t, with a best estimate of being nearer the higher figure," Mr Webster calculated.

Mr Webster added that this could be added back into the balance sheet as carry-over stocks and add “a modicum of pressure to late-season prices”.

He explained that the fall in demand was due to coronavirus lockdown measures, which were having differing effects on the main markets for flour – pre-packed for household use and retail bread and foodservice consumption.

Pre-pack/household use

According to figures from Nabim, the UK flour trade body, total annual demand requires about 4.2m tonnes of British wheat and 800,000t of imports.

Normally, about 4% of that is sold in 1.5kg packs for household consumption and about 2m of these are packed each week.

Since the lockdown measures were introduced, demand for packeted flour has more than doubled.

However, even with mills and packaging sites running 24 hours a day to produce 4m packets, there is insufficient capacity to meet household demand, Nabim said.

Mr Webster calculated an additional 14,500t of flour had been produced for retail sale, equivalent to an additional 18,200t of wheat consumed.

“Assuming this trend continues to the end of the season, an additional 37,900t of flour would, in theory, be produced for retail sale, equivalent to about 47,300t of wheat,” he reckoned.

Retail bread and foodservice consumption

While the household consumption is relatively simple to work out, the retail and foodservice sectors are more difficult to analyse.

Nabim say there is considerable overlap in output from bakeries that can supply both food service and retail outlets.

Collectively, they make up the remaining 95%, with roughly 70% of that going into food service and 25% into retail.

Further confusion surrounds closures as not all businesses, such as takeaways and other retail outlets, have shut down, Mr Webster said.

JOURNAL : Farmers Weekly

Better food security could be one important outcome of the coronavirus pandemic – which has highlighted the determination of British farmers to feed the nation.

MPs investigating the impact of the pandemic on the UK's food supply chain are expected to recommend steps to make sure people have better access to sufficient healthy food.

See also: Coronavirus: MPs probe threat to food supplies

Members of the House of Commons environment, food and rural affairs select committee held their first public evidence session as part of its inquiry on Tuesday (5 May).

Speaking afterwards, Keighley MP Robbie Moore told Farmers Weekly he believed the government must ensure UK food security and supply chain resilience.

Under scrutiny

He said: “We need, as a scrutiny committee, to make sure Defra does have those plans in place to ensure that food resilience is there now but also going on into the future.”

Mr Moore said the inquiry was an ideal opportunity for MPs to ensure food security and resilience was at the heart of Defra's thinking and policymaking.

Jack Ward, chief executive of the British Growers Association, said demand for food was “like the Christmas rush without any warning” ahead of the coronavirus lockdown.

“If this crisis has done one thing, I think it has partly restored the pride that farmers and growers have in producing food,” Mr Ward told the inquiry.

Wake-up call

“Suddenly, the nation has woken up to the fact that when all is said and done, food is absolutely critical and [producing] it is dependent on lots and lots of people.”

NFU president Minette Batters told MPs it was vital to keep food supply chains functioning so they could continue to feed the nation when the pandemic was finally over.

“We are only just starting this journey – it is not all going to be sorted. Lockdown is obviously going to be a very phased approach and who knows what that looks like.

“The new normal is going to be quite long lasting, so we are going to have to keep working at how we keep these living supply chains focused so we don't lose sight of British sourcing.”

JOURNAL : Farmers Weekly

The start of post-Brexit trade talks between the UK and US has prompted renewed warnings that British farm standards must not be undermined.

Talks between UK international trade secretary Liz Truss and US trade representative Robert Lighthizer are due to begin on Tuesday (5 May) via video conference because of the coronavirus pandemic.

See also: NFU20: British farm standards must not be undermined

The government has pledged that any agreement will not compromise the UK's high environmental protection, animal welfare and food standards.

But farm leaders want a clear statement that any food imports will not be produced using methods that would be illegal in the UK.

This would mean a ban on imports of chlorine-washed chicken and hormone-treated beef – both practices are allowed in the US, but banned in Britain.

Threats and opportunities

The Country Land and Business Association (CLA) said a potential trade deal offered both opportunities and threats to UK growers and livestock producers.

The US is a huge market and a free-trade agreement would give American consumers the ability to enjoy world-class British food produced to very high standards.

CLA president Mark Bridgeman said: “Our farmers grow some of the best produce in the world.

“Food and drink businesses are well placed to capitalise on growing demand and new markets abroad. They should be at the heart of our future trade talks.”

Conform to standards

Like other farm leaders, Mr Bridgeman said the US must conform to UK standards if it wanted greater access to the UK market for its own produce.

He added: “Allowing food produced to low animal welfare and environmental standards to undercut UK farmers is unacceptable.

“The UK government has repeatedly issued warm words in this regard – but it must go further and legislate to protect UK farmers in all future trade deals.

“Maintaining food standards needs to be part of the ***Agriculture*** Bill.”

According to the UK government, eliminating tariffs and reducing other trade barriers with the US could boost the economy by between 0.07% and 0.16% over the next 15 years, depending on the terms of the agreement.

JOURNAL : Farmers Weekly

An increase in environmental awareness has strengthened investors’ interest in an expanding forestry market.

Savills’ latest report on the UK forestry market shows that last year more buyers became interested in the asset, due to both its performance and environmental benefits.

A shift in public attitude towards climate change encouraged businesses to invest in forestry in order to offset their carbon emissions.

See also: Why we’re selling the family farm during coronavirus

Meanwhile, other trends continued, including low supply, strong competition and decent timber prices.

Values on the up

The value of the UK forestry investment market was just over £121m during the 2019 forest year (1 October 2018 to 30 September 2019) – a 2% reduction in overall sales value compared to the previous year.

The area of forestry traded also fell, down 4% from 36,819 acres to 35,583 acres, while the average value increased by 17% to £4,108/acre.

Forestry prices depend on location, accessibility, tree species, average age and timber volume.

Conditions and values vary across Scotland, though each area remains more productive and active than England and Wales combined.

North Scotland is a lower value area, due to the poorer physical growing conditions and extended distance to timber markets.

In 2019, North Scotland saw the highest rise in average values from £2,282/acre to £3,394/acre (45%). It was the only region to sell more acres in 2019 than 2018, reporting an increase of 1,977 acres to 9,612 acres.

The average value of forest in central Scotland rose by 31% during the 2019 forest year to £5,164/acre. It experienced no real change in the number of acres sold (12,182) and had the largest market share across Scotland, England and Wales.

Average values in southern Scotland rose by 38% to £6,139/acre. Although the number of acres sold (10,724) was down by 17% on 2018, it had the second largest market share.

The south is the most competitive area for timber marketing, and its forests benefit from excellent physical conditions leading to fast, even growth.

England and Wales have a scarcity of productive woodland for sale, which increases values. The average price of commercial forestry traded in England and Wales is higher than any Scottish region. In 2019, average values reached £6,637/acre, with 2,990 acres sold.

Tree-planting target

Investors now see forestry as a viable income stream, the report says, which has been supported by the introduction of the Woodland Carbon Guarantee in England, a scheme aiming to establish a public marketplace for carbon offsetting through woodland creation.

The UK government has committed to achieving net zero emissions by 2050. To achieve this,  it is estimated that 74,132 acres of trees need to be planted each year, nearly triple the current annual planting rate.

However, there are multiple barriers to achieving this, such as the UK nursery stock of tree saplings being limited to orders the nurseries know will be fulfilled, and a multi-year lag time to produce new stock to meet new demand.

Changing land use from ***agricultural*** production to woodland creation requires prior approval, which can be time consuming. And once approved, the land cannot be returned to farmland.

In addition, there is a relatively limited area within the UK that is suitable for tree planting. It is important not to compromise other economic land uses, biodiverse habitats and protected ecosystems, and planting must be appropriate – in the right place and for the right objectives, which must include production of sustainable, quality timber.

Woodland planting schemes

 £46.4m Forestry Grant Scheme, Scotland 2019-2020

£8m Glastir Woodland Schemes, Wales 2021-2023

£6,800/ha Woodland Creation Grant: Countryside Stewardship, England 2019

£50m Woodland Carbon Guarantee scheme, England

Source: Savills

What sold well?

Llanbrynmair Forest in the Montgomeryshire area of Powys, a region well-known for its timber production, sold in excess of its £27.5m guide price after being on the market with Savills for about six months.

The first commercial planting took place in 1960, and the most recent replanting of the 5,342-acre forest took place in 2019.

What’s on the market?

Northumberland forest

John Clegg & Co has launched 1,200-acre Whiteburn Forest in Northumberland for offers over £4.8m.

It includes mixed age, high yielding Sitka spruce timber ready to harvest, and a stone house that has previously been let as an activity centre.

Somerset woods

In the Quantock Hills near the West Somerset coastline, Westwood and Stileage Woods is available with Carter Jonas, guided at £295,000.

The 23 acres of amenity woodland has a mixture of tree types, is home to an abundance of wildlife, such as wild birds and deer, and includes a lake.

JOURNAL : Farmers Weekly

Research, expert advice and attention to detail have helped one first-time broiler grower achieve some of the highest performance figures in the wholesale sector.

David Hewitson's journey into broiler production started when he returned to his family's Hauxley Farm near Stockton-on-Tees in 2017 after serving in the Navy.

At the time, the farm already produced arable, pigs and sheep. But Mr Hewitson was interested in broiler production, which was enjoying a 10% year-on-year growth in demand.

See also: How to spot and treat infectious bronchitis in broilers

The positivity surrounding the sector, and low environmental impact, added to the attraction of broiler production, he says.

Farm facts: Hauxley Farm

Indoor broiler production

98,000 birds

Cockerels reared to 52 days

Pullets to 36 days

Red Tractor Assured

Research phase

Mr Hewitson began an extensive search for information on set-ups, production, industry targets and health and welfare issues.

"I set out to get as much information as possible online then began to contact growers to get a solid idea of how to set up a successful unit," Mr Hewitson says.

These were some of the most important people he spoke to during this phase. The practical advice and warts-and-all reviews helped build a realistic picture of the sector.

Farmer contacts also recommended who to talk to in the wider industry. Based on their advice Mr Hewitson began a round of discussions with broiler feed and processing companies to ensure there was sufficient capacity in the market.

As well as companies linked to broiler production, he quizzed advisers and consultants and secured assurances from potential buyers over demand for the stock produced.

Planning and construction

Following advice that suggested a minimum of 100,000 birds in two sheds was needed to achieve a decent return on investment, the Hewitsons submitted plans for a four-shed, 220,000-bird unit to allow for future expansion.

The planning permission process went smoothly and cost about £28,000. But it still took 12 months to complete and the additional environmental reports required, pushed up costs to £65,000.

Good weather during the winter of 2018 meant the Morspan building was constructed, Collinsons equipment and a Fancom environmental system installed, within four months.

Connecting the electricity supply proved to be the biggest headache. "Instead of hooking us up and allowing us to use the planned, energy-efficient, ground-source, heat pumps, the installer struggled and eventually quit."

"With hindsight, I should have looked harder at the company's credentials, and I would advise anyone thinking of entering the sector to carry out a thorough check," Mr Hewitson says.

The unit had to turn to emergency generators for power as the first flock was due to be placed. Gas heating was later installed as an interim solution while the work to connect up the ground-source heat pump continued.

Stocking phase

As the time approached for the arrival of the first crop, the amount of new information, checks and details were almost overwhelming, says Mr Hewitson.

One mistake during this initial phase could have caused a problem that held back the entire crop's performance. For help, Mr Hewitson turned to feed and nutrition specialist ABN.

The firm's Total Farm Performance service provides structured support to guide growers through production, and poultry adviser Kieron Daniels was assigned to Hauxley Farm.

"As David says, the amount of new information can be overwhelming. It would be easy to miss or skip a vital point, so my role was to guide the start-up," Mr Daniels says.

With the incoming crop approaching, one of the first tasks was to ensure that everything in the two new sheds was fully functioning and any potential glitches identified.

The two sheds were heated to 32C for two days before shavings were laid, and this temperature was maintained until after the chicks arrived.

This practice is needed because the newly laid concrete floor is cold and can chill the day-old birds. Performance would be hit from day one and never recovered.

Another key to getting performance from the outset was to prepare the water system at Hauxley Farm immediately before the birds arrived.

"Water intake governs food intake, which underpins performance. If birds don't drink, growth rates will not hit targets," says Mr Daniels.

To ensure water intakes are adequate, birds need cold, fresh water available to them continuously from the very first minute of arrival.

However, water can lie in the system pipework while the shed is pre-heated and also warm-up, allowing microbial populations to develop.

The water system was flushed through until it ran cold before the birds came in. Checks were also carried out on water pressure regulators.

There must be sufficient pressure for a drop of water to hang on the drinker nipple. The glistening drop catches the light, and the day-old bird is instinctively attracted to it.

However, if pressure is too high the system will drip, and shavings beneath can get wet and harbour disease.

Immediately before stocking, additional feed was provided at floor level to encourage the birds to feed from the start.

The crop

Once the birds were in, it was a case of careful monitoring and frequent, subtle adjustments to the system to optimise performance.

During the first crop, Mr Daniels walked the sheds alongside Mr Hewitson several times a week to help him get used to the process and to identify any irregularities.

The Hewitsons were advised to walk each shed three times a day for about 40 minutes and focus on the birds' behaviour, both individually and as a flock.

It's important to note how birds are feeding, drinking and their behaviour. For example, the flock can appear flighty, which can indicate the lighting regime needs adjusting.

From days one to 10, light levels need to be high to stimulate food and water intakes.

Early feeding helps birds' gut microflora develop faster, ultimately leading to better gut health, better digestion and increased feed intakes.

But levels need to be adjusted downwards as the birds grow, to keep them calm and improve growth rates.

Feed and drinker equipment was regularly checked during the shed walks.

The height of drinker nipples was fine-tuned when necessary, sometimes by as little as half an inch, to keep the line just above the birds' eyelines.

This maintains water intakes as the bird lifts its head to peck at the hanging droplet and the water then flows naturally back into its beak.

Set too low, and the water will drop away from the bird to the floor. If birds are unable to drink efficiently, feed intake is lower and ultimately weights drop.

Likewise, minute adjustments to the feeder heights are needed to allow the birds optimum access to the feed without wastage or competition.

As well as the visual checks, feed and water intake levels were ***collected*** and monitored through the system equipment. These were analysed at least once a day to spot any irregular upward or downward trends in intakes that might suggest disease or a system problem.

The task is made easier with ABN's InFocus app, which has been used to ***collect*** and collate ***data***.

The ***data*** can be sent straight from a phone to the cloud allowing both Mr Hewitson and Mr Daniels to access and analyse the results using graphs which highlight any discrepancies in performance or fluctuations in feed, water or the environment.

Mr Hewitson then made adjustments where needed to maintain optimum bird performance in both sheds.

It is important not to treat individual sheds as one unit. Each one will have a number of slight differences that can be overlooked but collectively add up.

The environments can vary considerably, so need managing differently to keep growth rates up.

Performance ***data*** analysis

At the end of the first crop, ***data*** was reviewed under the Total Farm Performance package.

The wholesale market requires a larger bird than retail outlets, and crops tend to be split-sexed. In Mr Hewitson's first crop, pullets started being taken at 33 days weighing an average of 1.91kg, and cockerels first went out on day 46 weighing an average of 3.65kg.

The shed was totally cleared on day 49. Mortality in the first flock was 5%.

Feed conversion ratios for the first crop were just 1.68:1 placing the Hewitson's flock at the top of ABN's performance chart across its monitored wholesale producers that year.

The first crop also saw growth rates peak close to 120% of the breed guide between 20-25 days.

The first crop's European Production Efficiency Factor (EPEF) was above 400, ranking Mr Hewitson's performance in the top four of ABN's flocks.

After monitoring the first crop results Mr Daniels and Mr Hewitson tweaked the system slightly.

"Despite the high peak in growth compared to the breed standard, we lost some performance in the early days," Mr Daniels notes.

From day one, growth rates were 79% of the breed standard and did not achieve a 100% figure until day six.

"For the second flock, we decided to put more feed on the ground as the new chicks came in. The move was successful and saw the flock hit 100% of the breed standard by day three.

"We also made a number of changes to the lighting intensity at different times/around week three of the growing period to encourage water consumption, and hence feed intakes, in the first few weeks.

"After which, further lighting changes were made to slow bird growth down later on – the aim was to reduce mortality by another 1%," Mr Daniels says.

The plan worked, and the growth curve peaked more gradually to 110% between 25 and 30 days.

A knock-on benefit of the more uniform growth was a 1% reduction in mortality over the lifetime of the flock.

The combined better growth and lower mortality saw the EPEF rise to 417.

With only his second crop, Mr Hewitson's broilers reached the second-highest performance figure of ABN's monitored flocks.

How the European Production Efficiency Factor is calculated

The efficiency factor allows broiler results from different flocks and different regions to be compared.

This factor standardises technical results, taking into account feed conversion, mortality and daily liveweight gain.

The formula is: (average grams gained per day x % survival rate )/feed conversion x 10

Crop 1: (ADG: 71.95 x SR: 94.96%) / (FCR 1.68 x 10) = 407

Crop 2: (70.48 x 95.92) / (1.62 x 10) = 417

JOURNAL : Farmers Weekly

Wheat growers are being urged not to cut back on fungicides on some of their thin, poor-looking crops, as showery weather could soon bring wet-loving septoria disease back with a bang.

Many late-drilled wheat crops have struggled out of the winter, prompting growers to think about cutting back on expensive fungicides as their yield potential is clearly lower.

But some experts argue that even potentially lower-yielding crops can be laid low by disease, and the current dry weather should not lull growers into complacency.

Bill Clark, technical director of crop consultant Niab, says there is plenty of septoria in winter wheat crops and all it needs is showery weather to make the foliar disease rise up from the lower leaves.

“Don’t talk yourself into lower inputs yet, as potentially lower-yielding crops can still see a big response to fungicides,” he says.

See also: How to counter the raised yellow rust risk in winter wheat

See what the situation is in regions across the country:

Kent

East Anglia

North Yorkshire/Durham

Northern Scotland

Herefordshire

Dorset

Dry weather approach

The current dry weather may help fuel a laid-back approach, as the multisite fungicide chlorothalonil will protect emerging leaves, but a change in the weather may herald the need for the eradicant properties of systemic fungicides, which travel into the leaves of plants, such as azoles and SDHIs.

Much attention has been focused on widespread yellow rust, but while it is fairly easy to control with relatively inexpensive azoles such as tebuconazole and epoxiconazole, the wet-liking septoria is often difficult to eradicate.

“Yellow rust is everywhere, but septoria is out there and if we get showery weather, it will jump,” Mr Clark warns.

An azole-multisite approach might work at T1, but there are risks attached, and he advises a SDHI-azole-multisite at T1 and a higher dose of a similar mix at T2.

The T1 stage is when leaf three on the wheat plant is nearly fully emerged, and often occurs in late April into early May, while T2 is when the final – or flag – leaf is emerged and usually occurs in late May into early June.

With yellow rust around, Mr Clark advises not reducing the SDHI-azole mix below half dose, as the rust active element will be too reduced.

He suggests trying new chemistry, such as Revystar, at T2, but to cut the dose of this more expensive mix to match that of previously used products.

Popular SDHI-azole fungicide mix products

Adexar – SDHI fluxapyroxad (Xemium) plus azole epoxiconazole

Ascra - SDHIs bixafen and fluopyram + azole prothioconazole

Aviator – SDHI bixafen plus azole prothioconazole

Elatus Era – SDHI benzovindiflupyr (Solatenol) plus azole prothioconazole

Keystone - SDHI isopyrazam plus azole epoxiconazole

Revystar - SDHI fluxapyroxad + azole mefentrifluconazole (Revysol)

Scottish septoria

In Scotland, where there are a lot more early-drilled wheat, Fiona Burnett, professor of applied plant pathology at Scotland’s Rural College (SRUC), says the dry and sunny weather is reducing the disease threat, with septoria only found on the lower leaves.

She suggests only using an SDHI, which are at a high risk of resistance developing, where there is a lot of disease present (and especially eyespot). In a low-risk situation, an azole-chlorothalonil approach may be adequate.

“If there are any savings to be made, then T1 could be the time,” says Prof Burnett.

For the T2 flag leaf spray, where the most responsive yield effect can be seen, she suggests following the SDHI-azole approach, and as these sprays in Scotland are likely to come after the ban on chlorothalonil on 20 May, the multisite component is likely to be folpet.

She does suggest that at T2, chlorothalonil may have been “propping” up some of the older SDHI-azole mixes, and suggests growers keep doses high and use the most effective new chemistry.

Kent

In the milling wheat heartland of Kent, there is quite a lot of septoria on crops and despite the dry spring, some showers and wind - causing leaf rubbing - will aid the disease’s spread.

Chris Bean, technical director at agronomy group Zantra, is looking to manage the risk sensibly, carefully checking the danger from yellow and brown rust. Growers will struggle with brown rust if not controlled at T0 and T1, he says.

His T1 approach for his area of Kent and south Essex will be an SDHI-azole-chlorothalonil mix, varying the rate according to risk, with strobilurins added to help with rust control and nitrogen update.

“There are a lot of milling wheats down here and strobilurins have been shown to improve the uptake of nitrogen, which translates into protein,” he says.

His T2 strategy will follow a similar approach, focusing on rusts, as all milling varieties saw brown rust in trials last year, with Zyatt and Firefly showing high levels as well as the very susceptible Crusoe.

East Anglia

Yellow rust is the main disease concern in these eastern arable lands, although there is plenty of old septoria in wheat crops after a very wet winter.

Dick Neale, technical manager at agronomy group Hutchinsons, advises growers to look carefully at their crops and make sure they have a rust-active element in their T1 fungicide sprays.

He suggests an SDHI-azole or SDHI-strobilurin route, both with chlorothalonil added, and believes not using an SDHI can be a bit too risky at T1.

“If you do a sensible T1, when you come to T2, you do not have to spend all that much money,” he says.

His approach at T2 would be similar to T1, but growers could drop rates depending on the weather and might omit the chlorothalonil in very dry weather.

North Yorkshire/Durham

Septoria is always the key focus for Nigel Scott, with early-drilled wheat crops of more susceptible varieties, such as Barrel and Kerrin, at risk from the disease.

He says there is a place for SDHIs at T1, especially for their greening effect, helping with rooting and their nitrogen scavenging properties, as well as their fungicidal effect. However, more backward crops may just get an azole-chlorothalonil treatment.

Septoria pressure is lower this year, especially with late-drilled wheat crops in his area of North Yorkshire and Durham, but after such a mild winter and with unknown weather ahead, the risk of this disease is there.

“It will be a decision made on a field-by-field basis. With no rain for more than six weeks, we have to look at spending,” says Mr Scott, who works for agronomy group ProCam.

For T2, the advantages of using an SDHI are clearer, and last year's experience proved the point, as a dry spring prompted thoughts of cutting back before the heavens open in mid-May.

Northern Scotland

Long-term disease control is key in northern Scotland, where the wheat harvest stretches well into September and even October, so coping with septoria is vitally important.

Agronomist Alistair Gordon, who covers Morayshire through to the Black Isle and into Easter Ross, is  seeing septoria in the base of wheat crops. There is more disease on the variety Barrel compared with Skyscraper, which is generally clean.

Mr Gordon, who also works for advisory group ProCam, says his approach is based on using two SDHIs, as he says they help reduce plant stress on the region’s dry, light soils.

He plans to use the older SDHI isopyrazam, along with either of the azoles epoxiconazole or prothioconazole at T1, and then a SDHI-azole-strobilurin mix at T2. He hopes this three-way mix will help counter the absence of chlorothalonil at T2.

“The T3 spray is the important spray for us, as there can still be two to three months to harvest, so we need to protect the crop,” he says.

Herefordshire

Andrew Goodinson is seeing septoria on the lower leaves of wheat crops that were sown early in his area. Yellow rust is visible on later-drilled crops that went in just before Christmas, while those sown after Christmas are generally clean of disease.

For T1, the agronomist’s approach for "cleaner" varieties in terms of septoria, such as Firefly, will be a low-dose azole plus strobilurin and chlorothalonil approach. He will only look at an older SDHI mix product on the more disease-prone crops.

Strobilurins will help crops due to their physiological greening effect and give extra protection against yellow rust, which has been more prevalent this season, especially on Gleam and Skyscraper.

For T2, it will be an SDHI-azole-multisite approach, with chlorothalonil used before 20 May and folpet afterwards, says Mr Goodinson, who covers Herefordshire and the surrounding areas for agronomy group Hutchinsons.

“It’s all about managing the disease threat in often thin and open late-drilled wheat crops this season,” he says.

Dorset

In  the wetter climes of south-western England, agronomist Russell Dean sees the use of SDHIs at T1 and T2 as commonplace to counter the threat of septoria.

He is surprised about the large amount of the disease he is seeing, as growers in his area have switched to more resistant wheat varieties such as Siskin, Costello and Graham in recent years.

Mr Dean, who covers Dorset and Somerset for agronomy group Frontier, is following an SDHI policy at T1, while making sure there is a good rust active included, as he has seen yellow rust as far west as Bridgwater, near the Somerset coast.

For T2, SDHI use will be commonplace across all his crops, and he will be looking to use the new chemistry such as Revystar at this fungicide timing, which traditionally gives the biggest yield boost.

“With high grain prices, growers will see a higher rate of return for only a modest few pounds more for the new chemistry,” he says.

Winter wheat variety disease resistance scores in the AHDB Recommended List

Variety

Septoria

Yellow rust

Brown rust

Zyatt

6.4

7

6

Crusoe

6.2

9

3

Siskin

6.6

9

5

Firefly

7

9

6

Barrel

4.3

9

5

Kerrin

4.9

7

7

Costello

6.1

9

5

Graham

6.8

8

6

Gleam

6.3

7

6

Wheat varieties are assessed on a 1-9 scale for disease resistance in the AHDB Recommended List, where 1 is very susceptible and 9 shows good resistance

JOURNAL : Farmers Weekly

George Eustice is probably still wondering what hit him.

He barely had time to settle himself into the big corner office in Smith Square before the coronavirus crisis was upon him.

Thrust into the full media limelight as shops began to run low on food, any initial roadmap of how he wanted to spend his first months in the top job has been hastily scrapped.

See also: Find all our coronavirus content in one place

The long-awaited consultation on dairy contract reform, for example, was meant to have been published last month, having first been expected in 2018, but has again been kicked into the long grass.

Instead, he has been taking his turn at the Downing Street podium as part of the revolving cast of ministers at the daily coronavirus press conference.

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Back at the office, there has been policy making on the hoof that has helped supermarkets continue to keep shelves full and public concern abated.

The actions that he has taken, and not taken, are giving us an insight into what the current government approach may mean for farmers.

The bedrock of this is a classic Tory belief in the ability of the free market to balance supply and demand and solve problems, with government only intervening to keep the playing field level, rather than supporting the players.

This can be seen with the recent oversupply of milk caused by closure of most of the foodservice sector.

Competition law

The policy lever reached for first was a relaxation of competition law that, in theory, could help rebalance markets, but not to rush back to intervention buying where the state becomes the customer.

And, even though intervention purchasing and private storage aid for some commodities are now available, those are EU measures, not UK government ones.

Defra was also for some time insistent that farmers should use the Coronavirus Business Interruption Loan Scheme (CBILS), rather than receive bespoke support.

The problem there is that many would not pass the viability checks – even though the scheme requires these to be based on the pre-crisis fundamentals of a business.

This is the crux of the issue. Why, a free marketeer might ask, is it the job of government to prop up businesses that didn’t even have the faith of their banks before coronavirus happened?

Furthermore, it can be argued that CBILS, with a maximum loan duration of six years, is very costly for farmers who normally borrow over much longer periods.

Unions have also been quick to point out that coronavirus has pushed food security up the political agenda, and farms need to be helped now in order to maintain UK production after this is over.

Milk promotion campaign

In response, and after much foot dragging, Defra have announced that farmers in England who have seen income drop by 25% or more will be eligible for grants of up to £10,000 to compensate them for up to 70% of lost income.

The department, along with the AHDB and Dairy UK have also this week announced a jointly-funded £1m milk promotion campaign.

Farming unions have been quick to welcome the concession that the Secretary of State and his team won from the Treasury amid the many competing demands from other beleagured sectors of the economy, but it is concerning for affected farmers outside of England that it was not possible to achieve a UK-wide plan of action.

However, despite this sticking plaster the direction of travel remains clear. Direct payments are being phased out. Environmental payments will not fully compensate for the Basic Payments Scheme income forgone.

The era of EU-levels of interventionism is over.

While paying tribute to farmers as essential workers, the government is prepared to allow more of them to fail.

And farmers who may expect Mr Eustice, a former farmer himself, to deliver more on their behalf need to remember which way power flows in cabinet – from the top down.

JOURNAL : Farmers Weekly

Good things, it is said, come in threes and, in terms of government measures to help farmers weather the coronavirus storm, this week has been no exception.

For starters, Defra has finally agreed to give English farmers an extra month to complete their Basic Payment Scheme (BPS) applications without penalty, recognising the disruption the pandemic has caused to many farm businesses.

See also: Defra extends BPS deadline to 15 June

In this endeavour, Defra is joining the Welsh government – though administrations in Belfast and Edinburgh have not followed suit.

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Another positive is the Defra announcement that 75% bridging loans will be made available this month to those still waiting for their 2019 Countryside Stewardship money.

It is estimated that about half of 2019 claimants are yet to be paid, so the loans will provide some essential cashflow to a significant number of farmers and landowners.

The third piece of good news is the government’s announcement of a Bounce Back Loan scheme.

This will offer small and medium-sized businesses affected by coronavirus loans of up to £50,000, guaranteed by the government, with no fees or interest payable for the first 12 months.

It is expected that this scheme will be considerably more useful than the Coronavirus Business Interruption Loan scheme, promising as it does easier access and faster payment.

These three measures are certainly helpful. But, as ever, there is more the government can and should be doing to underpin domestic food production – not least in the dairy sector.

Yes, it recently relaxed some competition rules, enabling processors to co-operate more and so ease product flow to different market outlets.

But that is far short of what is needed at producer level. Many hundreds, indeed thousands, are facing reduced payments, delayed payments and, in some cases, no payment at all for milk they have been forced to discard.

Coronavirus is hitting the whole economy hard, farming included. And while farmers are finally winning some recognition for their role as “essential workers”, to continue producing food for the nation, they need certainty

An NFU-organised letter writing campaign has seen more than 2,200 letters sent to 400 MPs calling for urgent help.

In particular, the NFU is demanding targeted grants for affected farmers, market support measures such as private storage aid, and a government-run milk reduction scheme to better balance supply and demand.

All these ideas make good sense and are fully justified by the extraordinary circumstances the dairy sector now faces, though, as Farmers Weekly went to press on Wednesday (29 April), Defra secretary George Eustice seemed to be playing down the prospects.

But, as well as such short-term measures, the government needs to offer some medium-term reassurance, too.

The EU Commission has already said it will allow 70% advances of BPS payments in October rather than December, and 85% advances for agri-environment schemes. The UK authorities should make the same commitment.

And looking further ahead, Defra should delay its plans to start phasing out direct payments to farmers in 2021 by at least a year, to give the sector more time to prepare for the radical shake-up this will then trigger.

Delaying would also give the government more time to consider its priorities when it comes to food security and supply chain relationships in a world order that is now so fundamentally changed.

Coronavirus is hitting the whole economy hard, farming included. And while farmers are finally winning some recognition for their role as “essential workers”, to continue producing food for the nation, they need certainty.

Starting to slash BPS payments next year – which for many farmers is the entire profit for their business – can only serve to undermine their viability.

JOURNAL : Farmers Weekly

So, the ***Agriculture*** Bill has cleared its third and final reading in the House of Commons and now heads to the House of Lords for the next stage of its parliamentary passage.

The bill paves the way for the new-look ***agricultural*** support system for English farmers, based on a winding down of direct payments and a winding up of a “public money for public goods” approach.

See also: What the new ***Agriculture*** Bill contains for farmers

During the Commons debate on Wednesday (13 May), MPs taking part remotely considered several amendments, including those tabled by opposition MPs and those sympathetic to rural voters.

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The most high-profile of these were the ones surrounding trade in ***agricultural*** goods and the terms to be agreed in any future free-trade agreement (FTA) with the likes of the US.

These amendments – including one from Neil Parish MP and another from Labour leader Keir Starmer – sought to ensure that any future food imports only come from systems that meet our UK standards of animal welfare, plant health and environmental protection.

The ***Agriculture*** Bill is silent on this point, as the government view is that trade matters should be dealt with in the separate Trade Bill.

But pretty much the whole food and farming industry disagrees, and it has been a recurring theme that it is not acceptable for our farmers to have to compete with food imports produced using methods that would be illegal in this country.

Some encouragement was provided by international trade secretary Liz Truss. Writing exclusively for Farmers Weekly, she insisted that “as we leave the EU, we will maintain the same import standards – no UK import standards will be diminished as part of an FTA.

“We will never undermine our high standards on domestic environmental protection, animal welfare and food safety – ensuring that in any agreement, British farmers are always able to compete.”

This is undoubtedly helpful. But it does not provide protection from substandard imports outside of any FTA, and it counts for little until it is enshrined in legislation.

During the debate in the House of Commons on Wednesday, the government whips secured enough support to ensure that the Neil Parish and Keir Starmer amendments were heavily defeated.

Fortunately, this is far from the end game. The Lords still have to give the bill full scrutiny and are expected to be much more sympathetic to the various demands of the food and farming industry - including those not related to trade.

Yes, the new ***Agriculture*** Bill, relaunched in January, contained some improvements to the original – notably requiring a review of food security every five years, introducing a multi-annual budget and providing for emergency market intervention.

But much more needs to be done. The planned cuts to the Basic Payments Scheme should be delayed, food production should be included as a “public good” worthy of taxpayer support, and any aid should be targeted at active farmers.

More power should be given to the groceries code adjudicator to ensure a fairer supply chain, food security should be subject to specific targets and reviewed more frequently.

Above all, protection from below-standard food imports must be enshrined in legislation.

The current ***Agriculture*** Bill is too weak on all these points. It is therefore imperative that industry lobbying is sustained as the Lords debate it in the coming weeks and months.

JOURNAL : Farmers Weekly

In the previous Global Grain Insight, published in the middle of February, we concluded: "If coronavirus continues to spread, it could have a negative impact on the whole global economy."

While that sentiment has proved correct, none of us could have imagined the extent to which the virus has affected our everyday lives, as well as the markets and wider economy.

Markets at this time of year usually have their eye on the weather, with any hint of unfavourable conditions giving support to prices, but while the world is not without these, the crushing destruction of demand from coronavirus is all-pervasive.

See also: Rust control advice to achieve high-protein milling wheats

With a world in lockdown, little travel taking place, hospitality mothballed and minimal global trade, markets are at a standstill.

Without coronavirus, grain markets would be looking very different.

Much of western and central Europe has gone from being too wet to too dry, and although recent rains have helped to stabilise conditions, estimates still put EU wheat production down 12.5m tonnes from last year to 134m tonnes for 2020-21.

Influence of main price factors

Red: Factors putting downward pressure on prices – 45%

Accounts for 45% of current market influence. Demand destruction due to coronavirus is outweighing any current supply hitches in wheat, with availability of low-cost maize aggravating matters.

Amber: Watch this space – 40%

Short-term weather changes could inject volatility into markets. Continuing dry weather in key markets such as the EU, Brazil, Russia and the Ukraine might still unsettle things. But for any long-term effect, they’ll have to be sizeable.

Green: Factors exerting upward pressure on prices – 15%

Current weather issues are enough to keep prices from falling too much, but so far, they are not sufficient to outweigh coronavirus and initiate a sustained rally.

Drier-than-normal weather in the main corn-producing states of Brazil has affected yield potential, and this could drop further if these conditions persist. It is a similar picture for wheat in southern Russia and the Ukraine, where rain is also needed.

That said, Russia is expected to produce 77m tonnes of wheat this year, compared with 73.5m tonnes in 2019-20.

Australian production is expected to rebound from last season’s drought-hit wheat crop of just 15m tonnes to more like 24m tonnes, and US maize plantings are well ahead of average.

Demand for maize, particularly for ethanol, has fallen dramatically, however, and the abundance of cheap maize is adding pressure to all grain markets.

Further weather problems could inject additional volatility into markets, resulting in short-term selling opportunities. There is also encouragement to be taken from some countries seemingly getting a grip on the virus and lifting restrictions.

But for the foreseeable future, nothing short of a major weather event will lift the weight of coronavirus sitting on global markets. Until demand returns, upside potential for markets is limited.

UK prices dictated by global events

UK price prospects have for some time now been driven by global events, with the reduction in domestic wheat production already well known in the market.

Current estimates put UK wheat production for the coming harvest at about 10m tonnes – a substantial drop from the 16.2m tonnes last year. The effect of this, at least in part, is likely to be offset by record carry-over stocks approaching 3.5m tonnes from the current season.

It’s a different scenario for barley, with a record crop predicted. That, in turn, brings with it the need to find export markets and that could be more challenging than normal in these difficult times.

Spain, usually a sizeable destination for UK barley exports, has experienced considerably better weather than many other parts of Europe recently and looks set to produce bumper crops this year.

This could mean a large proportion of UK barley exports must find their way into third country markets, which could prove challenging due to the lower moisture contents required.

With the UK set to leave the EU at the end of December, we could also see a repeat of last season, with growing pressure to export barley ahead of this deadline.

This heavy domestic barley supply, plus the prospect of sizeable maize and wheat imports, mean it is difficult to see how UK wheat prices can rise without global prices going up too.

JOURNAL : Farmers Weekly

Farmers are taking an increasingly measured approach to their grassland and manure management, helping to cut costs and improve efficiencies.

A new survey carried out by the organisers of the Grassland & Muck Event – the third such survey since 2011 – has revealed that more farmers are analysing inputs and outputs, enabling them to better target management decisions.

See also: Why farmers will pay heavily for not reseeding grassland

***Nutrient*** testing

Based on 224 responses from around the UK, it seems more people are testing their soil, and doing so more regularly, with 68% testing it every five years or even more frequently, versus 62% in 2017 and 57% in 2011.

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More than a third of grassland farmers now dig soil pits to analyse soil structure, compared with a quarter in 2017, and they are applying lime more regularly, too, with 56% doing so at least every five years, compared with 49% in the last survey.

“When you look at individual responses, there is good understanding driving these decisions,” says Yara agronomist Philip Cosgrave.

“People may be aware of the acidifying effect that last winter’s high rainfall will have on pH and are basing applications on soil tests.”

More than three-quarters of respondents are also routinely spreading manure or slurry on grassland, and there has been a continued shift to more accurate testing of manure ***nutrient*** content: 18% used laboratory analysis against 14% in 2017 and just 9% in 2011. “That is good to see – there is huge variation in organic manures,” says Mr Cosgrave.

But there is still room for improvement. For example, 27% of those surveyed do not produce a manure or ***nutrient*** management plan – very similar to the figure found in the previous survey.

That said, farmers are increasingly turning to professionals to calculate crop ***nutrient*** requirements, with 54% now using agronomists to do this versus 43% in 2017 and 39% in 2011.

Fertiliser use

As a result of this more technical approach, farmers have further reduced fertiliser use; 32% of survey respondents said they were using less nitrogen fertiliser, while about a quarter had reduced phosphate and potash applications.

However, the percentage of farmers altering applications across the three ***nutrients*** was higher than in 2017, suggesting more targeted, reactive use over that period, perhaps in response to manure applications and crop needs.

In contrast, 40% of respondents increased sulphur uses. “Farmers are much more aware of sulphur requirements – it’s up there with NP&K now,” says Mr Cosgrave.

But there is still scope for greater efficiency, with 37% of farmers saying they do not check their sprayer calibration for each product used.

“Carrying out a tray test is a good way of double checking your spreader is working properly,” Mr Cosgrave advises. “There is a lot of wear and tear in spreaders, so you need to ensure the setting you’ve selected is working correctly, otherwise you will get an uneven application.”

Grass growth

But it is an improving picture when it comes to grass management, with 54% saying they measure their grass – mostly using a plate meter – up from just 30% in 2017.

And about 44% use a consultant or software to make grass management decisions, compared with 31% who don’t use any such tools.

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Reseeding levels have remained fairly steady over the past three years, with 79% reseeding leys every one to six years, usually in response to poor yield and weeds.

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Most respondents are tackling grass weeds in-house – only 35% are using contractors – and 45% use a selective herbicide, while 23% are opting for spot treatment.

And when it comes to silage, an increasing number either always use (22%) or have started using (9%) an inocculant to improve forage quality and consistency – both up on the 2017 survey results.

“It is clear to see that farmers are focusing on producing better quality silage and grazing to produce more milk or meat from grass,” says Mr Cosgrave.

“If you start measuring ***nutrients*** and how much grass you’re growing you can start making changes and see whether you’re making progress. It all feeds back to better environmental impacts and lower costs of production.”

Grassland & Muck survey

This survey was carried out by the organisers of Grassland & Muck, which was cancelled this year due to the coronavirus outbreak.

Event organiser Alice Bell speaking about the survey said: “It’s wonderful to have been able to gather this information over several years, giving a really strong snapshot of the direction in which the industry is moving.

“Although we sadly had to cancel this year’s event due to the Covid-19 outbreak, we thought it important to publish the results so farmers and their advisers can identify trends and opportunities for greater efficiencies.”

JOURNAL : Farmers Weekly

There is a whole host of very good winter oilseed rape varieties on the current AHDB Recommended List, with 13 new additions to consider for all areas and growing situations, as well as some interesting candidates coming through.

Picking them apart is more difficult this year, believes Colin Peters, Niab’s breakcrop specialist, who points out that all varieties in trials performed better where there was less flea beetle pressure.

“There were issues with both flea beetle and lack of moisture last autumn,” he says.

“As a result, we’ve seen geographical variability, as success with crop establishment depended on the timing of the flea beetle migration in the local area and whether that coincided with some rain.”

See also: How to use active fallows to repair soils on undrilled land

Looking ahead to 2020 plantings without new drilling date guidance – other than the need to use available moisture – Mr Peters recognises that growers have some big decisions to make in a particularly challenging time for producing oilseed rape.

Top variety picks from the proven performers

East and West

North

Conventional

Aspire

Ballad

Elevation

Barbados

Hybrid

Windozz

PT275

DK Exsteel

“There are different trains of thought on whether to go for cheaper seed and higher seed rates or expensive seed and lower seed rates,” he says.

“There are also the tried-and-tested varieties versus the new-kids-on-the-block decisions to wrestle with.”

Proven performers

Starting with the tried-and-tested varieties, he notes that some popular choices are no longer listed.

“A good example of that is Campus. There’s no doubt that some of these will still be widely grown, as everyone knows what to expect from them.”

Looking at proven conventionals that are still on the Recommended List, he highlights Aspire and Ballad for the East/West region and Elevation and Barbados for the North.

Likewise, proven hybrids and Windozz and PT275 for the East/West and DK Exsteel for the North get flagged up.

“These are all good solid varieties that have produced the goods on farm.”

Newcomers

However, there’s no avoiding that the main variety talking point for 2020 is newcomer Acacia.

A conventional variety from Limagrain, it has been given a UK-wide recommendation and tops the list with a gross output of 109%.

In the East/West region, it has a gross output of 110%, while in the North it is 108%.

“It’s a versatile variety that has done very well in trials,” notes Mr Peters.

Acacia is very stiff, a characteristic liked by growers, but its disease resistance scores of a 6 for light leaf spot and a 5 for stem canker aren’t the highest of the current variety selection on the list.

“Acacia does not have turnip yellows virus resistance, which sets it apart from last year’s top conventional Aspire, which is also from Limagrain.

“Whether that will make a difference or not remains to be seen.”

Mr Peters says that virus resistance is another weapon for growers.

“The issue this year is whether or not you can get it and the yield performance you are after at a price that you want to pay.”

Welcome additions

Just behind Acacia comes a strong selection of new UK-wide varieties all from Limagrain and all beginning with the letter A – Ambassador, Aurelia, Artemis and Aardvark.

“They’re all hybrids with turnip yellows virus resistance, except for Aardvark,” he continues.

“Ambassador and Artemis are taller types, but stiff, with good stem canker scores.

“Aurelia has the best disease profile on the list, with 8s for both light leaf spot and stem canker. It’s certainly caught the eye.”

Both Aurelia and Artemis also perform well in the North, where height and maturity can be more of an issue.

“All of these new varieties are interesting and have good oil contents.

“Getting another year under their belts will be helpful in terms of differentiating them,” says Mr Peters.

In the North, new conventional variety Blazen from KWS offers a gross output of 105%, putting it slightly ahead of the rest.

Other types

The best of the Clearfield types is PT279CL, with suitability for all regions, he believes, but NizzaCL has now been recommended for the East/West region.

Otherwise, clubroot-resistant Crocodile offers a gross output of 105% in the East/West, which is a progression.

“Crome is a better choice for the North on clubroot-infested soils, with a gross output of 103%, which is up there with the best.”

13 new additions to the AHDB Recommended List

Variety

Type

Recommendation

Acacia

Conventional

UK

Ambassador

Hybrid

UK

Aurelia

Hybrid

UK

Artemis

Hybrid

UK

Aardvark

Conventional

UK

Dazzler

Hybrid

East and West only

Darling

Hybrid

East and West only

Nizza CL

Hybrid

East and West only

Blazen

Conventional

North only

Specialist varieties

Crocodile

Hybrid

Clubroot resistant

Croozer

Hybrid

Clubroot resistant

PX131

Hybrid

Semi dwarf

Resort

Hybrid

High erucic acid

Winter OSR candidates

It is early days for the 12 candidate winter oilseed rape varieties that are in the Recommended List system, but there are a few that Colin Peters picks out as showing promise where the ***data*** is available.

DSV’s hybrid Voltage is looking strong this spring and has a gross output of 108% in the East/West.

With good standing ability, it also has turnip yelows virus resistance and is up for a UK-wide recommendation.

So is another hybrid, Hermione, from KWS. Although it doesn’t have the highest yields in East/West, it performs very well in the North.

Hermione is a very stiff variety with excellent stem canker resistance.

Two others that are in contention for the East/West region are Antigua from Limagrain and DK Expectation from Bayer CropScience.

“These are both looking very well. They’re hybrids with turnip yellows virus resistance and strong disease resistance packages.”

Cabbage stem flea beetle: Lessons from autumn 2019

Cabbage stem flea beetle is ruining what is an exciting time for oilseed rape breeding with no new regulated chemical control measures available for this year, confirms Colin Peters.

Screening work with biopesticides and beneficials is being carried out by many organisations, he reports, while monitoring of flea beetle movement into crops by Niab will start earlier this year.

This work is being co-ordinated by Aoife O’Driscoll, who is taking the lead in Niab work on the pest.

To date, the work has shown a clear role for white mustard as a companion crop, and future work will involve looking at seed rates and a further understanding of the ecology and lifecycle of the pest.

“What we do know for certain is that pyrethroids aren’t the answer – they won’t do the beneficials any favours.”

JOURNAL : Farmers Weekly

Harper Adams students took the trophy in this year’s Farmplanner competition, with a plan to secure the long-term term viability of Exton Park in Rutland.

The plan included a trial of soya as an alternative break crop to reduce the risk of growing oilseed rape. The team also suggested taking 150ha out of the combinable rotation by planting miscanthus.

Staff would be reduced to one working farm foreman, a general farm worker, a herdsman/general estate worker, and one seasonal harvest worker.

See also: Managing contract farming agreements in difficult seasons

However this would be phased in, with a trainee farm foreman being recruited a year before the current foreman is due to retire, allowing knowledge exchange and training.

The host farm – Exton Park, Oakham, Rutland

1,286ha in hand, managed by Harry Campden, whose family owns the estate

900ha of mainly grade 3 arable land

130ha pasture

85 suckler cows, calves sold at 10-11 months

260ha woodland

Five full-time staff

Grain marketing strategy was targeted for improvement, chiefly by making the best use of a new grain store under construction to time grain sales to better advantage, but also by potentially using futures and options. A move from feed to milling wheat was also recommended.

The plan included replacing the suckler herd with 200 red deer hinds for venison production – a growing market compared with the pressured beef market.

Harper’s recommendations for diversification included a burial barrow within the farm’s woodland, a café in redundant farm buildings to benefit from high use of footpaths on the estate, and a woodland adventure trail for children aged 5 to 12.

Exton challenges for student teams

Labour All the current staff are due to retire in the next five years. Their knowledge of the farm, its land and associated services will be lost, so what new labour system should be put in place?

Farming system With the coming change in labour and associated skills, what arable and livestock systems should be considered?

Redundant buildings A new grain store is being built, making the current store and yard within the village redundant. What development should be considered for the redundant yard and buildings?

Woodland This hosts a shoot but is not used for any other activity – what other diversification opportunities could be considered?

The overall plan was projected to generate a pre-tax profit of £380,000 before subsidy, allowing continued investment and a sustainable business for future generations.

Farm manager Harry Campden, whose family owns the estate, said: “There are good ideas in all of the reports, particularly on the diversification aspects.

“The teams had a real challenge in presenting these remotely from the judges and from each other, and they rose to that very well.

“It was a close call but the Harper entry stood out as the better one of the four. It was professionally presented and the barrow, café and woodland adventure trail are interesting complementary alternative enterprises.”

The other finalists were from Newcastle University, Riseholme College and Bishop Burton.

Mr Campden’s interest was also drawn by Bishop Burton’s plan for a special educational needs enterprise in collaboration with local schools.

The judging panel comprised Mr Campden; Emma Watson of consultant Gasson Associates; Tim Brigstocke of IAgrM; Ben Hatton and Victoria Giles of Farmplan; and Suzie Horne of Farmers Weekly.

Could you host the 2021 Farmplanner competition?

Farmplanner challenges teams from UK ***agricultural*** universities and colleges, usually attracting about 10 entries from which a shortlist of three or four is selected.

The Institute of ***Agricultural*** Management is looking for a family farm business for the 2021 competition, ideally with at least two significant enterprises, preferably arable and livestock.

This should be an enterprise that needs to make decisions about its future and which is willing to host teams of students to walk the farm and draw up competing business plans.

The host must be prepared to set some challenging questions, for example on business structure, enterprise mix, staff, family involvement and/or assessing potential for new ventures.

Student teams make an initial visit to the farm, all on the same day, and then have a couple of months in which to make a report, including recommendations to the farm owner in the same way that an independent consultant would.

The final judging usually takes place at the farm with each team presenting and being questioned on its recommendations.

JOURNAL : Farmers Weekly

Precision-guided hoeing is being put through its paces on a Hertfordshire farm in an effort to improve blackgrass control in winter wheat and minimise the need for a spring-applied herbicide.

A spend of up to £60/ha on post-emergence grassweed chemistry across 620ha of combinable cropping prompted Jo Franklin to look at alternative weed control methods, with the aim of reducing the use of herbicides that have little efficacy on resistant blackgrass.

See also: Why biopesticides will play a bigger role on arable farms

One of the first to use the Garford Robocrop Guided Hoe on narrow 12.5cm rows in a conventional farm setting, she admits that getting the 6m hoe set up right as it moves around the farm is proving to be a challenge in such a busy spring.

“Some of our autumn-drilled wheat is already as forward as it can be for the technique to work,” she told Farmers Weekly in late March.

“You have to be able to still see the row – once the crop is at canopy close, it’s too late.”

For this reason, winter wheat drilled by Baldock-based Kaiapoi Farming towards the end of January proved to be an easier test site, with the hoe working well.

“The crop was still small and weed numbers were low. In those fields, one pass with the hoe will take us right through to harvest.”

Soil moisture

Her plan is to use the implement where conditions are right, as soil moisture is critical to its success.

If it’s too wet, the hoe tends to pull up a clod with the weed still attached, rather than pulling the blackgrass plant out cleanly.

Spring barley

Having a seeder fitted to the guided hoe will allow Jo Franklin to try putting clover into her spring barley crop as she goes through it for weed control purposes.

Her intention is to travel as late as is possible with the hoe – up to growth stage 31-32 in the spring barley crop – as there is a narrow window for getting clover to establish successfully.

If it works, a clover understorey will then develop in the barley, so that the farm’s sheep can graze it after harvest.

“It was never my intention to hoe the whole farm and we will be sticking with our pre-emergence herbicide programme for the foreseeable future,” she reveals.

“Although it’s theoretically possible to use the hoe in the autumn, our plan is to go through October-drilled wheat in early March.”

A concerted, integrated effort for the past few years has seen blackgrass numbers fall across most of the farm, but in the worst patches there can still be 500 heads/sq m.

“We haven’t got post-emergence chemistry that works in the spring.

“Any blackgrass that gets left behind by the autumn programme is an issue.”

Early lessons

Early learnings with the hoe are that it needs patience and a real desire to get it right, she adds.

“Getting it set up correctly is really important. It has to be accurately aligned with the drill coulters and, once in operation, you must follow the exact direction of drilling.”

Operator attitude is essential, as is training, believes Ms Franklin.

“It hasn’t been all plain sailing, and the coronavirus lockdown restrictions have made it more painful. Next year will be different.”

As one of the Agri-EPI satellite farms, she received help with the initial purchase cost of the machine of about £50,000.

Each unit has to be made according to the farm’s row spacings, which is why they have been more widely used in crops planted with precision drills to date.

Her 6m hoe is using 4cm feet on 12.5cm rows.

Accuracy critical

Getting it to work in narrow row cereals is more challenging.

Cameras mounted to the hoe capture images of the crop ahead of the tool bar, with the position of the rows guiding the hoeing tools so that weeds can be removed.

For such accuracy, however, the tractor needs to be almost following the exact path of the drill, to enable the cameras to take out the final few millimetres.

“To get this accuracy, we teamed up with Trimble using a centre point RTK [real-time kinematic] signal and self-steering GFX 750 system to ensure pass to pass repeatability,” she says.

“We were able to record the drill passes and then, several months later, follow the exact same pass with the hoe with less than 2cm difference.”

Agri-EPI satellite farms

Agri-EPI was established by the government as part of its Agri-Tech strategy, to focus on precision ***agriculture*** and engineering.

The satellite farms are a network of commercial farming operations that act as a test bed for research and development, helping scientists and engineers with new ideas.

JOURNAL : Farmers Weekly

A Lancashire veg grower and machinery maker has managed to rack up an impressive 600,000 miles in his mid-noughties Toyota Land Cruiser, without it suffering any serious mechanical maladies.

Peter Gresty, from St Michaels on Wyre, Preston, specialises in growing early crop carrots and has a business producing and selling veg processing equipment.

This work takes him all over the UK, Ireland and Europe, meaning he quickly clocks up miles on a vehicle.

See also: High-hour Horsepower: Land Rover Discovery hits 540,000 miles

But rather than going to the expense of running new cars and changing them regularly, he’s opted to pile the miles on a vehicle with a proven track record for reliability.

His 2004 Toyota LC5 is one of three such 4x4s featured in Farmers Weekly’s machinery pages, all of which have breezed past the 400,000-mile mark without any significant spannering required.

However, with almost 600,000 miles on the clock, Mr Gresty’s truck is the farthest travelled by some margin. The current clock readout is 596,000 and if it weren’t for the coronavirus lockdown it would have been well over 600,000 miles by now.

Peter Gresty’s Land Cruiser LC5

E Year 2004

E Engine 3-litre, four-cylinder Toyota D4D

E Power 161hp

E Towing capacity 2.9t

E Transmission Five-speed automatic

E Suspension Front coils and rear air bags

E Price paid £21,000 in 2007

E Mileage when bought 28,000

E Mileage now 595,000

The truck was purchased from a Toyota dealer in Nottinghamshire in 2007 – when it was on just 28,000 miles – and it cost him £21,000. “At the time I thought that was a lot of money to spend on a 4x4, but clearly it was a pretty good investment,” says Mr Gresty.

Running costs have been minimal and for a 2t vehicle it is pretty light on fuel use, returning about 35mpg when driven considerately and 22mpg when towing.

It’s only rated to pull a 2.9t trailer, meaning it can’t compete with modern pickup trucks for out-and-out capacity. But the 3-litre four-cylinder diesel has ample power and it could easily pull more if it was rated to do so, he says.

Agritec International

Mr Gresty has worked in the veg business for more than 30 years and grows 40ha of his own early crop carrots, as well as sowing and managing 120ha for other farmers.

Ten years ago, he completed a Nuffield Scholarship that looked at veg production and processing around the world. He saw a market for farm-scale veg processing equipment that would allow farmers to add value to their crops.

This led him to set up a business building and selling machinery for peeling and packing potatoes and carrots. He trades under the name Agritec International and he sells machinery across the UK and Ireland, as well as some exports further afield.

Rear air suspension – standard fitment on the LC5 model – also makes the ride particularly smooth and stable when towing, and it pumps up to help keep the vehicle level.

The generous internal space is handy for carrying large numbers of passengers and cargo too. With all three rows of seats in place, it can accommodate eight people, but with the rear set removed and the central row folded flat, there’s a cavernous void for loading equipment.

“It’s amazing what we’ve been able to carry in there and we can even slot a pallet in with the forklift if we need to,” he says. “This is where the newer Land Cruisers (apart from the commercial-spec model) fall short, as the third row of fold-down seats ruins the carrying space.”

Keeping it running

For the first 60,000 miles, the Land Cruiser was under warranty and during that time it was serviced by Toyota. Just before this ran out, the injectors began playing up – a known fault – and these were replaced free of charge.

Since then, servicing has been carried out at Mr Gresty’s local garage every 10,000 miles. This is always a full service with a complete set of filters and a timing belt on every sixth visit – there are currently 60 stamps in the book.

Considering the car’s mileage, it has required amazingly few replacement parts.

Apart from the injectors, the only other unexpected repairs have been to the rear air suspension system. The first was one of the air bags which went pop when he was towing a loaded trailer, and the second was a new compressor after the original broke down.

“It’s in a pretty poor location on the underside and gets plastered in crud, so it’s no wonder it gave up the ghost,” says Mr Gresty.

Other replacement parts have been limited to the usual batteries, wheel bearings, and brake parts, plus a few alternators. However, the original unit must have been particularly good quality as it held out for 320,000 miles.

It’s still on its original starter motor, but this does work loose and requires a tighten every 80,000 to 100,000 miles.

Interior finishes have stood up well too, with the seats showing remarkably little sign of wear. The only casualty has been the leather on the steering wheel.

Rather than shell out a fortune for a new wheel from Toyota, Mr Gresty purchased a cover from eBay, which he stitched on by hand. “It was a bit of a fiddle and took me about three hours, but it was actually quite satisfying.”

He also saved a small fortune when the satnav/entertainment unit packed up. Toyota quoted £2,000 for a new one, but Mr Gresty took it to a local TV repairer who fixed it for just £150.

The only continual niggle is the air conditioning system, which he has now given up trying to mend. “We’ve tried all sorts over the years, but I’ve had to resort to using the windows and the sunroof.”

Having run several brands of tyre over the years, Mr Gresty has settled on Dunlop Grand Trek, which cost £500 for a set and consistently cover 90,000 miles. The truck’s full-time four-wheel drive system also means wear is fairly consistent between the front and rear.

Building up a fleet

The Land Cruiser’s reputation for reliability means prices for the LC3, LC4 and LC5 models built in the 2000s are now starting to climb.

To make sure he’s got a good supply of vehicles, Mr Gresty has invested in two more to take the pressure off his original truck. These are 2004 and 2007 models that are on 290,000 and 206,000 miles respectively.

Similar Land Cruisers with fewer than 200,000 miles on the clock tend to cost more than £5,000, with lower mileage examples running to over £10,000.

Discovery still going the distance

The arrival of Peter Gresty’s Land Cruiser in our high-mileage vehicle club has nudged Martyn Rainbow’s impressive Land Rover Discovery into second place.

Farmers Weekly featured the 1996 300TDI model in May 2018 when it was on 540,000 miles and we’re pleased to report that it’s still going strong, sitting on a current tally of 569,000 miles.

Since our visit, the only mechanical letdown has been the solenoid on the original starter motor – we’ll forgive it for that. Click here to read the full story on Mr Rainbow’s Discovery

I can beat that

If you own an off-road vehicle that can beat Mr Gresty’s 600,000-mile Land Cruiser we’d like to hear from you – just email [*oliver.mark@proagrica.com*](mailto:oliver.mark@proagrica.com) with a few details.

JOURNAL : Farmers Weekly

Colleges and universities around the country closed their doors as the UK went into lockdown.

This presented big challenges for students, who had to adjust to new ways of studying, faced a premature end to the academic year and found themselves having to cancel holiday jobs.

Though the Covid-19 crisis has brought practical and financial problems for young people, ***agricultural*** students are facing the situation pragmatically.

We hear from two about how they are staying positive.

See also: Coronavirus: How two dairy farmers are staying positive

Charlotte Lawder, Harper Adams University

Charlotte is keeping her fingers firmly crossed her sandwich-year job will happen as planned. The 22-year-old, who’s in the second year of an ***agriculture*** with animal science degree, still expects to start her placement with a nutrition company in early June.

“As of now, it’s still going ahead, but what exactly I’ll be doing might change depending on the movement restrictions, as my role would have involved a lot of travel between farms.”

Charlotte is living with her family in Shropshire, where she’s been busy preparing for open-book exams and completing assignments using online learning material.

Working-from-home challenges

“Working at home has its challenges, but I set myself targets and am quite self-motivated – as long as I have regular tea breaks,” she says.

“Our lecturers have been great and they’re always at the other end of an email to answer any questions.”

Inevitably, the Covid-19 crisis meant a premature end to the academic year, she explains.

“I was living in a student house and we’ve ended up emptying that and moving out, which felt really bizarre.

"It wasn’t a task we were expecting to have to do until early June, but we’re all now working on the principle that we won’t be going back for the summer term.

“The legendary summer ball has also been cancelled, which I’m gutted about. It’s one of the highlights of the Harper year, with everyone’s traditionally in great spirits, having finished exams.

“That said, I’m conscious I’m incredibly lucky compared to a lot of people right now.

“As well as having my health, I’ve got a garden, a field and a horse, so can spend time outside, unlike so many of those who live in towns and cities.”

Charlotte says technology is really proving its worth and is taking advantage of online ways of staying in touch, such as the Zoom and Houseparty.

“Not seeing friends in-person is rubbish and doing it online isn’t quite the same, but the interaction is nice and really important to keep everyone’s spirits up.”

Cancelled travel plans

Another disappointment for many young people has been that they’ve had to cancel travel plans.

“I took a year out before I went to uni and, as well as working on a couple of dairy farms to gain experience and earn some money, I spent some time in the US.

“The sheer scale of the ranches over there was unlike anything I’d seen. It gave me a different perspective and I learned a lot.

“I’m someone who likes to have a long-term plan and the current turmoil won’t derail my plans to pursue a career in the nutrition sector.

“I love being around livestock and nutrition is such an important job – it’s crucial to get it right for the welfare and performance of the livestock and for the viability of the farm business.”

Thomas Gregory, Sparsholt College

Thomas says he’s so busy that it feels like “business as usual” for much of the time, although watching the news can still be shocking. The 19-year-old is helping at his family’s Hampshire-based farming and contracting business, in tandem with focusing on college work in the evenings.

Studying remotely requires extra self-discipline, but the college has been brilliant and the lecturers are amazing, says Thomas. He hopes to begin an ***agriculture*** degree at Sparsholt this autumn, after completing the second year of his Level 3 ***agriculture*** qualification.

“That was the plan, but nobody knows what the situation will be then. It’s not impossible that we’ll still be in lockdown.

Taking precautions

“Everyone has adapted their behaviour in the current crisis. We don’t mix with a lot of people anyway – we feed the stock and spend a lot of time on our own in a tractor – but we’re making sure we’re taking precautions such as handwashing and social distancing.

“Not being able to see mates hasn’t been too tough because most of them are from farming backgrounds and it’s such a busy time of year now and right through the summer that it’s rare we’d get much time to meet up anyway. I do miss the occasional evening in the pub, though.

“It’s also hard not seeing my girlfriend, who’s a Sparsholt student, too, but we’re keeping in touch by text and Snapchat in the day and we FaceTime in the evenings.

"I haven’t seen her since the day we left college and I don’t know when I will be able to again. We all have to respect the rules, though, and that means not doing any non-essential travel.”

Unnecessary trips out

Thomas is concerned, however, that many people are still not listening to the government advice and are leaving their houses unnecessarily.

“I see a lot of walkers on footpaths – sometimes the same people passing three times a day and the route they’re taking means they’ll have had to have been out for more than an hour.

“I also worry about my nan, who’s in her 80s. She lives on the farm and I used to visit her all the time, which I’m obviously not doing now. We take her food, though, and leave it outside her door.

“We’re all just taking it a day at a time at the moment. In some ways, the contracting side of the business hasn’t changed, but cattle prices have been badly hit.

"I don’t understand why they’ve fallen so much – people still need to eat, after all.

“I’m quite an upbeat and cheerful person by nature and, as there is nothing we can do about the current situation, I try not to get too down about it.

"I’m fortunate – no one I know has been affected by the virus and my work means I can be outside, still able to enjoy the fresh air and have the sun on my face.”

JOURNAL : Farmers Weekly

Sheep farmers on Anglesey have cut antibiotics use during lambing by almost 60% over a two-year period.

By improving nutrition, hygiene, colostrum quality and management, a group of seven farmers reduced the number of animals treated with antibiotics without affecting production or welfare.

In the lambing periods from 2017-19, the farms reduced antibiotics by 59.8%, on average.

With veterinary and nutritional advice funded by European Innovation Partnership (EIP) Wales, the farmers demonstrated that a proactive approach can significantly reduce reliance on antibiotics at lambing.

See also: 4-step guide to reviewing antibiotics use on your farm

Feeding space

One of the farmers, Gareth Thomas, of Tregynrig, Cemaes Bay, said one of the simplest, but most effective, measures he put in place was to allow sufficient feeding space for ewes.

His ewes are fed ad-lib silage and receive concentrates twice a day, at 8am and 4pm.

He increased space allowances to 15cm a head when feeding ad-lib forage, and 45cm a ewe when feeding restricted concentrates. He achieved this by reducing the numbers at each trough from 50 to 40.

Protocols at lambing on the project farms

Pre-lambing pens were cleaned out, disinfected and limed between batches.

Water troughs were cleaned out regularly.

Lame ewes were treated promptly and managed separately, to avoid spread of infection.

Castration and tailing of lambs in the first week of life was avoided to minimise stress and wounds where joint ill bacteria could enter.

Everyone involved in lambing and handling sick lambs wore rubber gloves.

Stomach tubes were washed in warm, soapy water and disinfected in baby bottle solution.

Lambing pens for sick ewes or lambs and for ewes that had aborted were set up in a separate area, away from the main lambing pens.

Where cow colostrum was used, the quality was assessed using a refractometer and only colostrum at 22 immunoglobulin G or higher was fed to lambs.

Hygiene

Mr Thomas runs a flock of 650 Suffolk cross North Country Mule ewes, which he breeds to Charollais or Texel rams.

He disinfected the sheds twice when ewes were housed for lambing in January, with a two-week gap between groups to reduce E coli levels - singles were grouped separately from twins and triplets.

To aid the reduction in antibiotics use, bedding was analysed for bacteria that can cause mastitis, joint ill, scours and watery mouth.

“Bedding tests in the pre- and post-lambing pens are vitally important for us to know if we need to do anything to reduce E coli," explains Mr Thomas.

“By testing the bedding, we could act on the results by disinfecting and liming."

Mr Thomas says the EIP project taught him he needs to lime more around wet areas, such as troughs and feeding areas.

Nutrition

Good pre-lambing nutrition is another reason fewer antibiotics were used. For the project, silage quality was analysed for dry matter, protein, digestibility, metabolisable energy, minerals and fermentation.

At Tregynrig, in addition to ad-lib silage, ewes were fed a compound feed at 12.8 megajoules (MJ)/kg DM. This was introduced five weeks before lambing, up to a maximum of 0.9kg for triplets a week before lambing, 0.7kg for twins, and 0.3kg for singles.

Each farmer worked closely with independent sheep consultant Kate Phillips and with Karen Wheeler of Adas to formulate the correct ration.

Mr Thomas, who supplies fat lambs to Woodhead Bros in April and May, says the project has allowed him to lower his costs.

“I've saved at least £2-£3 a head by using vaccinations more accurately and targeting treatment, rather than using a blanket treatment approach," he says.

All the farms involved had achieved savings too, he adds.

“We did this without compromising animal health and welfare, as our ewes were in the best possible condition before starting lambing.

“We are now concentrating our spending on the places where it needs it most."

Sheep vet Kate Hovers, who advised the farmers, says the project demonstrates what can be achieved with good hygiene and nutrition, and simple management changes.

“Wide adoption of these approaches could have a dramatic effect on antibiotics use across the sheep industry," she adds.

About EIP Wales

EIP Wales, which is delivered by Menter a Busnes and Farming Connect, has received funding through the Rural Development Programme 2014-2020, which is funded by the European ***Agricultural*** Fund for Rural Development and the Welsh government.

It aims to take the outcomes from research – whether it is a new technique or technology – and test them at farm scale. There are currently 34 projects across Wales that bring like-minded people from different backgrounds together to try to solve common ***agricultural*** problems.

Lynfa Davies, who is Farming Connect's knowledge exchange manager and heads the EIP Wales programme, said the programme is on course to deliver the target 45 projects, so it is closed to new applications.

However, a number of other Farming Connect services and projects are available to support innovation and the introduction of new technologies, as well as investigating more efficient ways of working.

For more information on EIP Wales, please visit the Farming Connect website or contact: [*eipwales@menterabusnes.co.uk*](mailto:eipwales@menterabusnes.co.uk)

JOURNAL : Farmers Weekly

The Bazeley family run well-established self-storage and bottled beer businesses at Offwell Farm, near Fareham, Hampshire.

A tenant of Southwick Estate, Martin Bazeley started the storage business in 2003 and launched Suthwyck Ales in 2000, teaming up with a local brewery to make beer using malt from the farm’s own barley.

See also: Coronavirus news and advice

The coronavirus lockdown caused the loss of 95% of the pub trade for the beer business and the closure of its Victorian Steam Brewery retail shop.

Home deliveries help compensate

However, a home delivery service has been swiftly developed and this, together with increasing orders from independent shops, has roughly made up for the loss of the pub custom, says Mr Bazeley, whose sister, Jane, runs the office for the businesses.

Storage and beer – preparing for end of lockdown

Marketing course with the Self-Storage Association

Google Ad words evaluation and improvement

Increased Facebook marketing

Thinking ahead, planning for possible loss of storage customers

Using time to make sure storage offer is spick and span

Review of shop hours and how to maintain new business of home deliveries

Developing online offerings at Barn Store and Southwick Brewhouse websites

“One or two pubs have been brilliant at innovating, selling take-away containers of beer alongside fruit and veg and much more,” says Mr Bazeley

“The shop already had an online order and payment facility, so it was simply an update to add free delivery within 15 mile radius and a minimum order of £30, and we were away.”

Online sales went from a trickle to a healthy flow, boosted by additional marketing efforts, including Facebook posts.

Brewhouse manager Matt Hallett’s latest e-newsletter included a video and just a couple of hours after it went out, he took £1,062 of orders.

Business review

The enforced turnaround has brought a swift reappraisal of the business.

“It has just made us revise the whole thing. Maybe this is going to be the new way we trade,” says Mr Bazeley.

“Perhaps we will open the shop just on Friday and Saturday for beer sales and take care of home deliveries from Monday to Thursday.”

The business qualifies for small business rates relief and received a £10,000 grant from Winchester council. “This has helped us gear up to the new way of operating, so it has been a brilliant help,” he says.

Three business customers of the Barn Store self-storage operation have been badly affected by the lockdown and have been offered a 50% rent reduction for three months, with a review at that point, says Mr Bazeley.

“It’s important to have an end point. We prefer to help a customer who has been genuinely adversely affected to get through the worst and remain a happy customer, rather than lose a customer who may be hard to replace.

“It costs five times as much to acquire a new customer than to retain an existing one.”

Just three new customers have moved into the storage units since lockdown.

“We have been able to remain open, albeit discouraging casual or unnecessary visits. It’s mostly the business customers, one of whom is a supplier to the NHS, that still access their units.

“The flip side is, we are expecting some ‘pent-up' move-outs post lockdown – people who would have moved out naturally had it not been for the restrictions.

“We are examining our marketing to do what we can to replace these customers when they go.

“We’ve got to keep positive and keep going,” says Mr Bazeley. “We are channelling time into making sure the storage premises are looking top-notch.

“We all have to remember that however bad this is, it is temporary. When people are able to, they will be spending.”

Uncertainty causes wedding woes

Michael and Jenny Churches had a record 38 weddings booked for this year and many more coming in for 2021 and 2022 at their Glastonbury Wedding and Events business.

The ceremonies and receptions are held in a deconsecrated church right next door to Godney Farm, near Wells, Somerset, where they have a dairy herd, sucklers and sheep.

Wedding challenges

Uncertainty over likely physical distancing rule changes makes communication with couples difficult and planning almost impossible

Cashflow drop from weddings mean delay to investment on farm

Summer 2021 will be more of a management challenge as some weddings have been moved from 2020 and the calendar will be more crowded

After a two-year planning saga and much restoration work, the first wedding was hosted in 2015.

Providing a wedding venue is hard work at any time, with tensions rising as the big day draws near, and very bespoke arrangements are needed to accommodate different couples’ requirements.

“Since the announcement of the lockdown on 27 March, it has been awful,” says Mr Churches. The uncertainty makes planning impossible and things have been frustrating and, at times, fractious, he says.

“It was very stressful getting in touch with couples and having to tell them they were going to be limited on numbers before the government stopped weddings and events altogether.

“We have since managed to move 15 weddings that would have been taking place in April, May and June, and lost three couples that cancelled.

“We have even had to move our daughter's wedding. When the invitations have already gone out it, it is even more frustrating for us and for other couples, because of the uncertainty and having to judge how long you leave it before you tell your guests it will not be happening.”

Six weddings are pending, with couples waiting to see if the government limits numbers or stops them altogether.

“The only small consolation is the farm is still operating as normal as can be possible,” says Mr Churches. “But the price of the milk and beef is not that good either. It is all looking a bit grim.

“We are grateful for the couples that still have their weddings with us and we are rolling all the deposits on for a year.”

The shutdown time is being used to extend the car park and do maintenance such as creosoting fencing and planning for five glamping pods, pending planning permission being granted.

“We could really do with having them here now so we can get the services into them,” says Mr Churches.

“It’s all moving forward, but we just need the cash coming in – we’re not alone, but it’s going to be challenging.”

The farm funded the £167,000 spent on updating and converting the church, and while this is preferable to owing the bank, the farm must be paid back, as improvements are needed there too, says Mr Churches, who has applied for the £10,000 small business rates relief grant.

The Churches’ son, Andrew, has converted two Rice horse trailers (pictured above) into mobile event bars. One generally stays at the farm for functions in the church, while he takes the other one to events off farm. Both are being kept in the barn until lockdown rules ease.

FW Awards finalists

Jenny and Michael Churches were finalists in the diversification category of the 2019 Farmers Weekly Awards and hosted a Farmers Weekly diversification event in October 2019.

Lakeland venture adapts to forced change of plan for first full summer

Isaac and Kerrie Benson only opened their Lakeland Farm Visitor Centre in July 2019.

Lockdown has meant the closure of the centre and the café, just as the business was looking ahead to its first full summer season.

However, like many others, the Bensons are adapting.

Before the closure, footfall at the centre and in the shop and café was about 90% local, but also heavily weighted to older customers, who in general will have to isolate for the longest, says Mr Benson.

This makes the outlook for the recovery a long one. It’s never going to be business as usual for the next 18 months, while the older generation will have to shield, he points out.

“But I’m not complaining; things could have been a lot worse.”

Lakeland Farm Visitor Centre

Farm experience venue, café and farm shop, near Ings, Cumbria

Demonstration area based on an auction-ring setting for safe livestock handling

Dry stone walling demos and classes, alongside wool spinning and craft classes

Adapted to supply takeaway ready meals to help make up for loss of café income

Meat sales from own livestock has doubled in shutdown

Meat sales rise

While the café and the centre are closed, the use of the farm’s own lamb and beef has doubled, benefiting from the closure of the local town’s two butcher shops, which were heavily dependent on the hotel and restaurant trade.

The business has adapted to provide reasonably priced takeaway ready meals all day, on which no VAT is payable. Staff costs are also lower, so the margin is higher. Orders and payment are generally taken over the phone, and customers can pick up their meals in the car park.

Family labour

The four full time café staff have been furloughed and the business is relying on family labour, alongside the full-time butcher in the shop.

“We’ll miss the whole summer season,” says Mr Benson. “But as long as the furlough system is in place, the jobs will be there for the staff to come back to. But if that goes, they’ll be looking for a new job, and that’s the brutal reality of it.”

“We can’t expect to go into the winter with a full team unless there is some sort of help package and until our older customers have the security of a vaccine.”

The Bensons also have a holiday cottage, for which they received some local authority grant aid, but as the farm visitor centre is still in the process of being rated, they are unsure how much help will be available for this.

JOURNAL : Farmers Weekly

Feeding a 50:50 ration of grass and maize silages to pregnant ewes three weeks before lambing is improving their ability to produce milk.

Home-grown maize silage is fed to the 500 Mule ewes at Bryn Farm, near Cowbridge, when they are housed before lambing.

“The maize makes the ewes very milky,” says Owen Rees, who oversees the sheep enterprise and farms with his father, Ed, his uncle, Robert, and cousins, David and Tom.

Farm facts

384ha farmed, of which 243ha are owned

Lambs sold to Dunbia at a liveweight target of 40kg

Most lambs sold by the end of September

100 lambs retained as replacements

Aberdeen Angus cross Friesian and Hereford cross Friesian suckler herd, calving from April to June

Offspring sold at 26-28 months old at a target of 280-330kg deadweight. Angus cattle are sold to Scotbeef and the Herefords to Celtic Pride

Why did they switch to feeding maize?

The business is largely self-sufficient in feed, growing 10ha of maize and up to 16ha of spring and winter barley.

The maize had been grown as feed for the 120-cow suckler herd, and was introduced into the ewe diet two years ago when the family were seeking an alternative to energy blocks.

“We were using the energy blocks to balance the grass silage and hay the ewes were getting, but they were costing us about £25 each and we were getting through two pallets of them," Owen calculates.

See also: All you need to know about feeding sheep a total mixed ration

With limited feed space, the blocks were positioned in ring feeders in a yard adjoining the housing.

“The blocks were expensive. We never knew which ewes were taking them and we were getting a lot of cases of twin lamb disease," Tom recalls.

Their nutritionist suggested adding maize silage to the ration.

Minimising health risks

Owen admits he initially had reservations, because ewes are known to gorge on maize and become fat, putting them at risk of metabolic disorders in late pregnancy.

But by introducing maize silage into the ration just three weeks before lambing, the Reeses say the condition of ewes can be maintained.

“Although we were advised twin lamb disease could be an issue with feeding maize, we haven’t had a single case since we introduced it two years ago," Tom points out.

He adds: “If anything, the flock is doing better on maize because ewes are producing more milk and the lambs are born stronger.”

Expert advice on feeding maize to pregnant ewes

Below, independent sheep consultant Kate Phillips offers some advice on feeding maize to pregnant ewes.

1. Analyse grass and maize silage to establish if supplementary protein is needed.

E To develop an appropriate nutritional plan for pregnant ewes, it is important to know the feed value of the silage being offered.

E Maize has a lower crude protein content than grass silage, but it is generally high in energy, so is an ideal partner to high-protein grass silage.

E The high starch level in maize provides plenty of rumen-fermentable energy; this gives a synergistic effect with the high protein of grass silage.

E It is important the ewe’s protein and energy requirements are met so that colostrum and milk supplies are plentiful. Check the grass/maize silage intake is meeting the ewes needs by assessing silage dry matter intake and comparing it to the standard energy and metabolisable protein needs as ewes approach lambing.

E Supplements may be needed to provide additional protein, but the level depends on the forage analysis. Rapeseed meal, beans and soya bean meal are all possible supplements.

2. Condition score ewes

E It is very easy to overfeed single-bearing ewes, so care should be taken to check ewe body condition and feed ewes according to body condition score and litter size.

E In late pregnancy, ewes on maize can become fat and prone to metabolic disorders, such as twin-lamb disease, so when condition scoring, feel for backfat rather than visually scoring ewes.

For advice on feed rates see p4 of the Improving ewe nutrition PDF.

3. Allow sufficient feed barrier space

E Allow a minimum 15cm of feed space a ewe when feeding a total mixed ration to avoid cramming, which increases stress and may lead to abortion in extreme conditions.

4. Don’t overlook minerals

E Maize has lower mineral and vitamin concentrations.

E Provide additional minerals – particularly calcium and trace elements.

The feeding process

The system at Bryn Farm is simple: a bucket of fresh maize is deposited in the central passage once a day and forked into the silage.

“There is no science behind it, but it is roughly 50:50 grass silage and maize silage," says Owen.

The feed is pushed up with a fork about three times a day.

In 2019, the maize analysed at 33% dry matter (DM) and 11 megajoules (MJ) of metabolisable energy (ME)/kg DM . The grass silage analysed at 32% DM, 15.9% crude protein, 11MJ ME/kg DM  and had a D-value of 69.

The Rees family give no supplementary feed. Instead, the aim is to produce lamb as cheaply as possible while maintaining ewe performance.

“Margins are very tight, and we are trying to keep costs low by making more use of home-grown feeds,’’ says Tom.

“Some of the ewes get a bit of barley when they are at grass, if they are a bit lean.’’

Ewes are typically at grass until they are housed three weeks before lambing, depending on the weather. Grass intakes are supplemented with baled silage and hay fed from a ring feeder.

Practical considerations

Maize can easily be incorporated in the diet because the Reeses grow a large acreage as feed for their beef herd – the 2019 harvest yielded 49t/ha, with about 50t fed to the sheep.

Although it has been straightforward to add maize to the ewe diet at Bryn Farm, Owen admits it can be impractical to grow maize in some sheep systems.

“If we needed maize just for our sheep, we would only need to grow 2.5 acres [1ha], and at that level we wouldn’t do it, because it would need to be harvested and clamped,” he says.

Another option for sheep farmers is to buy maize from a local grower, he suggests, although keeping it fresh could be a challenge if it is delivered in large quantities.

Owen admits it is not always easy to get the feeding of ewes right, but with maize silage, he says, he has found a system that works for him.

“Some farmers can overcomplicate their systems, adding to their costs, but we keep everything as simple as possible, to keep our costs to a minimum,” he says.

JOURNAL : Farmers Weekly

Buying “waste” dairy bull calves and finishing them on low-cost feed and crop waste is helping to keep feed costs low while improving arable ground.

Each year, Will King buys 1,000 dairy bull calves and dairy cross beef calves from the three main commercial dairy herds in Essex.

After rearing, they move on to a low-cost ration that uses unsaleable crops from the arable business and bought-in feed waste. This helps maximise potential margins.

See also: Target daily liveweight gains to cut beef finishing times

“I’m buying a low-cost animal that no one has tried to get a profit from before me,” explains Mr King.

“We’re feeding them waste products – while still providing a quality diet – and homegrown feed such as potatoes and homegrown fodder beet this year. My physical capital outlay is minimal.”

With Arla among a growing number of milk processors moving to stop the slaughter of dairy bull calves under eight weeks old, Mr King’s model could prove useful to dairy farmers looking for an outlet for calves.

Farm facts

Old Oaks Farm, Little Bentley, Essex.

Will King farms in partnership with parents, Brian and Judy (WL King & Son).

162ha at Old Oaks Farm, including 121ha of arable.

Will King is also part of Wix Farms, a co-operative farming arrangement with two neighbouring arable farmers. This business farms 810ha.

Grows winter wheat, winter barley, spring peas, potatoes, onions and maize and grass leys for cattle. Fodder beet also grown this year.

Grass and maize for cattle are bought at cost rate from Wix Farms by WL King & Son.

Construction business: K&J Construction – fabricates and manufactures steel-framed ***agricultural*** buildings.

This could be particularly attractive to arable farms looking to address diminishing soil fertility by reintroducing stock.

“Big arable farms are turning to AD plants and they’re feeding the concrete cow,” says Mr King.

“What’s the point when you can feed the real thing, get the muck back and produce a product the market wants?”

Sourcing calves

The value of mixed farming has long been recognised by the King family, who traditionally ran pigs and cattle alongside the arable.

The decision to source dairy-bred calves locally came about seven years ago when Mr King began to experience health challenges in bought-in cattle.

“We started buying from a dealer in Cheshire, but we were starting to get TB problems and pneumonia as they were coming from so many farms,” explains Mr King.

As a result, he instigated discussions with three Essex producers to see if he could source stock directly.

This would minimise any disease risk as they would be coming from herds of known health status on a four-yearly testing regime.

He now buys from three dairy farms and takes every beef calf they produce. Mr King works closely with the dairy farms to discuss requirements.

Good colostrum management is expected. Calves are also vaccinated for infectious bovine rhinotracheitis (IBR) and all herds are monitoring for bovine viral diarrhoea (BVD).

To maintain relationships, and encourage calf quality, on average, producers are paid slightly above market price, with Mr King aiming to take out the peaks and troughs of the market.

Rearing process

Mr King buys the calves from one week of age. They are then picked up from the dairy farms by contract calf rearer, Daryl King, who feeds calf milk replacer twice daily before weaning them at eight weeks of age.

At 14 weeks, they move to Will King’s farm, where they are housed year-round. Bulls are castrated. Will King believes diet consistency is essential to prevent dips in growth rates. With that in mind, he continues to feed the same pre-weaning pellet up to six months old.

He also avoids making any changes to the total mixed ration (TMR). The current TMR includes grass and maize silage, brewers grains, waste bread, homegrown fodder beet and some feed-grade urea. Sometimes, potatoes may be used instead of fodder beet.

Onions may also be fed to younger animals, but they must not be fed three months before slaughter to avoid meat taint. Some wheat or barley bran may be bought in, but the aim is to avoid concentrate feeding.

The proportions in the ration will be altered to deliver a 14% crude protein diet until 11 months of age, when this reduces slightly to a 13% grower/finisher ration.

The aim is to make the most of the better feed conversion efficiency in younger animals and finish them by 18 months old. Mr King believes keeping them any longer just encourages frame growth and adds to overhead costs, which reduces margins.

Half of the beef animals are finished and sold to Dunbia. These typically achieve 320kg deadweight at 18 months old at O- or O+3. The rest sold as stores. On average, cattle are hitting growth rates of 1.2kg/day from arrival to slaughter.

He explains: “Others will get better growths than me. I’m not getting the fastest growth, but I’m doing it economically.

“The margins in beef are very tight and you have to be careful with your overhead costs; they can easily spiral.”

Resilience

With the recent crash in beef prices, Mr King says all farmers will struggle to make money. However, he feels his low-cost model puts him in a better position than some.

“At the current price of £2.91/kg, any profit is very marginal. However, I feel we are in as good a position as we can be to weather the forthcoming storm,” he says.

He believes his model also proves there is a market for dairy-bred beef, particularly considering the demand for smaller cuts and processed beef – something that has increased in light of coronavirus.

Mixed farming benefits

Grass and maize provide a breakcrop for blackgrass.

Grass leys may be planted after barley to provide a cover crop over winter before maize drilling – this helps soil fertility and prevents winter run-off.

Maize can be put on ground not suitable for onions or potatoes.

Muck from cattle goes back on arable land to help fertility.

Leftover wheat may be ground for cattle. Stock feed potatoes are also fed to stock – converting waste into a valuable product.

JOURNAL : Farmers Weekly

Money-back schemes designed to compensate growers for some of the economic risk associated with failed oilseed rape establishment are being offered on seed purchases of selected varieties again this year.

After pilot initiatives in 2019, most breeders have launched risk-sharing or establishment guarantee schemes for 2020 drillings, with funding either coming direct from the breeder or through the existing Bipo model royalty system.

As such, it means OSR crops that are drilled but then fail to establish by a certain date – usually late October/early November - will be eligible for an agreed rebate of about £30/ha.

See also: Guide to which OSR varieties to drill in summer 2020

However, only named varieties nominated by the different breeders are covered and growers will be expected to submit evidence of crop failure in order to receive the money.

Crop support

The finer details of the various schemes may vary, but the intent is the same and reflects the industry’s willingness to support the crop at such a critical time, says James Barlow, head of seed at ADM ***Agriculture***.

“After two very tough years for oilseed rape establishment, there is recognition that growers are under pressure with the crop and reluctant to expose their businesses to more risk.

“These initiatives, which apply when the crop is still in the danger zone, can be a useful part of a risk-management strategy. There’s no extra cost associated with them, so there is no downside for growers.”

Where oilseed rape is to remain in the rotation, Mr Barlow recognises that farm-saved seed can seem attractive if establishment problems have been encountered previously and growers are looking for up-front savings.

“Remember that you won’t get useful traits such as turnip yellows virus resistance if you home-save. If you want top-line genetics and all the advantages they can bring, then you do need to go down the hybrid route and buy new seed,” he stresses.

Uptake in 2019

Last year, RAGT saw about 900ha of the crop sold through the company’s royalty payment scheme.

Of that, growers claimed on about 40% of the area, reflecting the tricky combination of high flea beetle pressure and lack of soil moisture at the critical establishment stage.

Tom Dummett, cereal and OSR product manager at RAGT, expects greater engagement with the company’s scheme this year and predicts 6,000ha of rape will be covered by it.

“It’s a very straightforward process to sign up – it takes two minutes and can be done online,” he says. “The system is based on the existing Bipo model, and it means we are sharing the risk with growers – our royalty income is affected if crops don’t establish.”

Just two RAGT varieties are included – the company’s new Clearfield variety, Nizza CL, and a French-bred hybrid variety, Azurite, which is not going through the Recommended List system.

“We want to encourage farmers to grow oilseed rape, so we’ve chosen varieties that have the vigour required for good establishment.”

Risk mitigation

Not all of the breeders are taking part; Limagrain has no current plans to offer an oilseed rape establishment guarantee.

With a very strong oilseed rape portfolio, including the top-yielding conventional and hybrid varieties, the company believes it has built-in risk mitigation.

“The conventional varieties have a lower seed cost and the hybrids are packed with traits,” says Will Charlton of Limagrain. “We think the genetics speak for themselves.”

What schemes are on offer for 2020/21?

RAGT

RAGT is putting its weight behind an oilseed rape royalty payment scheme, which means growers will save about one-third of their overall seed costs, or £30/ha, where crops fail.

Growers declare the area of oilseed rape established by 1 November and pay the royalty due. Failed areas are exempt - so there will be no royalties paid if crops don’t make it.

To be eligible, growers must have a signed royalty area ***collection*** agreement with an RAC number and have to declare the crop area established by 1 November.

Two RAGT varieties are in the scheme - Clearfield variety RGT Nizza CL and hybrid RGT Azurite.

BASF

BASF is backing all of its InVigor winter oilseed rape varieties with a seed risk-sharing scheme that will also pay growers £30/ha for crops that don’t establish.

Providing drilling takes place before 22 September and crops have failed by 31 October 2020, payment will be triggered.

All purchasers of InVigor seed will be automatically registered onto the programme, following a successful launch last autumn.

Bayer

Bayer has introduced an enhanced establishment scheme that will compensate growers by £100/bag or about £33/ha for any crops of more than 6ha of certain Dekalb hybrids that are lost by 31 October.

Three of its hybrid varieties are eligible – DK Exstar, DK Extremus and DK Excited. To take advantage of the scheme, growers need to purchase their seed through one of Dekalb’s participating distributors and register on the brand’s website.

Validated claims for crops drilled before 20 September that failed to establish by the end of October will be issued with credit notes by 20 November.

KWS

KWS has extended its Oilseed Establishment Partnership, which it introduced last year following concerns about the establishment of oilseed rape crops.

Growers will be expected to pay about 50% of the seed costs upfront, with the rest waived if the crop does not establish. Two conventional varieties are covered by the scheme – Blazen and Codex – with crops that have failed by 1 November being eligible.

The compensation amounts to £25-£28/ha, as the seed costs £115-£120 for packs with 4m seeds.

DSV

In a different approach to establishment risk, DSV will be supplying three of its triple-layer hybrid varieties – Duplo, Darling and Dazzler – in a larger seed bag, at no extra cost to the grower.

In practice, it means growers will be getting 20% more seed than before, with the bag now containing 1.8m seeds rather than 1.5m seeds. The company calculates the move is worth £50/bag.

HOLL varieties

Seed of two high-oleic, low-linolenic acid (Holl) varieties, V316OL and V367OL, will be replaced for free if the crop has failed by 15 September. To be eligible, the replacement seed has to be redrilled in the same year, highlights United Oilseeds.

Grower reaction

In Dorset, Tim Hall is halving his OSR area and does not plan to buy in any seed, so guarantee schemes aren’t relevant this year. He also wants the best varieties for his farm and system, rather than have them dictated to him.

The current OSR YEN winner, Richard Budd, in Kent, will be sticking to his tried-and-tested approach of using home-saved seed, drilled late at a high seed rate. This approach does not suit hybrids, he points out, as the seed cost would be prohibitive.

Andrew Wells, agronomist and farmer in Nottinghamshire, says he is very unlikely to grow oilseed rape this autumn, no matter what seed deal is available. He believes a co-ordinated regional break from the crop for more than one year is needed, to reduce the pest load.

In Staffordshire, farm manager Tim Parton intends to continue with his successful oilseed rape production and would take up the right money-back offer, just as he did last year. However, a planned move towards conventional varieties may limit his chance of benefiting from such schemes.

JOURNAL : Farmers Weekly

Genetics and a programme of tailored nutrition have helped two Herefordshire farmers successfully lift the laying cycle of their flock of free-range hens beyond the UK’s 72-week average.

As long as everything is working well, 100 weeks is definitely achievable, believes Nick Panniers, who farms with his father, Allan.

“The back end of the cycle is where you get the most profit; that is when you make the money to cover the cost of the pullets," he says.

See also: 4 key poultry management factors influencing egg size

The Panniers produce eggs from 64,000 Dekalb Whites at Wellington Farm, Bishops Frome, switching from brown layers in 2018 in response to a new supply contract.

Their existing packer, Stonegate, had asked the business to supply white eggs for Waitrose's essential free-range brand.

In response, they sourced white birds from Hendrix Genetics.

After visiting farms stocked with Dekalb Whites in Holland, they were confident the breed would last longer in their system than the typical 74-week cycle they had with Brown Lohmanns, although they did have initial concerns that the Dutch systems are mostly barn, while theirs is free range.

“That was a big point of difference to consider but we discovered that white birds perform extremely well in free-range," Nick says.

He initially set a depopulation target of 90 weeks, but increased that to 100 weeks to supply the Christmas market.

“As the hens were laying well we agreed to keep going and did so with very few issues," says Nick.

Their rate of seconds did increase to 12% at week 85, but this was due to an infectious bronchitis challenge.

“That knocked them a bit, so without that we think we can improve on our seconds rate this year,’’ says Nick.

He admits the practicalities around when to depopulate are a consideration.

“This year, if we deplete at 100 weeks it will fall in August when we are busy with the harvest, which doesn’t suit us very well, so perhaps we will need to deplete a bit earlier to balance the work out a bit.’’

The challenges of longer lay

One of the challenges of keeping flocks for longer is maintaining consistent performance. Nick says the system is set up to take pressure off the birds.

“We have to make sure that everyone involved is singing from the same hymn sheet. The routine is very important, we always pack at the same time, feed at the same time."

Four ways Wellington Farm  increased depletion age and maintained productivity

1. Genetics and vaccination

Through selection and breeding programmes there are now efficient laying hens with greater persistence of lay, alongside acceptable egg quality and egg numbers.

The Panniers pay about 5% more for white birds, but say this cost is balanced by the breed’s hardiness and longevity.

Their pullets are comprehensively vaccinated for Newcastle disease, Marek’s disease, egg drop syndrome, salmonella, infectious bronchitis, and also for E coli due to a challenge on the farm.

2. Nutrition

Helping the bird preserve good eggshell quality for a longer laying period requires specifically tailored nutrition.

The flock is run on a four-stage diet, with a high but consistent energy structure across all the rations to lower consumption and minimise stress on the birds when they are introduced to a new ration.

The farm’s nutritionist, Tom Lander of Lloyds Animal Feeds, devised the feeding programme. He says taking birds to 100 weeks is “a marathon, not a sprint".

“Really large, early egg size will render the 100 week programme unviable," he warns.

The strategy for feeding is as follows:

Start of lay ration

This is 18% protein to help birds recover from the stress of transit and to build bodyweight as they come into lay.

5% lay to peak ration

Crude protein level reduces to 17%, but fibre levels increase slightly to 5% and calcium to 3.75%.

Mr Lander says fibre content is designed to help slow digestion so that faecal matter is drier.

“Layers coming into lay very quickly can become stressed easily and their faecal matter can become quite loose," he says.

The extra calcium is important as the birds’ rate of lay increases.

“We give the bird every opportunity to absorb the right amount of calcium to reduce second quality eggs," says Mr Lander.

Post-peak ration

Once birds have maintained peak production for several weeks and egg quality and size are appropriate, the amino acid profile is slightly reduced, for methionine and lysine in particular, to prevent eggs getting too large very quickly.

This diet is 5.5% fibre, combining digestible and non-digestible elements, with supplementary dried lucerne bales used in the housing.

Home-grown oats are milled on farm and included at 5% post-35 weeks, increasing to a maximum of 8% later in lay.

Oyster shell and limestone content is increased every 10 weeks to reduce calcium exhaustion in the medullary bone and aid its transfer to the digestive tract.

Post 75-80 weeks

Eggs start to reduce in quality but increase in size, putting pressure on the bird.

To manage this, this diet is lower in lysine and methionine while, at 4.5%, the maximum level of calcium that can be usefully absorbed and digested by the birds is included.

Crude protein is 15.5% and fibre 6%

Regular analysis of home-grown feeds

At 12-week intervals, wheat is tested against target specification requirements

Finished feed analysis is also scrutinised to ensure it is at the correct specification

This policy pays off, says Mr Lander. “We had some wheat samples where protein was a little higher than what we expected so we addressed the balancer to take account of that result."

This made sure that they were not over-supplying the bird with crude protein and the amino acid profile stayed in line with target levels.

3. Management

The birds are flighty when they arrive, which can make weighing and stock management a challenge. But the Panniers and their stockmen, Gary Morgan and Jackie Dorrington, overcome this by weighing before the lights come on.

White birds pick up both good and bad habits in no time, says Nick.

“They quickly learn to go up into the system at night and into the nest boxes but they will also learn to lay floor eggs, so you have to be on the ball."

The early morning routine is consistent with birds walked every morning, at the same time, to check for feed, water and any changes to behaviour. Birds are not disturbed in the afternoon.

Dimmer lighting regimes help control egg size and quality at end of lay. “We run the sheds a bit darker to keep the birds calmer," says Nick.

4. Water quality

Water is tested every 12 weeks. If it is high in bacteria, with a total viable count (TVC) exceeding 100, an acid is applied and flushed through the drinker line. However they consider anything over 50TVC to be undesirable.

Water is particle and UV-filtered for each house to help reduce the TVCs further. “This maintains a low TVC on the farm, this solves a big part of the production puzzle," says Mr Lander.

JOURNAL : Farmers Weekly

Jim and Julia Beary have transformed an upland farm by doubling stocking rates and cutting 30% off prime lamb cost of production since moving to Yorkshire.

Rotational grazing, hard work and a helpful landlord, who contributed to the cost of improving water infrastructure, have made the gains possible.

Now farming a total of 250ha of grassland, ex-Farmer Focus writer Mr Beary has fulfilled his dream of farming full-time after several years of balancing farmwork with off-farm income, which still comes in from Mrs Beary’s part-time nursing.

See also: How beef herd is delivering £350/cow net profit with deferred, mob grazing

Now based near Sheffield, the Bearys moved to their current second tenanted farm – on a 10-year farm business tenancy – at the 140ha Ughill Hall Farm, Bradfield, in 2017.

Glen Farm: getting started

The first big step for the Bearys came in 2012 when Mr Beary took on his first farm, Glen Farm near Aston, in 2012 – an 34ha county council farm.

Mr Beary contract reared 900 dairy-cross calves a year and developed a flock of Aberfield cross New Zealand Romneys.

He also contract gritted through the winter.

Farm facts

Beary Farming

800 Aberfield cross Romney, Cheviot and Highlander ewes and 200 breeding ewe lambs

Lambs sold to Kepak on Tesco cost of production contract

Growing 100 dairy-cross steers a year on Dovecote Park contract for Waitrose

3,750 pigs grown for BQP a year on Freedom Foods system

Average rainfall of 1200mm/year

Land rising to 365m

250ha in total

140ha at Ughill Hall, 60ha at Dronfield and 50ha of grazing/cropping

Ughill Hall: chance of a bigger farm

In 2017, the Bearys applied for a larger tenancy at Ughill Hall after a friend had seen it advertised. Equipment and 600 sheep were moved from Staffordshire to South Yorkshire.

“The farm was in good order, but it was set up for set stocking,” explains Mr Beary.

“There were only four gates on the whole farm and two water troughs.”

The Bearys borrowed money to fence the farm and increase flock numbers, buying 200 one-to-three-year-old Cheviots from South Wales in 2018. Contract growing arrangements on batches of cattle and pigs were added last year to further dilute fixed costs across more output.

Previously, sheds were only required in the spring to lamb ewe lambs and some triplets, but the arrival of 900 pigs means sheds are used most of the year.

Weaned pigs arrive at 7kg and are grown to 50kg on loose-housed straw as part of the Better Quality Pigs (BQP) supply chain on a bed-and-breakfast contract. Dairy-cross cattle continue to be reared for Dovecote Park.

Cattle now arrive at about 150kg as strong weaned calves from Waitrose dairy farms and are targeted to gain 0.8kg/day over 12-14 months, taking them up to 450kg.

Apart from being built up from 1.5kg to 2.5kg a head a day of a 16CP grower pellet when housed for winter, the cattle just get silage and grazed grass until being sold to a finisher farm.

The mixture of enterprises helps with cashflow and the pigs and cattle produce P and K for the land. The cattle also help control parasites for the sheep.

Investments

A fencing overhaul at Ughill Hall has so far seen £15,000 spent on electric, semi-permanent and permanent fencing. Initially Mr Beary started by simply halving the biggest fields for grazing and then enlisted consultants Precision Grazing to map out paddocks.

Subsequent subdivision left 40-50 paddocks and required £20,000-worth of infrastructure, which was covered partly by the landlord.

Mr Beary opted for a 45,000-litre Agrismart bladder tank – enough for all stock for five days. Liming one-third of the farm has increased pH levels from an average of 5.5 to 6.

Mr Beary calculates a 30% return on investment on lime, fencing and water infrastructure.

Rotational grazing on 2.5ha paddocks has improved swards. Seeds have been stitched in to diversify species – only 20ha of reseeding has taken place after winter forage swedes (plantain, Aber grasses and clover). Nitrogen use has fallen from 70-80kg/ha on the lambing paddocks to just 25kg/ha.

“Letting the sheep graze and stitching in deeper-rooting varieties such as chicory, timothy, cocksfoot, plantain and clovers has helped soil health, helped clover return and cut nitrogen use.”

Progress

Stocking rates have lifted from 90 livestock units (LSUs) to 200, not accounting for 900 housed pigs. Grass use has also lifted. The farm grew 6t/ha DM of grass last year and used 80%, compared to growing 4t/ha DM and using 50%.

This has allowed Mr Beary to run the sheep without hard feed, which, hand-in-hand with a growing flock, has seen cost of production drop by £2/kg.

Future

Another 100 calves are arriving this spring, which will mean stocking rates will peak at a total of 200 cattle on the farm for four months until the previous year’s cattle are sold.

The farm expanded last year when the Bearys took on a 60ha ex-dairy farm 14 miles away, near Dronfield, in April 2019. The current plan is to re-establish the paddocks and water troughs at the new farm and use that as a finishing unit.

The upland farm is currently stocking at a little over one LSU/ha when accounting for moor, banks and restricted grazing, but Mr Beary says they could probably stock 20% more.

“We could expand but the plan is to make better use of what we have,” says Mr Beary, who would like to regenerative farming and possibly convert to organic.

“I am really excited by the holistic and regenerative farming principles of Joel Salatin and others.

“It makes sense to start with soil health, what’s there ends up in the plant and what’s in the plant ends up in the animal.”

“Whatever we do, we need to keep it simple, keep costs down and try to finish off forage, so we sell a better product at the end.”

Tips for expanding for new entrants

Try to expand steadily and maintain a secondary income. The Bearys did this with contract gritting and Mrs Beary’s nursing work.

Always have cash to buffer yourself as a plan B if things go wrong, such as bad weather, low output, disease.

Limit spending to infrastructure that you can take with you – for example, electric fencing, portable troughs and essential machinery.

Ensure quick returns from improvements the landlord will benefit from after you’re gone. Lime, fencing and reseeding can see a 30% return on investment if done well.

Keep machinery to bare essentials as it depreciates. Invest in stock instead as this can appreciate and grow your balance sheet to take more land or increasing borrowings. The Bearys use contractors for most work and have a load-all, 120hp tractor, quadbike, trailer, aerator and fertiliser spinner.

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**End of Document**



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HINA Digest

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**Body**

Zagreb,Hrvatska16 December 2020 (Hina) - Croatia registers 3,327 infections, 92 deaths ZAGREB, Dec16(Hina) - In the past 24 hours 3,327 coronavirus infections have been registered in Croatia, bringing the number of active cases to 22,042, and 92 COVID-19 patients have died, the national COVID-19 response team said on Wednesday. Currently 2,907 patients are hospitalised, including 294 on ventilators, while 53,286 people are self-isolating. Since the outbreak of the epidemic, Croatia has registered 183,045 coronavirus cases and 2,870 COVID deaths, while 157,773 persons have recovered, including 2,694 in the past 24 hours. To date 908,215 persons have been tested for the virus, including 11,387 in the past 24 hours. Death rate among COVID-19 patients on ventilators at Dubrava Hospital at 68% ZAGREB, Dec 16 (Hina) - The mortality rate for COVID-19 patients placed on ventilators at Zagreb's Dubrava Clinical Hospital is 68 percent, Health Minister Vili Beros said at a press conference of the national coronavirus response team on Wednesday.

"Today, on the 296th day of the pandemic, unfortunately 92 of our fellow citizens have died, and this indeed is a large number. Twenty-four patients died at Dubrava Hospital, of whom eight were on ventilators," Beros said, noting that the mortality rate among COVID-19 patients on ventilators was 68 percent. Beros said that 65 of the patients on ventilators who died today had three or more underlying chronic diseases. He said that the mortality rate among patients without comorbidities who were on ventilators was 16 percent. "Clinicians think that such a large number of deaths is the result of large daily numbers of new cases of two or three weeks ago which exceeded 4,000. If the number of new cases continues to fall, about three weeks from now we can expect the number of fatalities to start decreasing," the health minister said. Responding to reporters' questions, he said that at this point there was no reason to suspect that patient numbers provided by Dubrava Hospital were not true. Citing a report filed by the hospital today, Beros said that 457 COVID-19 patients are being treated there and that the hospital is operating at 73.12% capacity. The number of patients admitted in the last 24 hours is 45 and 73 patients are currently on ventilators. He said that the ventilator occupancy rate is 82.02%, adding that five new patients have been placed on ventilators and 31 have been discharged in the last 24 hours. Capak: Three-day rolling average of COVID-19 cases significantly lower ZAGREB, Dec 16 (Hina) - Croatian Public Health Institute (HZJZ) head Krunoslav Capak said on Wednesday that Croatia this week had a considerably lower three-day rolling average of new COVID-19 cases compared to past weeks, and that it was now fifth in the EU when it comes to the number of infections. At a press conference of the national COVID-19 response team Capak presented three-day ***data***, according to which there were 7,159 new infections this week, 9,019 new infections last week, while two weeks ago there were 8,269 such cases. The HZJZ also calculated the cumulative COVID-19 incidence rate for Croatia, which is 43,903 cases per one million inhabitants, and there are four EU countries with higher rates -- Slovenia, Belgium, the Czech Republic and Luxembourg. There are still big differences in incidence rates between counties, with Medjimurje County having the highest incidence rate, followed by Varazdin and Krapina-Zagorje counties, while Dubrovnik-Neretva, Istria and Pozega-Slavonia counties have the lowest incidence. Capak also said that the decline in the number of new infections had nothing to do with the fact that rapid antigen tests, who had been widely used in the past two weeks, were not included in the ***statistics***, and he explained that rapid antigen tests were not reliable in diagnosing new patients. He stressed that there was still no reliable information when the COVID-19 vaccine would be registered in the EU, and therefore when it would arrive in Croatia. "We have a promise from the manufacturer that it will deliver the promised quantities of the vaccine in January. Enough doses of vaccine havebeen pre-ordered for Croatia's entire population," Capak said. He explained that it was not yet known how many health workers would be vaccinated because the ***data*** from the conducted surveys were not available for all counties. Asked about the ethics of vaccines, he said there were differences in the technology of vaccine production, but that he personally did not know why some of the vaccines would be unacceptable for ethical reasons. The head of Zagreb's Dr Fran Mihaljevic hospital for infectious diseases, Alemka Markotic, said that the Oxford and the Russian vaccine had been produced using fetal cells, in the same way various vaccines had been produced in the past 55 years and which had been used to vaccine millions of people in recent years. Markotic called on those who had recently got infected with COVID and had risk factors to contact their family doctors or COVID treatment facilities at an early stage of the disease. 70 high-flow oxygen devices to be delivered to health institutions over next two days ZAGREB, Dec 16 (Hina) - Seventy high-flow oxygen devices will be delivered to health institutions across Croatia over the next two days, the Health Ministry announced on Wednesday. The devices will help health workers in providing adequate care to patients with respiratory problems. "I am glad to hear that the delivery of these devices and the training of health workers for their use has just begun. I believe that their use will reduce the pressure on the healthcare system," Health Minister Vili Beros said. PM: Epidemic has cost Croatia €4 bn, new measures on Friday ZAGREB, Dec 16 (Hina) -Prime Minister Andrej Plenkovicon Wednesday said that Croatia was nowfacing a challenging periodin the coronavirus epidemic which has cost Croatia HRK 30 billion so far and that the human casualties and the highnumber of people infected call for new measures. "At the moment we are hammering outseveral proposals for new measures. They will probably be ready on Friday when we plan to present them," Plenkovic told a press conference after coming out of self-isolation since his recovery from COVID-19. The CroatianPM said that it was not time to easethe measures and that measures that are to be extended will be presented on Friday and what else can be done to reduce contact and movement of the population and in that way prevent the epidemic from spreading. He confirmed that the number of deaths and new cases were still high and that at the moment Croatia is experiencing high COVID casualties. "That means that we need to continue taking measures, to be responsible and to continue tighteningtargeted measures and to do everything to help the overburdened health system," said Plenkovic expressing his condolences to all those who have lost loved ones to COVID-19. €4 bn to maintain normal life and enable the health system to function The Prime Minister underscored that since the outbreak of the epidemic the government has spent HRK 30 billion through various activities to maintaina normal life and to enable the health system to continue functioning. He said that progress in registering and approving COVIDvaccines was encouraging. "The European Medicines Agency has moved its deadline of 29 December to a few days earlier which means that, provided that Pfizer's vaccine is approved, after that member states, including Croatiavia its Halmed regulator, will approve the vaccine and the first batch of the vaccine could be in Croatia a few days after that and that is sooner than we haveestimated," said Plenkovic. Next week the government will adopt a vaccine rollout plan and also a schedule for administering vaccinationsin the first six monthsnext year and will explain the benefits of the vaccine to citizens, he said.. Plenkovic also said that the government would discuss measures to support the economy at its session tomorrow, including the continuation of the job-retention grant of HRK 4,000 per worker if a particular business activity has to go into lockdown. "For those activities that will not be able to work normally we will continue with the measure of HRK 4,000 per worker in January and February. Based on initial projections we estimate some HRK 500 million for that and about 1.5 billion for active employment policies," he said. "True lever for economic recovery and development" He recalledthat in the next ten-year period Croatia has €24.3 billion at its disposal, when funds from the new seven-year EU budget, the coronavirus recovery instrument known as Next Generation EU and the European solidarity fund are added. That is a "true level of economic recovery and development," said Plenkovic. In order to absorb €6 billion in grants for recovery from the consequences of the coronavirus from the Next Generation EU, Croatia has to prepare a National Recovery Plan, he said, underscoring that €6 billion had been approved for Croatia in grants which is 11% of last year's budget. "Not one EU country has such a high level," said Plenkovic and added there is€3.6 billion that Croatia has at its disposal in loans at the best possible interest rate, practically with no additional cost. Plenkovic: Govt taken adequate measures in fight against coronavirus ZAGREB, Dec 16 (Hina) - Prime Minister Andrej Plenkovic said on Wednesday that since the outbreak of coronavirus, the government had taken adequate measures to maintain the health system, reduce the dynamic of the epidemic and its impact on the economy, underscoring the responsibility of each and every citizen. "We have been responsible this entire time and introduced measures that we considered to be appropriate and adequate to maintain three basic objectives - sustainability of the health system, reducing the rate of the spread of the epidemic and most importantly, reduction of the impact on our way of life and in the end on our economy and wages for us all," Plenkovic told a press conference in Government House after recovering from COVID and coming out of isolation. The government does not have that luxury to just observe one segment but has to take account of everything, he added and underlined that thanks to the measures that were introduced, people in Croatia did not lose their jobs in the private or public sectors and everyone was paid. The tourism season too was solid and better than in other countries, he recalled. "Therefore, I think that we invested maximum effort to do what is expected of us and needed to be done, when observing the activities overall," he added. The battle against COVID-19 can be one with a combination of two aspects - measures at the national level through the response team, government and with the responsible behaviour of every individual, according to him. "Only a good combination of those aspects compatibly can produce results. And that is not easy," he said recalling that penalties for violations of anti-COVID measures were not introduced gladly. Our approach, he said, was cooperative, rational, and commonsensical. "We are aware that this is not a disease that does not kill. This is a disease that takes people's lives, unfortunately the elderly with other conditions, but regardless of how old someone is - we consider every life to be equally important," said Plenkovic and added that in the end the "responsibility is on those who manage the country." "And we are handling this disease and all other challenges the best and most efficient way we consider to be good and useful for citizens and we will continue doing so," he added. Essential to hold out for another six months The Prime Minister underlined that its is essential to "hold out for another six months," considering that a vaccine has been found. "The vaccine is here, however the way that it will be distributed requires time. In order to vaccinate an appropriate level of the population will require a minimum of six months. That is a match we have to keep up for another six months - from the aspect of health, economy, finance and in the end as a society. This is a topic that we will still have a lot of work with and demands a lot of responsibility and engagement by all of us," he underscored and announced that a campaign would be launched to inform the public about all the aspects of vaccination. The Prime Minister aurged citizens to socialise as little as possible during the coming holidays and to use other forms of communication. "Let's not socialise and jeopardise each other more than we need to. And that is the key. There is no restrictive measure that is better than responsible behaviour," he said. Plenkovic said that talks were still ongoing about possibly reintroducing passes for movement between counties, of how much that could contribute to reducing movement and in that way confine the dynamics of the disease from spreading. Tomorrow, he said, the scientific advisory council will meet so we can get a broader picture of what can still be done to reduce that dynamic." Reporters asked the Prime Minister if he regretted that Tomislav Saucha, who was convicted today pending appeal, kept the parliamentary majority in the government's past term and whether he feared that the "76 hands of support in the parliament" could depend on former Mayor of Velika Gorica Drazen Barisic if he activates his seat in parliament after being released from remand. "The assumption of some sort of regret or whether something was better like this or like that, is pointless because something that is happening now does not have anything to do with what happened before. And as far as the future is concerned...Barisic has the right, as a directly elected Member of Parliament, to activate his seat and no one can take the right away from him, including the Croatian Democratic Union, which has no need to do so," he said, adding that he does not know what Barisic intends to do. Situation with pandemic requires national unity, says PM ZAGREB, Dec16(Hina) - Prime Minister Andrej Plenkovic has saidthe situation with the pandemic requires national unity, solidarity and a high degree of responsibility in order to save as many lives as possible and the economy, accusingthe opposition ofirresponsibly undermining everything that is being done to fight COVID-19. In an interview with Globus weekly, Plenkovic says new COVID measures are being considered as well as an extension of the ones in force in order to reducethe number of infections. "I'll reiterate that our priority was and remains to preserve the health of our citizens and save every life. One should clearly say that the choice is not between health and the economy, it ishealth and the economy. It would be easiest to introduce another lockdown, but few are asking where the money would come from for salaries and financing the economy." He says it is extremely important that everyone comply with the COVID measures so as to reduce, through joint efforts, the number of infections and the pressure on hospitals and the medical staff "who are giving their all to save every life and keep the healthcare system running." Plenkovic says the economy is "key for financing the healthcare system." Speaking of the arrival of a vaccine, he says that if a large portion of the population gets vaccinated, infection will disappear sooner. Announcing a public campaign, he says the wish is for all the information on the vaccine be transparent, clear andbased in science so as to explain to citizens the benefits and how the vaccine can protect them from the disease. Speaking of the opposition's moves, Plenkovic says it is a pity that their contribution to the COVID crisis "boils down to undermining the work" of the nationalresponse team. "The opposition's attempts to have everything decided in parliament only additionally reveals their deep lack of understanding of the nature of this crisis in which it's necessary to make decisions. How, for example, would a two-thirds majority be achieved in parliament on whether the physical distance should be one metre, a metre and a half or two, how many people can be in shops or on the farmers' market?" Plenkovicsays parliament passed all the laws necessary to enable the government and the COVID response team to make the necessary operational decisions, adding that such a system "has ensured the necessary flexibility for adopting all the necessary measures on short notice." Plenkovic says the opposition has the right to "irresponsibly undermine all we are doing in the fight against COVID-19, but we will continue to adoptthe optimal measures for protecting health and maintaining the economy." Bozinovic: More precise measures to be presented by end of week ZAGREB, Dec 16 (Hina) -Interior Minister Davor Bozinovic did not say on Wednesday whether there would be closures between municipalities and counties, but he announced that a framework of anti-COVID measures would be more precisely hammered outby the end of the week. "We will know more about measures on Friday," he said, underscoring that all measures are aimed at reducing contacts. He added that the epidemic would pass, but not tomorrow, and that vaccination would start and last for most of next year. He stressed that it was "far too early" to relax. "This is why we are not yet in a situation to think about relaxing or, I hope, thightening the measures," Bozinovic said. He said that the extensions of the decision that expires on December 21 was being discussed. "At the momentI cannot talks about any concrete measures," he said, calling on citizens to refrain from gathering, travel and visits. Asked to comment on the request by some archdioceses to be exempt from the rule allowing only up to 25 to gather, Bozinovic said that representatives of the national response team and the Croatian Bishops' Conference were communicating at various levels and that they would inform the public on that as soon as the talks are done. EP approves additional aid to EU regions to fight against coronavirus crisis ZAGREB, Dec 16 (Hina) - The European Parliament on Tuesdayapproved the REACT-EU (Recovery Assistance for Cohesion and the Territories of Europe) initiative, a €47.5 billion package to mitigate the immediate effects of the corona crisis in European regions. "The aid will be made available through the EU Structural Funds, with 37.5 billion EUR assigned for 2021 and 10 billion EUR for 2022," it was said in the press release. "Operations covered by REACT-EU will be eligible for funding from 1 February 2020, retroactively. The resources can be spent until the end of 2023," the EP said. "EU countries will be able to allocate part of the money to the European Social Fund, the Fund for European Aid to the Most Deprived (FEAD), the Youth Employment Initiative, as well as cross-border programmes (Interreg). Investments will be focused on the sectors most affected by the economic fallout of the pandemic," it was said. Within REACT-EU, crisis response and recovery measures implemented under two packages of coronavirus response investment initiatives (CRII and CRII+) will be continued and expanded, which will ensure smooth economic and social recovery in the context of the coronavirus pandemic. "Resources for REACT-EU will come from Next Generation EU, the European Union recovery instrument," the press release said. Daily: Vaccination in Croatia begins on Dec 28? ZAGREB, Dec16(Hina) - Although the European Medicines Agency has announced that Pfizer and BioNTech's COVID-19 vaccine could be approved by December 29, the German daily Bild says it could happen on the 23rd already in which case,the Germans say, vaccination could begin on the 26th, Jutarnji List daily said on Wednesday. The European Commission has announced that after the EMA's final say, all member states will get the vaccine at the same time, which means that Croatia could begin vaccination on December 26 or 28, the newspaper said. BioNTech has saidthe dispatch of the Pfizer vaccinefrom the primary distribution centre in Purs, Belgium can begin as soon as the EMA and the Commission give the green light. German Foreign Minister Jens Spahn has said at a press conference thatmedia reports that the EMAis expected to approve the vaccine onDecember 23 are correct and that this will occur in a regular, nota fast-track procedure "because we want citizens to trust the vaccine." "We have information that the Pfizer vaccine will arrive in Croatia on January 4. But the company said earlier that, as soon as the EMA approves it, symbolic quantities of the vaccine could be delivered this year alreadyfor all EU countries, as agreed, while the rest is expected to arrive after the New Year," says Krunoslav Capak,head of the Croatian Institute of Public Health. He is confident that if the EMA approves the vaccine on December 23, Croatia will get the first doses at the same time as Germany and other EU countries, Jutarnji List said. Croatia has ordered a million doses of the Pfizer vaccine which will arrive in tranches, as in other countries. The first tranche of 125,000 doses is intended for care home residents and staff as well as older workers. People older than 65 and patients with chronic conditions will be next. ECHR says has no jurisdiction to hear Slovenia's LB suit against Croatia ZAGREB, Dec 16 (Hina) - The European Court of Human Rights (ECHR) on Wednesday statedthat it "does not have jurisdiction to hearthe case of Slovenia versusCroatia" over the receivables of defunct Ljubljanska Banka's (LB) Zagreb branch dating back to the 1980s The dispute refers to claims by the LjubljanskaBankaagainst Croatian companies for loans issued during the the former Yugoslav federation. Croatia's representative before the court, Stefica Staznik explained that Ljubljanska Banka had since 1991 filed several litigation suitsbefore Croatian courts related to claims for unpaid loans and guarantees approved to Croatian companies, mostly in the ***agriculture*** and food sector. Slovenia called on multiple violations of the Convention on Human Rights and Fundamental Freedom while Croatia claimed that ECHR had no jurisdiction to examine the application because Ljubljanska Banka is a government organisation and does not qualify as non-governmental. "Slovenia v. Croatia, GC decision: Lack of jurisdiction to examine inter-State application vindicating the rights of a legal entity which does not qualify as “non-governmental,” the ECHR tweeted on Wednesday. "In the present case and having regard to all the material in the file, the Court saw no reason todepart from its findings in the Ljubljanska Banka D.D. case to the effect that Ljubljana Bank did not enjoy sufficient institutional and operational independence from the State and could not therefore be regarded as a “non-governmental organisation” within the meaning of Article 34. Accordingly, Article 33 did not empower the Court to examine an inter-State application alleging a violation of any Convention right in respect of this legal entity. The Court therefore lacked jurisdiction to hear the present case," the Strasbourg-based court says in its comment on this case, Croatia wins "LB case" which Slovenia launched against it before ECHR ZAGREB, Dec 16 (Hina) - The European Court of Human Rights (ECHR) on Wednesday ruled that Slovenia cannot sue Croatia on behalf of the Ljubljanska Banka for violation of humans rights saying that it has nojurisdiction to examine that inter-state applicationalleging violation of human rights worth almost €430 million. The court upheld Croatia's arguments ruling that the now defunct Ljubljanska Banka (LB) is not a non-governmental organisation but is closely related to the state so Slovenia cannot act on its behalf and cannot lodge an application alleging violation of any Convention right. "The ECHR published its decision not allowing Slovenia to act in the inter-state applicationagainst Croatia regarding the Ljubljanska Banka, and declared that it does not have jurisdiction to hear the case because the bank is not a non-governmental organisation but is closely connected to the sate," Croatia's representative before the court, Stefica Staznik said. Sloveniafiled the application in 2016 claiming several violationsof the Convention perpetrated byCroatia's judicial and executive authorities when they acted in the case of receivables by the now defunct Ljubljanska Banka from Croatian companies. Croatia,however, claimed that the ECHRdoes not have jurisdiction to examine the case because the bank is owned by the Slovenian government and is managed by the Succession Fund. "The ECHR does not have jurisdiction to examine applications by government organisations nor is the Convention designed to protect a country's financial interests but to protect individuals and nongovernmental organisations who are the victims of human rights violations by a state," Staznik explained. She claimed that there was no difference in the way cases were conducted or ruled in which the Ljubljanska Banka was the petitioner before Croatian courts compared to other similar proceedings and the bank had not exhausted all domestic legal means.Also, Slovenia did not respect a six-month deadline before applying to the European court. Since 1991 the defunct LjubljanskaBank filed several suits before Croatian courts forreceivables on loans and guarantees issued to Croatian companies, mostly in the ***agriculture*** and food sector. In most cases, recovering these debts was impossible as debtors and their companies hadgone bankrupt and no longer existed. Slovenia demanded compensation that would be on par to its losses, allegedly due to the violation of the convention's rights, amounting to €429,536,070,30 with interest. The ECHRdecision is final and Slovenia cannot lodge a new application to that court for the same matter. Plenkovic: ECHR ruling very positive and very good for Croatia ZAGREB, Dec 16 (Hina) - Prime Minister Andrej Plenkovic said on Wednesday that the ruling by the European Court of Human Rights in the Ljubljanska Banka case brought by Slovenia was "very positive and very good", adding that he expected the two neighbouring countries to continue dealing with their outstanding issues. The European Court of Human Rights (ECHR) announced on Wednesday that Slovenia could not sue Croatia on behalf of Ljubljanska Banka for violating human rights, saying it did not have jurisdiction to hear the case, worth nearly €430 million. The ECHR ruling is "very positive and very good for us, and in a way it confirms the consistency of Croatia's position on the Ljubljanska Banka issue," Plenkovic said at his first press conference after recovering from the coronavirus infection. Croatia had claimed that the ECHR did not have jurisdiction to rule on the case because Ljubljanska Banka is a government organisation, owned by Slovenia and managed by the Slovenian Succession Fund. Plenkovic said he did not expect a deterioration in relations with Slovenia but a continuation of efforts to resolve all outstanding issues with the neighbouring country. "It has gone unnoticed how Prime Minister Jansa and I, and our teams, have developed a very high level of good relations, relations of trust, in addressing all issues calmly," Plenkovic said. Apart from "a couple of residual issues" relating to Ljubljanska Banka, delimitation of the sea border and the Krsko nuclear power plant, Croatia has noother unresolved issues with Slovenia, so it is only logical that "we should create an excellent relationship with Slovenia," the prime minister said. Plenkovic recalled that Slovenian Prime Minister Janez Jansa had represented Croatia at theEuropean Council meeting last week, noting that this sent out "very clear, firm and friendly" signals. Visit by Russian foreign minister Plenkovic received Russian Foreign Minister SergeyLavrov on Wednesday, and they discussed global and security issues, Ukraine, Azerbaijan, Armenia, Turkey, Syria and the United States. "There wasn't an issue of relevance to a foreign-policy visit of this profile that we didn't touch upon," Plenkovic said. He said he had repeated to Lavrov Croatia's position on Ukraine, which he had presented before and which he said hadnot changed. Four years ago, Plenkovic offered Ukraine Croatia's experience with the peaceful reintegration of the Croatian Danube region as the best model for the reintegration of Donetsk and Luhansk into Ukraine, as well as for the reintegration of the Crimea, which has been annexed by Russia. "The point of the peaceful reintegration of the Croatian Danube region is that it was a peaceful reintegration of territory without casualties, without people getting killed or wounded.It wasn't a frozen conflict going on for years," the prime minister said. He said that there were no bad reactions from the Russian foreign minister, whom he described as "a person with considerable experience and a doyen among all foreign ministers in the world." Croatia's position is well known, and the issue of eastern Ukraine will be dealt with by respecting the Minsk agreement and the UN Security Council resolutions, Lavrov said earlier in the day. Slovenia to seek bilateral solution to Ljubljanska Banka claims in Croatia ZAGREB, Dec 16 (Hina) - The Slovenian government on Wednesday expressed regret that the European Court of Human Rights (ECHR) had found it had no jurisdiction to hear its case against Croatia relating to Ljubljanska Banka's claims from Croatian companies, saying that it would try to resolve the matter with Croatia through bilateral talks. Despite this ruling, Slovenia will continue to try, both at political level and through diplomatic contacts, to reach a solution for Ljubljanska Banka's claims in Croatia, the government said in a statement. Slovenia wanted the ECHRto order Croatia to pay back €430 million, which is the amount Ljubljanska Banka claims to have lent to Croatian companies. Ljubljanska Banka said that over the past 30 years, despite the numerous actions brought before Croatian courts, it had been prevented by Croatian judicial and executive authorities from ***collecting*** its claims. The ECHR, citing Article 33 of the Human Rights Convention,said it had no jurisdiction to examine an inter-state application, adding that Ljubljanska Banka was not a non-governmental organisation but an entity closely connected to the state. Russia has good relations with Croatia, says Lavrov ZAGREB, Dec16(Hina) - Russia has good relations with Croatia, Foreign Minister Sergey Lavrov said on Wednesday after talks with his Croatian counterpart, anddismissed Western andU.S. accusations of Moscow, saying they were contrary to ethical and international norms. Lavrov last visited Croatia 16 years ago and the latest visitoccurred after being postponed twice due to the COVID-19 pandemic. Croatian Foreign Minister Gordan Grlic Radman called it an "incentive to continue the positive trend" in the relations between the two countries. "The European Union is not quite ready for good relations with Russia, but Russia has good relations with Croatia," Lavrov said after the signing of two agreements.He invited Grlic Radman to visit Russia. "Despite the current challenges," Grlic Radman said they talked about "possibilities of intensifying cooperation between the EU and the Russian Federation. Communication channels should stay open." Lavrov arrived in Croatia on a tour which included Bosnia and Herzegovina and Serbia. Two members of the BiH Presidency refused to receive him, dissatisfied with his stand on BiH's NATO and EU integration and the Dayton Accords. In Zagreb, Lavrov reiterated that Moscow was strongly committed to honouring the peace agreement. "We have a common uniformstand" on the respect for the equality of the three constituent peoples, he said. Speaking of changing the Electoral Law, which Croats in BiH demand, Lavrov said BiH should decideon its political goals on its own. "Everybody should respect those decisions. Everybody should understand that all three peoples should be respected (because) there is no BiH without that." In that sense, it is also necessary to respect the stands of BiH's Serb entity, he said. "That means also respecting Republika Srpska's positions on military neutrality." Moscow is against revising the Dayton Accords, Lavrov said in Sarajevoon the 25th anniversary of the agreement which ended the war in BiH, but the general assessment today was that Moscowdemandsan upgrade so that BiH canbecome a functioning and progressive state. In Sarajevo, Lavrov also called for closing the Office of the High Representative, saying that BiH does not need an "international protectorate". He alsosupportedRepublika Srpska's stand on "military neutrality" and accused NATO of undermining international stability. Because of those statements, BiH Presidency members Sefik Dzaferovic and Zeljko Komsic refused to receive him, accusing Russia of opposing BiH's strategic goals to join NATO and the EU. They said they did not want to be Russia's pawn in the Balkans in its score-settling with EU member states or NATO. A day later in Belgrade, Lavrov said Dzaferovic and Komsic werenot deciding autonomously but defending on others' orders the interests of outsideforces notinterested in Western Balkan countries building "mutually beneficial cooperation with all external partners." In Zagreb, Lavrov said Moscow was used to constant accusationsby Western countries and the U.S. "That only shows our partners'lack of respect for ethical norms. That's not in line with international norms," he said, accusing the U.S. of obstructingEastern Mediterranean countries' cooperation with Russia. "They are prohibiting Mediterranean countries from cooperating with Russia." On Tuesday, U.S. Secretary of State Mike Pompeo said "Russiacontinues tothreaten the stability of the Mediterranean" and "spread chaos"among countries in the region. The U.S. is trying to undermine Orthodoxy, including in Ukraine, said Lavrov. Asked when President Vladimir Putin would visit Croatia, he said it would occur when conditions allowed. The two agreements signed today were aprogramme of cooperation in culture in 2020-22 and a plan of consultations between the two foreign ministries in 2021-22. Russia is interested in opening a science and culture centre in Croatia, Lavrov said and hoped that the intergovernmental commission for cooperation in trade,the economy, scienceand technologywould resume work soon. Plenkovic, Lavrov discuss political and economic ties between Croatia and Russia ZAGREB, Dec 16 (Hina) - Prime Minister Andrej Plenkovic on Wednesday received Russian Foreign Minister SergeyLavrov, who wason a mini tour of the region marking the 25th anniversary of the Dayton peace accords. Lavrov stopped over in Zagreb to open the new building housing the Embassy of the Russian Federation. Plenkovic appeared in public for the first time after recovering from the coronavirus infection. According to a press release issued by his office, the meeting reaffirmed good bilateral political and economic relations between the two countries. Plenkovic and Lavrov exchanged viewson the situation in southeast Europe, global issues and the further fight against the COVID-19 pandemic. They stressed the importance of tourism in Croatian-Russian relations, which is expected to get a boost after the pandemic ends. They also expressed a mutual desire to continue bilateral dialogue. Plenkovic invited his Russian counterpartMikhailMishustin to visit Croatia. Earlier in the day, Lavrov and his Croatian counterpart, Gordan Grlic Radman, also highlighted tourism as an area with potential to expand cooperation. They announced reactivation of the intergovernmental commission on trade, economic, scientific and technical cooperation. Lavrov arrived in Zagreb as part of his mini tour that included Bosnia and Herzegovina and Serbia. At the end of his visit in the Croatian capital city, the ministerformally opened the new Russian Embassy building. The Croatian Embassy in Moscow has already moved into a new building. Speaking earlier on Wednesday, Lavrov said he was willing to answer any questions raised by his interlocutors, including those concerning Moscow's reaction to Plenkovic's visit to Ukraine four years ago,when he had offered Croatia's experience with the peaceful integration of the Croatian Danube region as the best model for the reintegration of Donetsk and Luhansk into Ukraine, as well as for the reintegration of the Crimea, which has been annexed by Russia. Croatia's position is well known, and the issue of eastern Ukraine will be dealt with by respecting the Minsk agreement and the UN Security Council resolutions, Lavrov said. President Milanovic talks with Russia's FM ZAGREB, Dec 16 (Hina) - Croatia's President Zoran Milanovic met with Russia's Foreign Minister Sergey Lavrov, who wason an official visit to Croatia, the president's office said on Wednesday. They discussed political and economic relations between Croatia and Russia and the situation in Southeast Europe. They also talked about the possibilities of improving Russia's relations with the European Union, of which Croatia is a member, the press release said. Lavrov opens new Russian Embassy building in Zagreb The Russian Federation opened the new Embassy building in Zagreb on Wednesday, an event with which Lavrov ended his official visit to Croatia. Earlier in the day, Lavrov met with senior Croatian officials as part of his regional tour that included Bosnia and Herzegovina and Serbia. At the new Embassy building in Bosanska Street, the Russian foreign minister was welcomed by Croatian Minister of Foreign and European Affairs Gordan Grlic Radman, former President Kolinda Grabar-Kitarovic and Mayor Milan Bandic. Bandic, who was the only one to speak to the press, said that Lavrov had invited him to visit North Ossetia, a region in the Caucasus of which he is an honorary citizen. He conveyed his greetings to President Vladimir Putin, who had presented him with the Order of Friendship. "We are two branches of the same tree. We are one of the 27 capitals of the European Union, but we must never forget our good cooperation with our Russian friends. Long live friendship between the Croatian and Russian people!" Bandic said. Croatia and Russia sign programme for boosting cultural cooperation ZAGREB, Dec 16 (Hina) - Russian Foreign Minister Sergey Lavrov and Croatian Culture and Media Minister Nina Obuljen Korzinek signed on Wednesday the sixth Programme of Cooperation in the Field of Culture for the 2020-2022 period, the Croatian Ministry of Culture and Mediasaid. The programme was signed as part of Russian Foreign Minister's official visit to Croatia, and it encourages exchange and cooperation between artists, cultural and art institutions and associations, as well as direct cooperation between cultural institutions of mutual interest, the MKM said. Mutual cooperation, the Ministry said, encompasses a wide range of activities related to museums, galleries, performing arts, literature and publishing, as well as the existing high level of cooperation in the area of audiovisual activities. The Ministry recalled that in the domain of cultural heritage the cooperation was especially pronounced between the Underwater Research Centre of the Russian Geographical Society, the Lomonosov Moscow State University Marine Research Centre and the International Centre for Underwater Archaeology in Zadar, an UNESCO Category II Centre. Signing the Programme will improve, the Ministry said, the existing cooperation between organisations, artists and experts. In addition to a good and meaningful bilateral cooperation between the two countries, which is achieved through direct contact between cultural institutions and artists working in Croatia and Russia, the cooperation within international platforms will also continue, the Ministry of Culture and Media said. Croatia FM says equality was key for concluding Dayton deal ZAGREB, Dec16(Hina) - Founding Bosnia and Herzegovina on the equality of the three constituent peoples was decisive for concluding the Dayton Accords in December 1995, Croatian Foreign Minister Gordan Grlic Radman said on Tuesday at the international conference"25 Years of the Dayton-Paris Peace Agreement". "Only on that basis was it possible to win support from the negotiating parties for ending the war and for the establishment of a territorially integrated, multinational Bosnia and Herzegovina," he said, adding that the full implementation of the agreement remained "its anchor of stability and peace." Today BiH needs more cooperation and less divisions, and its stability and functioning greatly depend on the equality of Bosniaks, Serbs and Croats, said Grlic Radman. "If that equality is not respected, it will continue to be a cause of tensions, the lack of a functioning state and possible crises." There is no struggle between the three peoplesbut between those who want to stamp out that equality and impose themselves on others and those who offer a waytowards European decentralisation and federalism models which see differences as a strength, not a weakness, the minister said. "The equality of all the constituent peoples cannot be ensured without the much-needed reform of the Electoral Law. Its reform should make it possible to overcome the blockades in the functioning of the state, whereby adecisive step would be made towards the country's political stability," said Grlic Radman. "As a signatory to the Dayton Accords and a neighbouring and friendly country, Croatia nurtures a special interest in and responsibility for Bosnia and Herzegovina's well-being and is therefore committed to and fully supports its territorial integrity as a sovereign and unified country and the equality of the three constituent peoples," he said. "I want to be very clear, both separatist and unitarist tendencies are equally dangerous for BiH as both deny the very core of BiH, its history, present and future." The minister said the process of Euro-Atlantic integration was key for BiH's stability, security, prosperity and democratic transformation. He said the Dayton-Paris Peace Agreement had been "the long-awaited light at the end of a dark and terrifying tunnel, the bloodiest war in Europe since World War II." "It was the result of genuine Euro-Atlantic efforts. Negotiated in the U.S., signed in Europe, and later adopted by the UN Security Council," he said, adding that the agreement could be considered historic. BiH's progress on the path of reform and EU and NATO membership is not only the best investment in the country's future but a way to bridge the difficult baggage of the past, he said, adding that Croatia would continue to strongly support BiH in its ambition to join the EU. "BiH's stability is of the utmost importance for all its neighbours and all of Europe," he said. BiH deserves our attention, understanding and support, and as a multinational stateit won't achieve political stability and economic development if the political rights of its peoples are not guaranteed as they were 25 years ago with thethe Dayton-Paris Peace Agreement, he added. Grlic Radman said the prerequisites for concluding the agreement and establishing peace first had to be achievedon the ground. BiH remembers the support Croatia gave it as one of the first states to recognise its independence in the most difficult period of the Slobodan Milosevic regime's aggression, an Zagreb provided shelter to hundreds of thousands of refugees, of whom 70% were Bosniaks, he said. "Croatia also prevented the fall of Bihac, a UN safe zone, and a repeat of the Srebrenica genocide," he said, adding that "it's a historical fact that Croatia was key for the survival of BiH as an independent state." Covic thanks Plenkovic for supporting Croats in Bosnia ZAGREB, Dec16(Hina) - The president of the Croatian National Assembly of Bosnia and Herzegovina, Dragan Covic, on Tuesday thanked Croatian Prime Minister Andrej Plenkovic for his support for and advocacy of the equality of BiH Croats, changing the BiH Electoral Law, and BiH's progress towards EUand NATO. Covic sent Plenkovic a letter after a Zagreb conference on the 25th anniversary of the Dayton peace agreement, underlining Plenkovic's important role. He also thanked him for the "well-intentioned and friendly activities and all that has been unselfishly done" for BiH, notably for the "firm stand" on the political equality of Croats as one of the three constituent peoples. Covic described Plenkovic as a "recognised ally" of Croats in BiH and BiH as astate. He echoed Plenkovic's opinion that changing the Electoral Law was key for the normal functioning of BiH in future, sayingthat Croats in BiH would achieve full constitutionality once they exercised their right to a free and independent election of their political representatives in bodies "intended for the legitimate representation of the constituent peoples." Komsic and Dzaferovic tell Lavrov and Covic they weren't acting on instructions ZAGREB, Dec 16 (Hina) - Twomembers to Bosnia and Herzegovina's tripartite presidency SefikDzaferovic and Zeljko Komsic, on Wednesday rejected claims that they were acting on anyone's instructionswhen they refused to meet Russia's Foreign Minister Sergey Lavrov in Sarajevo. "Having in mind Lavrov and Dragan Covic's statements,and by some analysts...for your information, I made that decision on my own. Naturally, I consulted with my staff the day before. And the only other person I consulted with was Dzaferovic and then we made a joint decision to not attend the meeting with Minister Lavrov," Komsic told reporters in Sarajevo. HDZ BiH leader Covic told RTL television that Komsicand Dzaferovichad acted on instructions by the leader of (Bosniak) Party for Democratic Action (SDA) Bakir Izetbegovic.Lavrov said during a visit to Belgrade on Tuesday that the Bosniak and Croat representatives on the Bosnian presidency, who refused to meet with him earlier in the day, were not autonomous in their decision making and were obviously following someone's orders. "One of them is talking about Western powers while the other one is mentioning SDA. Neither any Western power and especially SDA can influence my stance in these issues. Even if they wanted to they wouldn't have succeeded and in any case there was no contact. The only person I made contact with outside my office was Dzaferovic and no one else," said Komsic. Talking to Federation television,Dzaferovictoo denied that claims that hisboycott ofLavrovwere the result of someone's instructions, adding that he and Komsic want to send a clear message of what is not allowed to be done in relations with BiH. He underlined that Lavrovproved them right when in Belgrade he questioned BiH's EU interests. "This is European Union territory and BiH will be a member of the EU. This is NATO territory and BiH will be a member of NATO...we trust NATO the most. NATO stopped the aggression against this country. It helped to reform the defence of this country. It is a friend to all citizens and peoples in this country. That is why we want to be in NATO, and then some influential diplomat arrives from such a big country to tell us that is a problem. No it is not a problem," said Dzaferovic. Croatia to take over Central European Defence Cooperation initiative in 2021 ZAGREB, Dec 16 (Hina) - Croatia takes over the chairmanship of the Central European Defence Cooperation (CEDC) initiative from Slovenia in 2021 and will work on improving cooperation together with southeastern European countries, Defence Minister Mario Banozic said after a meeting of CEDC defence ministers in Postojna, Slovenia on Wednesday. The meeting took place on Tuesday and Wednesday, involving the defence ministers of Austria, the Czech Republic, Hungary, Slovakia and Poland, which has observer status. The meeting was hosted by Slovenian Defence Minister Matej Tonin. They discussed ways of improving regional cooperation between the CEDC members and the countries of southeastern Europe, their common contribution to the initiative to strengthen civilian-military cooperation within the EU, and lessons learned from the COVID-19 pandemic, the Defence Ministry said in a press release. They were joined online by the defence ministers of Albania, Bosnia and Herzegovina, Montenegro, North Macedonia and Kosovo. The CEDC ministers expressed their support to the five countries on their paths towards Euroatlantic integration. "I have no doubt that eventually we will see the whole of our region integrated into the Euroatlantic family. We theCEDC ministersare here to help in this process," Banozic said. CEDC is a regional security and defence initiative launched in 2012 to explore possibilities of pooling and sharing of defence capabilities. It comprises Austria, Croatia, the Czech Republic, Hungary, Slovakia, Slovenia, and Poland as an observer. U.S. donates mine clearance equipment for navy divers ZAGREB, Dec 16 (Hina) -US Navy's donation of mine clearance equipment for divers was presented to the Croatian Navy in the"Admiral Flote Sveto Letica - Barba" navy base in Split on Wednesday. This is a valuable donation in continuation of bilateral cooperation between US armed forces aimed at developing the navy's mine clearance capabilities, the Defence Ministry said in a press release. The official handover ceremony was organised as part of a joint exercise by the Croatian and US navies which is currently being conducted at the Split navy base. Commodore Damir Dojkic, deputy navy chief of staff and Brigadier Matthew Denny attended the ceremony. Dojkic thanked the US military delegation for itspermanent support to Croatia's navy, underscoring that this significant equipment will improve the process of training and developing mine clearance capabilities and in the end strengthen the navy's interoperability. A joint demonstration by Croatia's and U.S.navy units of how to use the equipment was presented during the ceremony in the Poljud port. After the ceremony a jointmeeting was held where the delegations discussed future bilateral cooperation and the US delegation was given a tour of the OOB-31 OMIS navy vessel. AmCham conference: Croatia's growth may be constrained by tourism's slower recovery ZAGREB, Dec 16 (Hina) - Croatia can reach its pre-corona crisis Gross Domestic Product level in 2022, but the tourist industry could constrain such developments, the conference "Overview of 2020 and Outlook for 2021", organised byAmCham Croatia, was told on Wednesday. Addressing the conferenceDaniel Lenardic, a partnerof KPMG Croatia, was quoted as saying that "the impact of the coronavirus (COVID-19) is being felt by businesses around the world. Leaders are navigating a broad range of interrelated issues that span from keeping their employees and customers safe, shoring-up cash and liquidity, reorienting operations and navigating complicated government support programs. For many of us, things are not going to return to the way things were - nor should they." Commenting on Croatia's prospects, Lenardic pointed to the worrying dependence of Croatia on its tourism sector. The contribution of this sectorto Croatia's GDP is about 18%, and in this way, the exposure of Croatia's economy to tourism is the highest in the EU, according to this expert. Lenardic said he did not believe the tourism industry couldreturn to pre-crisis levels in the next two or three years. The outgoing U.S. ambassador Robert Kohorstcommented on the biggest achievements in his ambassadorial term in Croatia, pointing out the U.S. assistance to Croatia to get the LNG terminal off Krk. He mentionedtheCroatia-US talks on an agreement on the avoidance of double taxation as well as progress in efforts to enableCroatians to travel to USA without visas underthe Visa Waiver Program. The diplomat believes that the procedure for concluding the Visa Waiver programme could be completed in the first half of 2021. Considering the USA-Croatia defence cooperation, Kohorst spoke about the donations of military equipment. He said he also hoped that Croatia would choose the U.S. bid for the procurement of multipurpose fighter jets. No matter whatdecision Croatia, as a sovereign country, willmake when choosing the best bid for military aircraft, the United States will respect it, Kohorst said, recalling the partnership between the two countries of more than 25 years. He praised Croatia for improving the business environment, but called for expediting the reform ofthe judiciary andreducing red tape. FinMin: Croatia has HRK 5 at its disposal for every kuna paid into EU budget ZAGREB, Dec16(Hina) - Finance Minister Zdravko Maric said on Wednesday Croatia had big financial and economic benefits from EU membership and that in the next seven years it would have five euroor kunaat its disposalfor everyeuro or kuna itpaid into the EU budget. Speaking in parliament, Maric said that since entering the EU on 1 July 2013, Croatia had absorbed HRK 30 billion more from the EU budget than paying into it. He was speaking during a debate on a draft decision endorsingtheCouncil Decision on the System of Own Resources of the European Union,one of the EU's key acts aimed at ensuring financing in the next seven years. Responding to questions from MPs, Maric said Croatia would pay HRK 4 billion into the EU budget this year, HRK 4.4 billion in 2021, HRK 4.5 billion in 2022 and HRK 4.5 billion in2023. "The ratio we currently have is that we get up to three euros for one kuna or euro paid. Now, with the new financial perspective, that goes over four to five euros," he told Boris Lalovac of the Social Democratic Party. There is no new levy Responding to Josip Begonja of the Croatian Democratic Union (HDZ), Maric said the introduction of a new revenuecategory in the 2021-27 EU budget, from non-recycled plastic packaging waste, was not a new levy for citizens. He said that revenuewas based on statistical ***data*** on waste quantitiesand that it was €0.8 per kilogram for all countries but that some, including Croatia, would have reductions. We have envisaged that amount in the 2021 budget and it amounts to HRK 121.7 million, he added. Maric confirmedGrozdana Peric's (HDZ) statement about the importance of the EU Solidarity Fund, from which over €680 million is envisaged for Croatia to deal with the effects of the March earthquake inZagreb. If the funds for healthcare are added, thatamount surpasses 700 million, he said, adding that an advance had already arrived. Last year Croatia was among the five countries with the biggest differencesbetween funds paid and drawn, over 3% of GDP, Maric told Branko Bacic (HDZ), who said that some MPs questioned the purpose and benefits of EU membership. All that is a product of the work invested, Maric said, recalling Prime Minister Andrej Plenkovic's role in the protection of Croatian interests.He was responding to Vilim Matula (Green-Left Bloc), who asked if the fact that Croatia was receiving the most from Europe was related to the fact that it ranked as the worstboth economically and in COVID-19 terms or onlyto the prime minister's knowledge. As a rule, the net payers into the EU budget are countries with the best economic indicators such as Germany and the Scandinavian countries, while the net receivers are countries like Croatia, Maric said. He said the EU budget financing system consisted of three main revenuecategories, own funds, mainly customs duties, VAT revenue, and revenuefrom own funds based onGross National Income. The agreement on the 2021-27 Multiannual Financial Framework envisages new revenue categories based on own funds fromnon-recycled plastic packaging waste in line with the EU strategy of green transition and sustainable economy. "That's not a new tax or levy, but every country's contribution will be reduced by that amount based on Gross National Income," Maric said. Additional revenue sources are envisaged from digital licencing, the carbon border adjustment mechanism,a tax on financial transactions, and revenue from auction sales as part of theEU emissions trading system. Maric: Absorption of EU funds depends mostly on us ZAGREB, Dec16(Hina) - Finance Minister Zdravko Maric said on Wednesday that how much of the European Union's funds would be absorbed in Croatia "depends on us." "Reforms will be key along with solid preparation of projects of theNext Generation EU (NGEU) recovery fund," Maric said at the end of today's parliamentary discussion on the European Union's budget and revenues and contributions from member-states. The discussion referred to the motion to ratify theCouncil Decision on the System of Own Resources of the European Union,one of the EU's key acts aimed at ensuring financing in the next seven years. Sandra Bencic of the We Can party asked whether the EC had madethe drawing of money from the Recovery and Resilience Fund (RRF) conditional on Croatia's use of funds from the current financial perspective, and Maric answered in the negative. Maric explained that the activation of the RRF could be expected in late 2021, after all the member-states forwarded their plans and after the evaluation of those documents.Croatia is entitled to 10% advance payment that is 600 million euros in 2021 from the RRF, he added. Erasmus+ made 2,600 education projects possible with HRK 1.14 billion ZAGREB, Dec 16 (Hina) - The biggest programme for youth education and training in Europe, Erasmus+, has in the past seven years enabled Croatian citizens to carry out over 2,600 projects, for which HRK 1.14 billion in grants was available to them, it was said on Wednesday at the "Together we are Stronger" conference in Zagreb. The conference was organised by the Agency for Mobility and EU Programmes (AMPEU), and the aim was to complete the first seven-year period of Erasmus+ in Croatia, as well as two years of the European Solidarity Corps programmes. Ninety-nine percent of the funding has been contracted, and more than 57,000 Croatian citizens of all generations have taken part in the projects, said AMPEU director Antonija Gladovic, noting that the Erasmus+ and European Solidarity Corps projects have had a positive influence on numerous institutions, individuals and organisations, even the society as a whole. The Erasmus+ programme provided its participants with new knowledge, skills and experience, it broadened their horizons and enriched their lives, and institutions exchanged examples of good practice and found new ways of teaching, she said. The European Solidarity Corps programme has been running since 2018 in order to help young people with volunteering, internship and employement projects. In two years, 183 projects have been approved, they have been granted over HRK 28 million, and more than 2,500 Croatian participants have been involved in them, Gladovic said, adding that the interest of young people in participating in volunteer programmes is not decreasing despite the pandemic. During the conference, the Agency presented users with projects especially successful in the area of involving groups with fewer possibilities with recognition awards. Those were the Faculty of Electrical Engineering and Computing in Zagreb, the Slava Raskaj Educational Centre Zagreb and the Museum of Contemporary Art Zagreb. Ivana Puljiz of the AMPEU said that Erasmus had a modest €1.6 million at its disposal in its first year, and it ended 2020 with more than €9 million. Numerous innovative results have been achieved and many curricula have been modernised, while institutions have strengthened their capacities for project management and increased their visibility, it was said. Coric: Govt to stand by enterprises throughout COVID pandemic ZAGREB, Dec 16 (Hina) -Minister of Economy and Sustainable Development Tomislav Coric said on Wednesday that the government would stand by the commercial sector throughout the coronavirus pandemic and that additional measures may be introduced in addition to the existing ones. Representatives of the Croatian Employers' Association (HUP), Croatian Chamber of Crafts (HOK) and the Croatian Chamber of Commerce (HGK) on Wednesday met with Minister Coric and discussed measures banning and restricting economic activities that are currently in force, also the support measures and compensation. Coricsaid that the government would stand with the entrepreneurial sector as long as the pandemic lasts, and that possible additional initiatives could be introduced in addition to existing measures. After meeting with employer associations, Coric said that he would meet with union representatives on Thursday. Asked to specify measures for the first quarter of 2021, Coric said that the current measures would continue for a little while. Head economist at HUP, Iva Tomic said that the government needs to inform of any new rules on time so that employers can plan their business operations. Croatia among 4 EU countries with decreased labour costs in Q3 ZAGREB, Dec 16 (Hina) - Hourly labour costs in the EU and the euro areain the third quarter of 2020 decreased in Croatia for the first time in almost four years, show the latest ***data*** released by ***Eurostat*** on Wednesday. The hourly labour costs rose by +1.6% in the euro area and by +1.8% in the EU,compared with the same quarter of the previous year, ***Eurostat***'s press release says. In the second quarter of 2020, hourly labour costs increasedby +3.6% and +3.5% respectively. Labour costs were reduced due to tax reliefs and subsidies introduced by governments in an effort to support enterprises affected by the coronavirus crisis. The non-wage component or contributions declined by -0.1% in the third quarter of 2020 year on year. In Q2 it remained unchanged. In the euro area however it dropped by -04% in Q3 y-o-y. It increased by +0.7% Q-o-Q. In the EU, the costs of hourlywages & salaries increased by +2.4% Q-o-Q, after a jump of +4.6% in Q2. In the euro area, the cost ofwages & salaries per hour worked grew by +2.2% after increasing4.5 percent in the period from April to June. The highest increases in hourly wage costswere recorded in Slovakia, Czech Republic, Portugal and Romania. US firm invests $60m in Croatia's Microblink ZAGREB, Dec 16 (Hina) - US growth equity firm Silversmith Capital Partners has invested $60 million in Microblink, a global leader in artificial intelligence-based computer vision technology, the Croatian company announced on Wednesday. "Since its foundation seven years ago, this is the first time that outside capital has entered Microblink. With a strategic, long-term approach, we have managed on our own,by reinvesting the profit, to develop a company that has become a global tech leader in its segment. This has been a very successful first stage in the company's development, and our further ambitions are even greater," Microblink's co-founder Damir Sabol said. The partnership with Silversmith willenable accelerated growth in key business areas including product development, go-to-market and team expansion, Microblink said. Microblink has experiencedstrong growth over the last few years. "Despite the global crisis caused by the pandemic, we have recorded an increase in sales revenue of as much as 36 percent from last year," said Izet Zdralovic, a co-founder and management board member, adding that the company's team has grown threefold over the last three years and now exceeds 100 employees in Croatia. HNBCouncil: High level of expansionary monetary policy maintained ZAGREB, Dec 16 (Hina) - The Croatian National Bank (HNB) maintained a high level of expansionary monetary policy in the second half of 2020, ensuring favourable domestic financing conditions and maintaining the stability of the kuna exchange rate to the euro, the HNB Council said on Wednesday. During a meeting, the council discussed current economic and financial trends andadopted its forecast of monetary policies for 2020 to 2023, macroeconomic trends and forecasts, and the bank's financial plan for 2021, the bank said in a press release. The press release added that liquidityin banks in November reached its highest level ever which went in favour of keeping the majority of interest rates at a historic low level, similar to those prior to the pandemic outbreak. During the first nine months of the year loans to the general population slowed down, mostly due to a decrease in personal cash loans. Following a strong increase in the first quarter, in the period from April to October, loan activities to enterprises were stifled, the press release said. Capital market provides financing opportunity for good projects ZAGREB, Dec 16 (Hina) - The capital market will be very important after the corona crisis because it enables all good projects and ideas to have access to capital with the assistance of funds and investors and that financing has far greater benefits than bank loans, it was said at a conference on the capital market on Wednesday. The virtual conference“Capital market after the coronavirus crisis, an opportunity for companies and investors“ was organisedby theCroatian Financial Services Supervisory Agency (Hanfa) and the Hanza Media company. Finance Minister Zdravko Maric, who addressed the conference via videolink,said that the government had promptly responded to the corona crisisboth as far as protecting health is concerned and regarding economic-financialaspects with its priority being to save jobs and employment. The measures have brought about some results but challenges still exist and measures continue to be necessary to help the economy survive the crisis and start recovering, the minister said. He announced that steps regarding the capital market and activating state assets are planned. Maricrecalled that Croatia had entered the European Exchange Rate Mechanism ERM II after fulfillingall the requirements despite the corona crisisand is now in the 'waiting room' before introducing the euro currency. Another important aspect is the new EU perspective and Croatia's envelope that was negotiated through the Multiannual Financial Framework, and Maric calledon stakeholders in the capital market and entrepreneurs to prepare themselves to absorb as much funds as possible. Aladrovic:Crisis is an opportunityto reset the system Ministerof Labour, Pension System, Family and Social PolicyJosip Aladrovicsaid that some sections of the economy will probably not be renewed nor will the current method of creating values be the same anymore. "That is a challenge for us to accept as a society and adapt to," he said. "This is an enormous challengebut also an opportunity to reset the system and create new opportunities and measures that will be better, fairer and more tenable," he said. He recalled that jobkeeping measures have so far covered more than 600,000 workers and more than 100,000 employers and that the planned amount of the job retention grant scheme will be more than HRK 8 billion before the year's end. The government is focused on resolving burning issues that have existed for years, underscoring amendments to the Labour Act and establishing a sustainable pension system. "We have to quickly regulate working from home because these are new circumstances we live in. I want to create a new framework that wil motivate investments and commercial activities. Investors come if a country is competitive and amendments to the Labour Act hide one of the keys to increasing competitiveness," said Aladrovic, adding that the proposed bill would be presented in the first quarter of next year. He added that the government intends to relax the regulatory framework so that pension fund assets can be more strongly activated on the market. "It is necessary to additionally empower Croatia's economy, primarily the ICT industry which needs capital to additionally internationalise business. Shareholding companies focused on exports also need help and there is room to create and finance key infrastructure such as transport and renewable energy resources," underscored Aladrovic. HANFA: Liquidity on the market never greater HANFA CEO Ante Zigman said that there has never been more liquidity on the EU financial markets however trends aren't the best. Financing bonds is becoming more expensive the state's debt is increasing, commercial banks as a source of financing are still too expensive, said Zigman pointingout the process of integrating the capital market as a contribution to EU financial stability and the economy's recovery. One of the objectives of integrating the capital market is to relieve the dependence on commercial banks. Next year already the EU will try and strengthen long term financing, loans for SMEs and increase financial literacy in an effort to motivate enterprises to exit onto the market and bypass commercial banks as sources of capital, he said. “The capital market will be extremely important after this pandemic because companies need fresh inflows of cash. What they receive from banks through loans is burdened with interest and other costs. When they withdraw money from the capital market there are no such costs, and investors are much more ready to take care of the company's fate. The capital market gives a chance to everyone with very good projects and good ideas, so that, with the help of pension or investment funds and investors who buy shares directly, they can get the much needed capital“, saidA. Žigmanprior to the conference, as reported on HANFAs' web site. Croatia's November consumer prices down 0.2% y-o-y ZAGREB, Dec 16 (Hina) - Croatia's consumer prices fell by 0.2% in November 2020 compared with November 2019 and by 0.3% compared with October 2020, according to ***data*** released bythe National Bureau of ***Statistics*** (DZS) on Wednesday. Annual consumer prices have been on the decline since April 2020, with the exception of September when they stagnated. Consumer prices fell by 0.1% on the year in October and August, by 0.3% in July, by 0.2% in June, by 0.6% in May and by 0.2% in April, which was their first year-on-year drop since the end of 2016. The annual decline in consumer prices in November was mainly driven by a 5% drop in prices of transport, which account for slightly over 15% of the consumer basket, the DZS said. Compared with November 2019, clothing and footwear prices fell by 1.9%, housing prices by 1.6%, prices of education by 0.3% and prices of furnishings, household equipment and routine household maintenance by 0.1%. On the other hand, consumer prices went up for alcoholic drinks and tobacco (+4.7%), communications (+2.1%), recreation and culture (+1.7%), and for miscellaneous goods and services (+1.6%). Increases were also observed for health care (+1.1%), restaurants and hotels (+0.8%), and food and non-alcoholic beverages (+1.0%). Compared with October 2020, clothing and footwear prices fell by 1.3%, prices of food and non-alcoholic beverages by 0.5%, transport prices by 0.4%, housing prices by 0.1% and prices of miscellaneous goods and services by 0.1%. The decline was softened by increased prices of recreation and culture (+0.2%), alcoholic drinks and tobacco (+0.1%) and prices of furnishings, household equipment and routine household maintenance (+0.1%). At the same time, prices of health care, communications, education, and restaurants and hotels remained unchanged from October 2020. Owing to inflationary pressures from the start of the year, consumer prices in January-November 2020 were 0.2% higher on average than in the same period of 2019. No significant changes to consumer price trends are expected in the last quarter of the year, analysts atRaiffeisenbank Austria (RBA) said in their comment on the DZS report. There will be no pressures on the demand side, while those on the expenditure side will remain subdued, RBA said, expecting a modest rise in consumer prices next year, of below 1.0% on average. Chamber of Commerce: Holiday consumption could drop by as much as 20% ZAGREB, Dec 16 (Hina) - Pre-Christmasconsumption in Croatia could this December decline by as much as 20% compared to December 2019, the head of the Croatian Chamber of Commerce's (HGK) retail sector, Tomislava Ravlic, said on Wednesday. "According to HGK's first estimates, we will spend up to 20% less than in December 2019, when consumption totalled HRK 15.8 billion," Ravlic said. She recalled that last year's December saw a record holiday consumption. According to her, the total drop in retail turnover this year compared to last year will be between 7 and 9%. She underscored that consumer habits were changing, so online shopping in the first ten months of this year rose by 12%. She called on consumers to choose local products when doing their holiday shopping. According to the president of the HGK's retailassociation, Ivica Katavic, the retailsector started experiencing problems at the start of the pandemic, causing panicked shopping in March, followed by the lockdownand then recovery in the summer, and turnover in October was only 2.5% down compared to last year. However, there was a resurgence of the pandemic in November and a partial lockdown in December. In December, "there won't be a disaster" in retail, Katavic said, and the decline will be between 10 and 20%, depending on the type of shop and its location. "The most important thing is to protect the health of customers and retailers and comply with the civil protection authority's measures," Katavic said. According to him, the vaccine brings optimism and he urged citizens to get vaccinated as soon as possible. The latest ***data*** by the national statistical office (DZS) show that retail consumption in Croatia in October 2020 dropped by 2.5% compared to October 2019. That was the eighth consecutive month of consumption decreasing on the year, but the decline was lower compared to the7.3% drop in September and it was the lowest decline since March. In the first ten months of 2020, retail turnover was down by 6.5% in real terms compared to the corresponding period of last year. Saucha sentenced to three, Zeljko to 4.5 years in prison in travel allowance case ZAGREB, Dec 16 (Hina) - Tomislav Saucha, former prime minister'schief of staff charged with falsifying travel allowance claims, was on Wednesday sentenced pending appeal to three years, while Sandra Zeljko, his former secretary, was sentenced to four and a half years in prison. They were also banned from performing official duties, and they will have to return the money syphoned via falsified travel allowance claims to the state. The verdict was handed down by a Zagreb County Court panel of judgeschaired by Sanja Mazalin. Zeljko was not present. Saucha and Zeljko have been pleading guilty since the start of the trial in the "travel allowance case". The USKOK anti-corruption office claimed that Zeljko had continued falsifying travel allowance claims even after Saucha's departure from the office ofthe then prime minister Zoran Milanovic, estimatingthe total damage at about one million kuna. The investigation was first launched only against Saucha, then an MP of the Social Democratic Party (SDP), and was later extended to Zeljko, who was initially the mainwitness in the case. After his release from pre-trial detention in February 2017, Saucha left the SDP and supported the ruling majority in the former parliament as a member of the Croatian People's Party (HNS). Ex-prime minister's chief of staffsays will appeal conviction ZAGREB, Dec 16 (Hina) -Tomislav Saucha, a former prime minister'schief of staff on Wednesday said that he would appeal a conviction and three-year sentence in the travel allowance claims graft while the USKOK anti-corruption office said that it is satisfied with the outcome of the trial. "I can't comment. This is just the first instance sentence, the battle still awaits me," Saucha said after the sentence was delivered in Zagreb County Court. The court handed down the verdict, pending appeal, against Saucha and his secretary Sandra Zeljko who were charged with having falsifiedtravel allowance claims while Sauchawas Zoran Milanovic's chief of staff. Saucha was sentenced to three years while Zeljko was sentenced to four and a half years. Saucha's defence attorney announced appeal “We will submit an appeal against the conviction. We think that we have a lot of arguments. I in some way thought the court would uphold our arguments but it didn't. We will see what the reasoning will say," Saucha's defence attorney said. He added that their key argument is that all the witnesses against Saucha were deeply involved and were in fact defending themselves. USKOKsatisfied with conviction, will appeal for higher sentence Deputy USKOK director Kresimir Ostrogonacsaid that the conviction was to have been expected considering the evidence. He added that although USKOK is satisfied with the conviction it would submit an appeal and call for a higher sentence. The suspects werecharged on quite a number of counts and we believe the sentence should be higher, all the more so because Saucha was employed in Government House, which certainly should not be somewhere where gradual stealing for so many years should be occurring, Ostrogonac said. He added that the state was attempting to return almost HRK 600,000 thatis estimated to have been siphoned from the state budget in the scam.That can only be done however, after the conviction becomes final. Another suspect in JANAF corruption case released from custody ZAGREB, Dec 16 (Hina) - Vinko Grgic, a Social Democratic Party MP and former mayor of Nova Gradiska, was released from investigative custody on Wednesday afternoon after spending three months behind bars because of his involvement in the JANAF corruption case. Given that Grgic was remanded in custody because of the risk that he might interfere with witnesses, he was released because all the relevant witnesses had been interviewed. Grgic told reporters on leaving Remetinec Prison in Zagreb that he was "feeling fine and continuing the fight." He said that he had not taken a bribe of HRK 100,000. Supreme Court acquits tycoon Gucic of war profiteering charge ZAGREB, Dec 16 (Hina) - Croatia's Supreme Court on Wednesday acquitted runaway tycoon Josip Gucic, of the war profiteering charge and accordingly reduced his eight-year sentence to five years for murky dealings and economic crimes in the process of privatisation of the Amfora and Primorje companies in Makarska. The highest court in the countrydetermined that wrongdoings in financialtransactions andfraud which Gucic was found guilty of could not come under the law related to war profiteering during the privatisation and transition process as the crimes referred to were committed in 1993 and 1994. The Supreme Court upheld a final conviction under which Gucicwas convicted for unlawfully obtaining the Amforacompany by purchasing shares from small shareholders in the Primorje Makarska company when he paid only 15% of the total price of the company which was valued at HRK 16 million. The Supreme Court ruled that the first instance court erred in describingGucic's behaviour as war profiteering. As far as the economic wrongdoings areconcerned, the Supreme Court overruled a Split County Court sentence of eight years and reduced it to five years of imprisonment. Gucic has been on the run since 2007 and is hiding in Serbia, where he fled to after serving a prison sentence for bribing a court expert. Ex-farm minister Tolusic loses defamation lawsuit against journalist ZAGREB, Dec 16 (Hina) - Virovitica Municipal Court on Wednesday acquitted reporter and vice president of the Croatian Journalists' Association (HND), Goran Gazdek, of the charges of the slander of the reputationof former ***agriculture*** minister Tomislav Toslusic, theHND has reported. The court's ruling is subject to appeal. Tolusic filed thedefamation lawsuit against Gazdek, who is the editor of the Virovitica.net news portal, seeking 180 dailyincomes or approximately HRK 40,000 in compensation for violation of personal rights. Commenting on the presidential election in December 2019, Gazdekreferred to TomislavTolusic, Ivica Kirin and Josip Djakic as ruffians in of the HDZ party. Tolusic was insulted by the remarkand sued Gazdek for emotional pain. Apart from this private lawsuit, Tolusic lodged a legal actionagainst the web portal for another two articles and is seeking HRK 40,000 in compensation. NGO marks 29th anniversary of 1991's Gornje Jame and Josevica massacres ZAGREB, Dec 16 (Hina) - The Documenta NGO on Wednesday drew attention to the inadequate efficiency in identifying and prosecuting perpetrators of war crimes against civilians, noting that it was also the result of unsatisfactory bilateral cooperation between countries. In a statement marking 29 years since the commission of war crimes against Croat civilians in the villages of Gornje Jame and Josevica,Documenta recalled that 12 civilians, including three underage children and seven women, had been killed in the house of Mate Kireta in Gornje Jame on 11 December 1991. The circumstances surrounding the deaths of the 12 victims remain unclear to this day, and their bodies have never been found, the NGO warned. According to its information, Gojko Pavlovic, aSerb civilian from Donje Jame, was also murdered as he tried to protect his Croat neighbours. These crimes are covered by an indictment issued by the Sisak County Prosecutor's Office on 30 July 2010, in which five citizens of Serbia were charged with war crimes against civilians and prisoners of war. The defendants are beyond reach of the Croatian judiciary, and Zagreb County Court is preparing the trial of one of the defendants, Vlado Cupovic,in his absence. In the village of Josevica on 16 December 1991, 21 Croat civilians were killed and one was severely wounded. Among those killed were 14 women, mostly elderly ones, and four younger persons. A couple from Skela, who had found refuge with their relatives in Josevica, were also killed, the statement said. Another eight Croat civilians were killed in this village between 1991 and 1994. Two Serb paramilitaries were found guilty of killing the 21 Croat civilians in Josevica and sentenced to 15 years in prison pending appeal. Their three co-defendants were acquitted for lack of evidence. Gornje Jame and Josevica are located near the town of Glina, about 80 kilometres south of Zagreb. Slovenia logs 2,107 new coronavirus infections, 39 deaths ZAGREB, Dec 16 (Hina) - Over the past 24 hours, Slovenia has registered 2,107 new cases of the coronavirus infection and 39 related deaths, the Slovenian government said on Wednesday. In the past 24 hours, 6,579 coronavirus tests have been performed, and 32% returned positive. Currently, there are 1,251 COVID patients in hospitals, 33 fewer than on Tuesday, while the number of patients in intensive care units decreased by seven and is now at 211. The number of hospitalised patients is decreasing on the week, albeit very slowly, government spokesman Jelko Kacin said. The epidemiological situation is still considered to be very severe, so some restrictions will only be relaxed until December 23 in order to avoid another surge in infections at a time when people could increasingly socialise outside their family circle. Slovenia's Health Minister Tomaz Gantar said on Tuesday that he was in favour of tight restrictions during the coming holidays, including a lockdown of economic activities at a time when many people go on holiday, which would cause the "least damage" to the economy. Bosnia reports 859 coronavirus infections, 50 COVID deaths ZAGREB, Dec 16 (Hina) - Over 850 new coronavirus cases and 50 COVID-19 deaths were confirmed in Bosnia and Herzegovina on Wednesday and the two entities' public health institutes said the infection rise had stabilised. In the past 24 hours, just under 3,500 samples have been tested, with 577 coming back positive in the Croat-Bosniak Federation entity and 282 in the Serb entity. Also, 28 COVID patients have died in the Federation and 22 in the Serb entity. Since the end of last week, the number of new infections has not surpassed 900, but COVID mortality remains high. The death toll since the outbreak of the epidemic in March stands at over 3,400 and is the highest in the region. Serbia records slight decrease in coronavirus infections ZAGREB, Dec 16 (Hina) - The trend in new coronavirus cases in Serbia indicates a slow fall this week however there are still over9,000 hospitalised patients and there have been more than 300 patients on ventilators for several days now, according to aCOVID tally released by health authorities on Wednesday. In the past 24 hours, 49 people died as a consequence of COVID-19,5,353 tests of a total of 18,484 taken in that period proved positive, Serbia's Health Ministry reported. There are currently 9,443 patients in hospital treatment, 333 of whom are on ventilators. Since the outbreak of the epidemic on March 6, a total of 2.08 million samples have been taken, registering 282,601 positive cases and 2,482 people have died. The country's COVID response team will be meeting on Friday to examine the effects of the epidemiological measures introduced thus far, adding that restrictions of not more than 5 people together and restricting working hours to 5 pm on weekdays will remain in force. No work is allowed from 5 pm Friday until 5 am Monday with the exception of food stores, pharmacies and petrol stations but only for fuel. As of 20 December anyone entering the country has to provide a PCR test no older than 48 hours, with the exception of Serbian citizens but they will be required to bequarantined forten days . Stoltenberg confident Montenegro remains committed NATO ally ZAGREB, Dec16(Hina) - NATO Secretary General Jens Stoltenberg said in Brussels on Tuesdayhe was confident Montenegro would remain a loyal and committed ally. Speaking at a joint press conference with Montenegro's new Prime Minister Zdravko Krivokapic, Stoltenberg said the country's commitment to NATO's goals was Krivokapic's clear message during their meeting. He thanked Krivokapic for his commitment to Euro-Atlantic integration and reform as well as for Montenegro's commitment to common security. Asked by the press if Krivokapic assured him that Montenegro would meet the membership commitments given that his team includes people who had participated in setting the NATO flag on fire, Stoltenberg answered affirmatively. Commenting on the fact that his home policy advisor was present at and supported the flag-burning, Krivokapic said he regretted that but, he added, people changed and should be given a chance. He thanked NATO for the solidarity in the fight against COVID-19, vowing that Montenegro would fulfilL all the obligations stemming from membership, both financially and regarding missionswhich, he said, Montenegro was undertaking successfully. Asked about relations with Russia, Krivokapic said Montenegro would strengthen relations with everyone, including Moscow. Earlier in the day he met with European Council President Charles Michel, saying afterwards that Montenegro had the full support of its European partners for EU membership. "Close ties with the Western Balkans countries are crucial for the EU and Montenegro is an essential partner.You have our full support for the reforms your country is undertaking,"Michel tweeted. The leaders of the three coalitions which won Montenegro's parliamentary voteon August 30 committed in a post-election agreement to not changing the country's foreign policy goals nor bringing Montenegro's recognition of Kosovo into question. In other news: Indices down more than 0.6%, falling for 4th day in a row ZAGREB, Dec 16 (Hina) - The main Zagreb Stock Exchange indices continued their downward trend for the fourth day in a row, mostly due to a decrease in prices in the construction sector. The Crobexdropped by 0.63% on Wednesday to 1,713 points, while the Crobex10 fell by 0.68% to 1,068 points. Both indices have been in the red for four days, losing about 3% in all in that period. The construction index fellthe most among sectors, diving by 6.14% while the biggest increase was generated by the tourism sector (+0.3%). Regular turnover amounted to HRK 7.6 million or 3 million more than on Tuesday. The highest turnover in regular trading of HRK 1.9 million was generated by the preferred shares of the Adristourism and insurance group. The price of Adris shares went down by 1.61% to HRK 367. The secondmost liquid stock wasthe Atlantic food manufacturer with a turnover of HRK 1.8 million. The price of its shares dived by 2.22% to HRK 1,320 per share. The HT telecommunications company's shares closed at a price of HRK 178, down 0.28% and generated a turnover of HRK 1.09 million. (€1 = HRK7.530889) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2100 HRS WEDNESDAY. (Hina) ms Masthead Brief News Bulletin is published by the Croatian News Agency HINA Marulićev trg 1610 000 ZagrebCroatia web:[*www.hina.hr*](http://www.hina.hr) mail: [*hina@hina.hr*](mailto:hina@hina.hr) phone: (+385 1) 48 08 660; fax (+385 1) 48 08 822 Publisher: Branka Gabriela Valentić, DirectorEditor in Chief: Serđo Obratov Bulletin Editor: Marija Šestan

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**Body**

Brenntag

2019 Sales: $14.37bn (12.8bn)

Essen, Germany

[*www.brenntag.com*](http://www.brenntag.com)

CEO: Christian Kohlpaintner

Products: Full-line range of more than 10,000 products; industrial chemicals; adhesives; paints; oil and gas chemicals; food and nutrition ingredients; water treatment chemicals; personal care ingredients; pharmaceutical ingredients; cleaning chemicals; coatings and construction chemicals; animal nutrition products; pulp and paper chemicals

Services: Tailor-made distribution solutions for industrial and specialty chemicals; one-stop-shop solutions; specific application technology; technical support; just-in-time delivery; product mixing; formulation; repackaging; inventory management; drum return handling

Assets: More than 640 locations in 77 countries; workforce of more than 17,500 employees

Univar Solutions

2019 Sales: $9.29bn

Downers Grove, Illinois, US

[*www.univarsolutions.com*](http://www.univarsolutions.com)

President & CEO: David C. Jukes

Products: Amines; aviation fuel additives; chelants; additives; hydrocarbons; essential chemicals & ingredients; military specification chemical products; monomers; silicone alternatives; oils; oleochemicals; pigments; plasticizers; polymers/resins; silica; silicones; solvent blends; solvents; surfactants

Services: Corporate accounts; ChemPoint; custom blending; custom packaging and private label services; lab and formulation services; MiniBulk; supply chain services; telemetry services; transportation services; warehousing services; solutions centre; onsite services; ChemCare services

Assets: More than 3,500 tractors, tankers, trailers; more than 650 distribution facilities; over 10,300 employees in 31 countries delivering to more than 130 countries

Tricon Energy

2019 Sales: $6.69bn

Houston, Texas, US

[*www.triconenergy.com*](http://www.triconenergy.com)

President & CEO: Ignacio Torras

Products: Chlor-alkalis; aromatics; glycols; fibre intermediates; solvents; olefins; polymers; fertilizers

Services: Marketing; pre-export financing; shipping; logistics; packaging; blending; storage; just-in-time delivery; repackaging; inventory management; risk management for commodity price and foreign exchange; global presence with sales into over 100 countries

Assets: 28+ offices; more than 450 employees

IMCD

2019 Sales: $3.15bn (2.81bn)

Rotterdam, Netherlands

[*www.imcdgroup.com*](http://www.imcdgroup.com)

CEO: Piet van der Slikke

Products: Specialty chemicals and ingredients for pharmaceuticals; coatings, adhesives, sealants, elastomers (CASE); personal care; advanced materials; food and nutrition; animal nutrition; nutraceuticals; lubricants; synthesis; HI&I; oil and gas

Services: Technical sales; marketing; local and central stock holding; drumming; repackaging; blending; sampling

Assets: Nearly 50 market-focused application laboratories; nearly 3,000 employees in 80 offices and 89 warehouses throughout all operating companies in Europe, Turkey, Israel, Africa (EMEA); Australia, New Zealand, India, China, Malaysia, Indonesia, Philippines, Thailand, Singapore, Vietnam, Japan, South Korea (Asia-Pacific); US, Canada, Brazil, Puerto Rico, Chili, Argentina, Uruguay, Colombia, Mexico (Americas)

Kolmar Group

2019 Sales: $3.08bn

Zug, Switzerland

[*www.kolmargroup.com*](http://www.kolmargroup.com)

CEO & chairwoman: Ruth Sandelowsky

Products: Aromatics; olefins; fibre intermediates; LNG and natural gas; alcohols; crude oil and oil products; renewable fuels; solvents

Services: Blending; storage

Assets: 2 biofuels plants

Trading sales: 76.5%

Sinochem Plastics

2019 Sales: $2.72bn

Beijing, China

[*www.sinochemplastics.com*](http://www.sinochemplastics.com)

General Manager: Zhang Xiaolei

Products: Engineering plastics (ABS, AS, PS, PMMA, MS, PC, PA, POM, ASA, POE, PVC, EVA, Q-resin and ABS HR); high performance plastics (modified nylon, modified PBT, modified polyformaldehyde, polysulfone and PES); plastics additives (antioxygen, flame retardants, lubricants, matting agents, compatilisers, TiO2); epoxy resin (BPA and crude glycerine); UPR (phthalic anhydride, 2-methyl-1, 3-propanediol, neopentyl glycol); coatings (organic silicon, emulsion, coating agents, surfactant); hygiene products (fluff pulp, SAP); synthetic rubber (IIR, SSBR, EPDM, SBCs, TPE); automotive plastics (PE, modified PP, ABS, ASA, modified nylon, modified PC); PU, rubber chemicals; specialty chemicals; ***agricultural*** products; palm oil chemical products

Services: One-stop procurement; supply chain management; technical support; commissioned processing; brand maintenance; information consultation

Assets: 3 warehouses; 2 office buildings

Trading sales: 46%

AZELIS

2019 Sales: $2.41bn (2.15bn)

Luxembourg

[*www.azelis.com*](http://www.azelis.com)

CEO: Dr Hans Joachim Mueller

Products: Thousands of specialty chemicals and food ingredients for the following markets: animal nutrition, food and health, personal care, home care and industrial cleaning, pharmaceuticals, specialty agri/horti, CASE, electronics, essential chemicals, fine chemicals, lubricants and metal working fluids, rubber and plastic additives, textile, leather and paper

Services: Laboratory analysis; formulation development and blending; expert technical and regulatory support; re-packaging; flexible pack sizes; local stockholding; market research and trend analysis; GMP and cleanroom pharmaceuticals facilities; integrated supply chain; sampling

Assets: 60+ application laboratories; offices and access to warehouses across EMEA, Americas and Asia Pacific; technically trained sales force

Biesterfeld

2019 Sales: $1.44bn (1.29bn)

Hamburg, Germany

[*www.biesterfeld.com*](http://www.biesterfeld.com)

CEO: Thomas Arnold

Products: High-performance polymers; engineering polymers; thermoplastic elastomers; styrenic polymers; acrylic polymers, standard polymers and additives; raw materials for cosmetics, pharmaceuticals, organic synthesis, household cleaning, culinary, spice, dairy, beverage, functional food; coatings, adhesives, sealants and elastomers (CASE); performance products; synthetic rubbers; silicone and fluorosilicone rubber compounds; carbon blacks; industrial and ***agricultural*** chemicals; plant protection products and fertilizers; pharmaceutical raw materials

Services: Individual solutions; technical expertise and consulting; active application development and product specification; direct and warehouse distribution; blending; storing; formulation and technical assistance; laboratory support of specialty chemicals; less-than-truckload (LTL) quantities; customised logistical solutions; marketing; consultancy and advisory services for Europe’s REACH regulation; legal compliance; silicone rubber compounding

Assets: Subsidiaries in more than 30 countries; application laboratories; blending and storage facilities for solid and liquid chemicals

Trading sales: 14%

Stockmeier Holding

2019 Sales: $1.40bn (1.25bn)

Bielefeld, Germany

[*www.stockmeier.de*](http://www.stockmeier.de)

CEO: Peter Stockmeier

Products: Industrial chemicals (acids, caustic, solvents, solids); specialty chemicals for industrial and home care (cosmetics, coatings, construction); cleaning products; peracetic acid; polyurethane chemicals; flavours and spices; printing inks; textile auxiliaries; AdBlue; water treatment chemicals

Services: Warehousing; blending; toll manufacture; specialised laboratories; logistics

Assets: More than 50 locations in Europe; 200 trucks

Barentz International

2019 Sales: $1.37bn (1.22bn)

Hoofddorp, Netherlands

[*www.barentz.com*](http://www.barentz.com)

CEO: Hidde van der Wal

Products: Starches; proteins; enzymes; hydrocolloids; vitamins; antioxidants; preservatives; emulsifiers; excipients; active ingredients; lanolin

Services: Blending; spray-drying; mixing; encapsulating; testing and formulating

Assets: Spray dryers; liquid and powder mixers

Trading sales: 8%

Omya

2019 Sales: $1.35bn (Swfr1.31bn)

Oftringen, Switzerland

[*www.omya.com*](http://www.omya.com)

Vice president: Peter Bigler

Products: Minerals and specialty chemicals for polymers (film and sheet, wire and cable, pipe and conduit, profile, moulding, compounding, thermosets, rubbers and elastomers, flooring), construction (decorative paints, industrial coatings, printing inks, adhesives and sealants, plasters and renders, construction), water and energy, ***agriculture*** and forestry, alu-finishing, printing and writing, packaging; ingredients for consumer goods (food and nutraceuticals, personal care, home care and animal nutrition)

Services: Global marketing and sourcing; global supply chain management (logistics, customer service); regulatory affairs management and services; R&D; technical service; analytics; microscopy; quality control

Assets: R&D center for surface science, mineral pigment, chemical engineering, microbiology and consumer goods; technical application services hubs in Europe, Americas and Asia Pacific for all product categories; sales affiliates in more than 50 countries; global network of 70+ warehouses

Snetor

2019 Sales: $1.29bn

Courbevoie Cedex, France

[*www.snetor.com*](http://www.snetor.com)

President: Emmanuel Aubourg

Products: PE; PP; PVC; PET; PS; ABS; engineering polymers; polyols and TDI; industrial chemicals

Services: Trading; packaging; technical support

Assets: 30 warehouses

Trading sales: 75%

Manuchar

2019 Sales: $1.26bn

Antwerp, Belgium

[*www.manuchar.com*](http://www.manuchar.com)

CEO: Philippe Huybrechs

Products: Sodium sulphate; soda ash; zeolite; caustic soda; sodium bicarbonate; calcium chloride; sodium lauryl ether sulphate (SLES); linear alkyl benzene sulphonic acid (LABSA); glycerine; surfactants and oleochemicals; silicones; emulsifiers; resins and monomers; homecare and detergent chemicals; textile chemicals; personal care and cosmetics ingredients; paints and coatings chemicals; construction chemicals; mining chemicals; oilfield chemicals; food and feed additives; fertilizers

Services: Local know-how and technical support in emerging markets; tailor-made warehousing; logistics/supply chain services; financial solutions

Assets: 75+ affiliates worldwide accross 35+ countries; 160+ locations; 405,000+ square metres of warehouse space

Trading sales: 36%

ICC Chemical

2019 Sales: $1.05bn

New York, New York, US

[*www.iccchem.com*](http://www.iccchem.com)

President: Naveen Chandra

Products: PVC resin; acrylonitrile; alpha olefins; styrene; mixed xylenes; acetone; isopropyl alcohol; MMA; n-paraffin; acetic acid; pygas; chloroform; 2-ethylhexanol; solvent C9

Services: Packaging

Assets: 30 offices and representatives worldwide

Trading sales: 82%

DKSH Holding (Performance Materials)

2019 Sales: $1.03bn (Swfr1.0bn)

Zurich, Switzerland

[*www.dksh.com/pm*](http://www.dksh.com/pm)

CEO: Stefan P Butz

Products: Food and beverage ingredients; personal care and cosmetics ingredients; pharmaceutical ingredients; specialty chemicals

Services: Marketing and sales; logistics; innovation and formulation services; regulatory services; sourcing services; blending and repackaging; after-sales services

Assets: 46 innovation centres; 100 business locations; 35 distribution centres

Caldic

2019 Sales: $988.0m (880m)

Rotterdam, Netherlands

[*www.caldic.com*](http://www.caldic.com)

CEO: Olav C van Caldenborgh

Products: Specialty food ingredients such as hydrocolloids, creative sensory products, vitamins, minerals and nutraceuticals, preservatives, antioxidants and acids, processing aids; health and personal care ingredients such as specialty solvents, excipients, APIs, acids and alkalies, pigments, surfactants; specialty chemicals for industrial markets such as specialty solvents; specialty polymers; pigments and dyes; hydrocarbon and water-based resins; emulsifiers; silicone water repellents and anti-foams; adsorbents and ion exchange resins; preservatives; plant-based solutions; elastomers and plasticizers

Services: Sourcing and procurement; production; supply chain; innovation and formulation; regulatory; blending; mixing; repackaging

Assets: 23 entities with 45 sites comprising offices, warehouses, production facilities, laboratories and innovation centres

QUIMIDROGA

2019 Sales: $982.4m (875m)

Barcelona, Spain

[*www.quimidroga.com*](http://www.quimidroga.com)

CEO: Vicente Munoz

Products: Solvents; monomers; glycols and intermediates; fine chemicals and specialties for food and feed, agrochemicals and fertilizers, pharmaceuticals, cosmetics, flavours and fragances, detergents, coatings, adhesives, paper, water treatment, plastizicers; resins; plastics; elastomers

Services: Storage of liquid and packaged products; blending; standard and tailor made packaging; dissolutions

Assets: Logistics complex at the Port of Barcelona with capacity of 30,000 tonnes of packaged products plus 155 tanks for 12,000cbm of liquids; two sites in Burgos and Madrid, Spain with capacity of 1,500 tonnes of packaged products plus 20 tanks for liquids each one; nine distribution centres; a fully equipped quality control laboratory; new application and development laboratory

Trading sales: 5%

Ravago Chemicals

2019 Sales: $920.6m (820m)

Arendonk, Belgium

[*www.ravagochemicals.com*](http://www.ravagochemicals.com)

General Manager EMEA: Filip Van Camfort, General Manager US: Kevin Wettstein

Products: Industrial chemicals (coatings, PU & polymers, construction, asphalt), specialty chemicals (care, life science, performance, water) and base chemicals (solvents, inorganics, intermediates, plasticizers)

Services: Distribution, technical expertise, warehousing, logistics, blending, repackaging, lab facilities

Assets: Network of warehouses (own and third party), drumming & blending & lab facilities, feed premix plant, pressure vessel manufacturing & water treatment unit factory

Trading sales: 10%

TER GROUP

2019 Sales: $916.1m (816m)

Hamburg, Germany

[*www.tergroup.com*](http://www.tergroup.com)

CEO and managing shareholder: Christian A Westphal

Products: Waxes; gum rosin; thermoplastic and thermoset polymers; adhesives; hotmelts; additives; polybutenes; SIS/SBS block copolymers; IIR rubber; caseine; amorphous polyalpha-olefins; hydrocarbon resins; pigments; dyes; polyvinyl alcohol; food ingredients; vaseline

Services: Blending; packaging; storage; production

Assets: Numerous office buildings; warehouses; trucks

Trading sales: 25%

Jebsen & Jessen Group

2019 Sales: $808.3m (720m)

Bangkok, Thailand and Hamburg, Germany

[*www.ingredients.jjsea.com*](http://www.ingredients.jjsea.com),   [*www.jebsen-jessen.de*](http://www.jebsen-jessen.de)

CEOs: Heinrich Jessen, Fritz von der Schulenburg

Products: Coatings and resins; plastics and rubber; food and nutrition ingredients; feed additives; oil and gas chemicals; oil derivatives; bioethanol; pharmaceutical and personal care ingredients; home care specialties; adhesives; water treatment specialties; mining components; agrochemicals; modified starches; collagen and sweeteners

Services: Sales and marketing; R&D; import/export; regulatory affairs; warehousing; sourcing; factory audit; credit report; local currency financing

Assets: 24 offices worldwide; 15 warehouses; six laboratories; three regional innovation centers

Emeraude

2019 Sales: $780m

Paris, France

[*www.emeraude-international.com*](http://www.emeraude-international.com)

CEO: Umar Rafique

Products: Polyethylene (PE); polypropylene (PP); polyvinyl chloride (PVC); polyethylene terephthalate (PET); polystyrene (PS); polyurethane (PU); recycled resins; masterbatches and additives; adhesives and coatings

Services: Logistics; packaging; storage

Behn Meyer Group

2019 Sales: $763.4m (680m)

Hamburg, Germany

[*www.behnmeyer.com*](http://www.behnmeyer.com)

Products: Fertilizers; crop protection chemicals; ingredients for food, personal, home care and pharmaceuticals; feed additives; specialties for rubber and plastics; solutions for water treatment, petrochemicals, coatings, leather and textiles, and process industries

Services: Technical sales and marketing; customer service; regulatory and risk management; innovation and formulation; laboratory testing; blending, tailoring and packaging; warehousing and logistics; supply chain management; omni-channel support; business development

Assets: Over 1,200 employees; office and warehouses in 14 countries; 38 warehouse locations; global production facilities in Malaysia, Thailand, Indonesia, Italy, Netherlands and US; laboratory facilities in Malaysia, Indonesia, Thailand, Vietnam, Italy and Netherlands

Safic-Alcan

2019 Sales: $726m

La Defense, France

[*www.safic-alcan.com*](http://www.safic-alcan.com)

CEO: Philippe Combette, CEO Myrtil (holding company) Martial Lecat

Products: cosmetics, pharma, nutraceuticals, rubber, plastics, coatings, industrial specialties

Services: Blending, packaging

Assets: nine state-of-the art laboratories (for cosmetics, coatings, rubber, pharmacy and water treatment in France, UK, Netherlands, Italy, Turkey and China)

Hydrite Chemical

2019 Sales: $700m

Brookfield, Wisconsin, US

[*www.hydrite.com*](http://www.hydrite.com)

CEO: Paul Honkamp

Products: Extensive line of products including peracetic acid (PAA); chlor-alkali; industrial chemicals; foam control chemicals; food processing and sanitation chemicals; food ingredients; liquid sulfites; fertilizers and liquid micronutrients; pulp and paper chemicals; organic and inorganic chemicals; styrene/acrylic emulsion polymers; metal finishing chemicals; solvents; and wastewater treatment chemicals

Services: Contract manufacturing; formulation; solvent reclamation; hazardous waste removal; packaging and transloading; technical training; customer product research

Assets: 15 locations; bulk storage of 15m gal; private fleet of trucks and professional drivers

Solvadis Group

2019 Sales: $650.7m

Frankfurt, Germany

[*www.solvadis.com*](http://www.solvadis.com)

CEO: Andreas Weimann

Products: Sulphur; sulpuric acid; methanol; petrochemicals; solvents; industrial chemicals; industrial minerals; pharmaceutical raw materials; synthetic lubricants; laboratory chemicals; coatings; fertilizers; packaging materials; personal protective equipment

Services: Marketing; storage; transport; logistics; packaging; supply chain management; processing; transloading; remanufacturing; sulphur forming (prilling); regeneration

Assets: 10 tank farms; two storage facilities/warehouses; two production facilities

Trading sales: Less than 5%

GTM Holdings

2019 Sales: $628m

Sao Paulo, Brazil

[*www.gtmchemicals.com*](http://www.gtmchemicals.com)

CEO: Rodrigo Gutierrez

Products: Specialty, performance and industrial chemicals for oilfield, coatings, inks, adhesives, sealants, elastomers, cosmetics, personal care, fragrances and flavors, pharmaceuticals, ***agriculture***, water treatment, food ingredients, animal feed, pulp and paper, mining, lubricants, household & industrial cleaning

Services: Mixing and blending; formulation; packaging; storage (bulk and packed warehousing); preparation of samples; chemical analysis; production of lubricants (automotive and industrial); labelling; stock control; logistics; just-in-time delivery; drum return handling; inventory management; technical support; waste management

Assets: 45 facilities throughout Latin America, including six owned maritime terminals; tank farms and blending units in all countries; 19 laboratories (product development, application technology and quality control)

Hawkins

2019 Sales: $535.5m

Roseville, Minnesota, US

[*www.hawkinsinc.com*](http://www.hawkinsinc.com)

President and CEO: Patrick Hawkins

Products: Caustic soda; bleach; minerals; lactates; sulphuric acid; hydrochloric acid; sodium citrate; vitamins; ferric/ferrous chloride; urea; chlorine

Services: Manufacturing; custom blending; packaging; private label

Assets: Seven industrial manufacturing facilities; 29 water treatment distribution warehouses; 125+ trucks; nutraceutical manufacturing plant

Nordmann, Rassmann

2019 Sales: $497.4m (443m)

Kajen 2, 20459 Hamburg, Germany

[*www.nordmann.global*](http://www.nordmann.global)

Managing director, chairman of the managing board: Dr. Gerd Bergmann, Managing directors Carsten Güntner, Felix Kruse

Products: Adhesives and sealants; composite materials; construction and coatings chemicals; contact lens, dental and medical materials; flame retardants; food additives; industrial chemicals and intermediates; lubricant additives; monomers; oleochemicals; personal care additives; pharmaceutical and nutraceutical ingredients; polyurethane chemicals; synthetic rubber and rubber chemicals; thermoplastics and polymer additives

Services: Laboratories, studies and R+D; chemical synthesis and compounding; marketing and market intelligence; legislative and regulatory support; quality management and safety; global supply chain management; repacking and refilling; sample service

Assets: Warehouses located all over Europe, Asia and North America

Trading sales: 5%

Redox

2019 Sales: $493.4m

Sydney, Australia

[*www.redox.com*](http://www.redox.com)

Managing director/chairman: Robert Coneliano

Products: More than 1,000 products serving over 140 industries; commodity and specialty chemicals; food ingredients; ***agricultural*** chemicals; household and personal care chemicals; mining chemicals; surface coatings; plastics additives; grease and lubricants; water treatment chemicals; building and construction chemicals; pharmaceutical ingredients

Services: Custom blending; dilutions; repackaging; bulk storage of powders, solvents, acids, alkalis; palletised storage

Assets: 12 regional sales offices; 2 manufacturing sites; 7 owned and operated warehouses; more than 50 stock locations

Quadra Chemicals

2019 Sales: $491.7m

Vaudreuil-Dorion, Quebec, Canada

[*www.quadrachemicals.com*](http://www.quadrachemicals.com),   [*www.quadraingredients.com*](http://www.quadraingredients.com)

CEO: Tony Infilise

Products: Performance adhesives; flexible packaging; household, industrial and institutional cleaning chemicals; water treatment chemicals; mining and smelting chemicals; soluble fertilizer; pulp and paper chemicals; metal treatment and galvanizing chemicals; construction chemicals; CASE; pool and spa chemicals; oilfield chemicals; nutritional and functional ingredients; food and beverage ingredients; sports and animal nutrition ingredients; pharmaceutical ingredients; cosmetics and personal care ingredients

Services: Storage; packaging; blending

Assets: Six locations with warehouses and tank farms

Maroon Group

2019 Sales: $463m

Avon, Ohio, US

[*www.maroongroupllc.com*](http://www.maroongroupllc.com)

CEO: Terry Hill; President and COO: Mike McKenna

Products: Specialty chemicals and ingredients for the CARE, HI&I, food and beverage, CASE, performance materials and specialty intermediates markets

Services: Technical and formulary support via laboratories; custom blending; repackaging; micronisation; drumming; public warehousing; FDA and SQF storage

Assets: 130,000sq ft headquarters in Avon, Ohio; 170,000sq ft facility in Lincoln, Rhode Island and 37,000sq ft facility in Newark, New Jersey; six additional market facing customer service centres located throughout North America; additional 47 total warehouses in North America; seven owned trucks; CARE laboratory (Rhode Island); HI&I laboratory (Florida); CASE laboratory (Florida); oil and gas laboratory (Oakville, Ontario Canada); food test kitchen (Oakville, Ontario, Canada)

Lehmann & Voss & Co/LEHVOSS Group

2019 Sales: $449.1m (400m)

Hamburg, Germany

[*www.lehvoss.com*](http://www.lehvoss.com)

Managing partners: Knut Breede, Soenke Thomsen, Dr. Thomas Oehmichen

Products: high-performance composites, magnesia, blowing agents, flame retardants, active cosmetic ingredients like hyaluronic acids, active nutraceutical ingredients like MSM, diathomatious earths, rare earths, zirconium compounds, rheological additives, antioxidants, 3D printing materials, additive masterbatches

Services: product development, production, re-packaging, storage, recycling, laboratory

Assets: Five production plants, five laboratories

Trading sales: 30%

EIGENMANN & VERONELLI

2019 Sales: $428.3m (381.5m)

Rho, Milan, Italy

[*www.eigver.com*](http://www.eigver.com)

Chairman: Ludovico Balbo di Vinadio

Products: Specialty chemicals for adhesives and sealants, animal nutrition and health, building, ecology and water treatment, food ingredients, home and industrial care, leather, lubricants and industrial auxiliaries, organic synthesis, paper, personal care, pharmaceuticals, plastic additives, polyurethanes, rubber, surface coatings, textiles

Services: Production including toll and third party manufacturing; re-packaging; warehousing

Assets: Three production plants; Three warehouses

Trading sales: 20%

Indukern

2019 Sales: $411.6m (366.6m)

Barcelona, Spain

[*www.indukern.com*](http://www.indukern.com),   [*www.grupoindukern.com*](http://www.grupoindukern.com)

CEO: Daniel Diaz-Varela

Products: Food ingredients; pharmaceutical ingredients; pharmaceutical APIs; flavour and fragrance ingredients; veterinary and animal nutrition ingredients

Services: Blending; premixes; packaging; storage

Assets: Nine warehouses in Spain; subsidiaries

Trading sales: 8%

Wego Chemical Group

2019 Sales: $372.7m

Great Neck, New York, US

[*www.wegochem.com*](http://www.wegochem.com)

Principal and President: Bert Eshaghpour

Products: ***Agricultural*** chemicals; animal nutrition and feed ingredients; antifreeze and coolant; CASE; corrosion inhibitors; lithium batteries and electrolytes; lubricants and greases; pharmaceutical and fine chemicals; HI&I; flame retardants; food and beverage ingredients; metal-working, finishing and flux chemicals; oilfield chemicals; plastics, resins and rubber chemicals; pulp and paper chemicals; water treatment and pool chemicals

Services: Supply chain solutions; logistics; warehousing; outsourcing

Assets: 100+ worldwide professionals; 14 international offices; global distribution network of 50+ warehouses

Trading sales: 20%

Anastacio

2019 Sales: $364.0m

Sao Paulo, Brazil

[*www.anastacio.com*](http://www.anastacio.com)

CEO: Jan Felix Krueder

Products: Cosmetics and personal care ingredients; pharmaceutical ingredients; flavours; animal health ingredients; ***agricultural*** chemicals; rubber; household and auto care chemicals; lubricants; plastics; polyurethane; paints and coatings; resins and adhesives; food and feed ingredients; sports nutrition ingredients

Services: Storage; blending; packaging; bulk distribution; trading; cargo consolidation; dedicated procurement

Assets: Eight warehouses - three in Sao Paulo, one in Santa Catarina, one in Rio Grande do Sul, one in Pernambuco, one in Goias and one in Buenos Aires, Argentina

Trading sales: 14%

EMCO Chemical Distributors

2019 Sales: $358m

Pleasant Prairie, Wisconsin, US

[*www.emcochem.com*](http://www.emcochem.com)

President: Edward Polen

Products: Acids and alkalis; additives; aliphatic and aromatic hydrocarbons; amines; carbonates; chelating agents; ester and ether esters; glycols; ketones; pigments; plasticizers; resins; silicones; surfactants; terpene and citrus solvents

Services: Blending and packaging; waste services; application laboratory services; warehousing; order fulfillment; USP and food grade packaging; private fleet delivery

Assets: Three production facilities (US – North Chicago, Illinois; Columbia, Illinois; Pleasant Prairie, Wisconsin); Six warehouses (US – Elkhart, Indiana; Minneapolis, Minnesota; Cincinnati, Ohio. Canada – Calgary, Alberta; Toronto, Ontario; Montreal, Quebec); 5,000sq ft CASE applications lab; 40 trucks and 90 trailers

VIKUDHA OVERSEAS

2019 Sales: $351m

Hong Kong, China

[*www.vikudha.com*](http://www.vikudha.com)

CEOs: Vikash Adukia, Deap Adukia

Products: Chemicals and polymers for agro and feed, cosmetics and personal care; detergents and home care; food and beverages, mining, oil and gas, paints and coatings, plastics, polyurethane, rubber and paper, textiles and leather, water treatment

Services: Product sourcing, market development, creative financial solutions, market intelligence, logistics expertise, shipping advisory and documentation

Assets: 17 offices across the globe; 165+ employees globally; multiple warehouses

Trading sales: 70%

Pochteca Materias Primas

2019 Sales: $329.3m

Mexico City, Mexico

[*www.pochteca.com.mx*](http://www.pochteca.com.mx),   [*www.pochteca-english.com*](http://www.pochteca-english.com)

Executive director: Eugenio Manzano

Products: Inorganic chemicals; solvents and blends; food ingredients; chemical specialties; lubricants

Services: Blending; packaging, storage and logistics solutions; product application; product development; quality control; industrial waste management

Assets: More than 333,000sqm of logistics capacity; capacity to store 22m litres of liquids and more than 113,000sqm of storage of dry goods; 33 distribution centres in Mexico, three in Central America and five in Brazil; fleet of more than 200 units; solvent recycling plant; 12 product application laboratories; 12 quality laboratories

ECEM European Chemical Marketing

2019 Sales: $321.7m

Amsterdam, Netherlands

[*www.ecem.com*](http://www.ecem.com)

CEO: Barend Barendse

Products: Acrylates and methacrylates; hydroxy monomers; 150 special monomers; anhydrides; phosphonates; water treatment; polyurethanes; food and feed ingredients; pharmaceutical ingredients; complementary products for coatings resins and polymers; adhesives and sealants; water treatment chemicals; TDI and MDI for polyurethanes

Services: One-stop shopping and global supply chain service to customer sites in Europe, US and Brazil; consignment stocks; agents/representatives for producers; drumming operations; sales in packed materials; fully REACH registered in EU; blending; returnable IBCsAssets: Bulk storage and warehouses in several countries; drumming installations; 8 owned isotanks for dedicated bulk transport; over 100 returnable (custom tailored) stainless steel IBCs; over 70 professional staff in global sales and logistic managers, plus workers on several terminals and warehouse operations; sales offices in Brazil, Japan, China, US and EU

Trading sales: 3%

CellMark

2019 Sales: $300.5m

Gothenburg, Sweden

[*www.cellmark.com*](http://www.cellmark.com)

President, Chemicals Division: Hugo Galletta; President, Basic Chemicals Division: Ersin Alkan

Products: Basic chemicals; lignosulfonates; caustic soda; semiconductor materials; renewable batteries; oilfield chemicals; water treatment chemicals; coatings; agrochemicals; flame retardants; food and beverage ingredients; cosmetics and active pharmaceutical ingredients; organic and inorganic chemicals; vitamins, plant extracts, nutraceuticals and amino acids; specialty and fine chemicals

Services: Sales and marketing; sourcing; custom manufacturing; packaging; blending; milling and granulation; R&D; regulatory; market research; logistics

Assets: Production equipment and inventory held at public warehouses in over 20 locations worldwide

Trading sales: 40%

Protea Chemicals

2019 Sales: $300m

Bryanston, Gauteng, South Africa

Interim managing director: Pieter Swart

[*www.proteachemicals.co.za*](http://www.proteachemicals.co.za)

Products: Food ingredients; water-care chemicals; consumer care ingredients; animal nutrition ingredients; coatings, adhesives and solvents; polymers; bulk liquids; bulk powders

Services: Freight; dry and liquid blending; third-party manufacturing; warehousing; laboratory services; planning; training; environmental management

Assets: 200 Trucks; over 30 warehouses; 10 facilities; eight distribution facilities

Trading sales: 10%

MCassab

2019 Sales: $294.3M

São Paulo, Brazil

[*www.mcassab.com.br*](http://www.mcassab.com.br)

CEO: Victor Cutait Neto

Products: performance and specialty chemicals for polyurethanes, paints, resins, construction and polymers sectors; solvents; additives; silicones; pigments; monomers; emulsifiers; polyols; isocyanates; biocides; APIs and pharmaceutical excipients; home and personal care ingredients; veterinary products; feed and food premixes and ingredients; vitamins; amino acids

Services: blending; packaging; storage; dilutions; technical applications laboratories (polyurethanes, home and personal care, pharmaceuticals and food); full technical support; formulation; physical, chemical and microbiological accredited ISO 17.025 laboratory

Assets: Three warehouses in Brazil; one warehouse in Argentina; four premix facilities for animal nutrition; one premix facility for food nutrition

Trading sales: 0.5%

Pon Pure Chemicals Group

2019 Sales: $293.4m

Chennai, Tamil Nadu, India

[*www.pure-chemical.com*](http://www.pure-chemical.com)

Chairman and managing director: M Ponnuswami

Products: Basic chemicals; acids and derivatives; coatings and inks; plastics and composites; textile chemicals; leather and paper chemicals; sugar chemicals; water treatment chemicals; lubricants; monomers; aromatics; ketones; esters; ethers; alcohols; aliphatic solvents

Services: Small packaging; underground storage; technical service; custom blending; just-in-time delivery

Assets: 25 branches in India; five overseas branches in Dubai, Australia, Singapore, Bangladesh and SriLanka; 23 warehouses across India (inclusive of seven explosive repackaging warehouses); leased terminal facilities at Kandla, Mumbai, Ennore, Kakinada and Haldia

TOP Solvent

2019 Sales: $291.6mChatuchak, Bangkok, Thailand

[*www.topsolvent.com/en*](http://www.topsolvent.com/en)

CEO: Acharee Tiyabhorn

Products: Hydrocarbon solvents (hexane, pentane, SBP group (rubber solvents), toluene, xylene, aromatic solvents (A100 / A150), white spirits; chemical solvents (IPA, acetone, MEK, ethyl acetate, butyl acetate; styrene monomer (SM); ethylene glycol (MEG, DEG); specialty chemicals; food ingredients; pharmaceutical ingredients; personal care ingredients; animal feed products; cleaning products

Services: Manufacturing of hydrocarbon solvent products; storage; drum filling; multi-delivery mode offerings - vessel, bulk lorry, isotank, drum; thinner blending

Assets: One manufacturing plant for hydrocarbon solvents with nameplate capacity of 141,000 tonnes via subsidiary Sak Chaisidhi Company Limited (SAKC); two tank terminals in Thailand; two tank terminals in Vietnam; 73 chemical storage tanks with capacity of over 46m litres; 7 warehouses with capacity of 38,000 drums (200 litres); loading and unloading facilities; drum filling station; laboratory (QC and technical); 54 bulk lorries (contracted); 45 pack trucks (contracted)

Trading sales: 3%

PVS Distribution Group

2019 Sales: $289m

Detroit, Michigan, US

[*www.pvschemicals.com*](http://www.pvschemicals.com)

CEO: Tim Nicholson

Products: Full line distribution specialising in inorganic chemistry, surfactants, water treatment, HI&I, metal working, food, oil and gas and ***agriculture***

Services: Blending; packaging; storage; delivery; bulk; minibulk; microbulk; transloading

Assets: Six warehouses; 100 company-owned trucks; multiple terminals

Quimtia

2019 Sales: $287m

Lima, Peru

[*www.quimtia.com*](http://www.quimtia.com)

President and CEO: Diego Collard Bovy

Products: Mining chemical products and blends; water treatment products; paper chemical blends; oil and gas chemicals; basic industrial chemicals; feed additivies and specialties; poultry pigments; feed premixes; animal health products; food ingredients, blends and flavours; plastic bags and sacks

Services: Packaging and storage; blending; dilutions; production (pigments, animal vaccines, flavours); application consultanting; quality control; total chemical management services at customers

Assets: 13 warehouses; eight labs (quality control, applications); four headquarters in Lima (Peru), Buenos Aires (Argentina), Curitiba (Brazil), Medellin (Colombia)

Trading sales: 2%

KTM

2019 Sales: $277m

Istanbul, Turkey E [*www.ktm.com.tr/en*](http://www.ktm.com.tr/en)/

CEO: Keyan Zulfikari

Products: polymers, oxo alcohols, solvents, plasticizers, monomers, rubber & rubber chemicals, polyurethane raw materials, TiO2, organic & inorganic chemicals

Services: international marketing, distribution, logistics, packaging, storage, inventory management, VMI & JIT, blending, financing, risk management

Assets: pan European coverage and offices, shore tanks & bulk storage facilities, numerous warehouses covering Europe and Turkey, truck fleet and road tankers

Trading sales: 25%

LBB Specialties (Charkit, AIC and Dien)

2019 Sales: $271.1m

Westborough, Massachusetts, US

[*www.LBBSpecialties.com*](http://www.LBBSpecialties.com)

CEO: Darren Birkelbach

Products: Personal care ingredients; nutritional ingredients; food and beverage ingredients; biotech and life sciences chemicals; aroma chemicals and flavours and fragrances; HI&I chemicals; imaging chemicals; metal and water treatment chemicals; paint and coatings materials; imaging components; specialty chemicals; industrial products

Services: Warehousing; blending; packaging; custom/contract manufacturing; custom synthesis; product development

Assets: 32 stocking locations in North America

Rakha Al Khaleej International

2019 Sales: $267m

Dubai

[*www.rai-uae.com*](http://www.rai-uae.com)

CEO: Henry F Roth

Products: Polymers, masterbatch and filler

Services: Distribution & trading

Assets: Four owned warehouses, several on lease

Trading sales: 20%

Tennants Distribution (and associated companies)

2019 Sales: $266.7m (£201m)

[*www.tennantsdistribution.com*](http://www.tennantsdistribution.com)

Managing director: Tim Griffiths; Chairman: Andrew Mitchell

Products: Acids and alkalis; animal feed raw materials; fatty acids, alcohols and esters; food ingredients and flavours and fragrances; general chemicals; Greenox AdBlue; personal care ingredients; pharmaceutical products; resins; solvents; specialty products; surfactants; water treatment chemicals; white oils and petroleum jelly

Services: warehousing and storage; re-packaging; blending; formulating; re-labelling

Assets: 20 sites (including warehousing and storage); own vehicles

Trading sales: 2%

Norkem Holdings

2019 Sales: $260.6m

Knutsford; Cheshire; UK

[*www.norkem.com*](http://www.norkem.com)

Group MD; A Nicholson

Products: Iodine and iodine salts; zinc oxide and zinc salts; manganese compounds; copper salts; barium carbonate; citric acid; potassium carbonate and hydroxide; food chemicals; pharmaceutical intermediates; feed chemicals

Services: Blending; packaging; manufacturing; liquid suspensions; liquid solutions

Assets: 12 locations worldwide

KPL International

2019 Sales: $260.1m (Rs18.54bn)New Delhi, India

[*www.kplintl.com*](http://www.kplintl.com)

Managing director: Surinder Kumar Kak

Products: Bulk and essential chemicals; polymers; paper and allied chemicals; specialty chemicals; paints and coatings chemicals; industrial and specialty gases; engineering consumables; darjeeling teas; renewable energy

Services: Development of markets for new products and applications; re-packaging; market intelligence, technical support for quality control, testing and plant audits; after-sales support; sourcing, export, procurement and auditing services; sourcing and exporting from India, China and Middle East to international markets; warehousing and logistics

Assets: Eight warehouses; two bottling facilities for refrigerants and industrial gases; eight wind turbines with generation capacity of 15.35MW; tea gardenTrading sales: 27.76%

KRAHN Chemie

2019 sales: $254m (226m)

Hamburg, Germany

[*www.krahn.eu*](http://www.krahn.eu)

CEO: Rolf Kuropka, Axel Sebbesse

Products: Coating ingredients (additives, rheology modifiers, pigments and colorants, resins, biocides, film consolidation agents); construction chemicals (additives, pigments, fillers, rheology modifiers); adhesives ingredients (resins, plasticizers, additives, bonding agents); plastic ingredients (additives, plasticizers, flame retardants), rubber ingredients (synthetic rubber, adhesion promoters, mould release agents); ceramic ingredients (zirconia, alumina, binders); CIM & MIM compounds; lubricant ingredients (base oils, additives & additive packages); heat transfer fluids

Services: Technical sales and marketing support; R&D; application development; laboratory analysis, colorimetry and colour-matching service, formulation advice, production, warehousing and logistics solutions, mixing and blending, re-packaging, sampling service, legislative and regulatory support

Assets: Three technology centres

Trading sales: 0%

Interstate Chemical

2019 Sales: $246.4m

Hermitage, Pennsylvania, US[*www.interstatechemical.com*](http://www.interstatechemical.com)

Chairman and president: Albert R Puntureri

Products: Alcohols; ketones; solvents; glycols; catalysts; plasticizers; resins; thermal fluids; caustic soda; acids

Services: Blending; storage; toll manufacturing; river terminal services; manufacturing catalysts, plasticizers, resins, thermal fluids and various sodium-based products

Assets: nine warehouses; two river terminals; 98 trucks; 170 tankers; storage tank rentals

ARKEM KIMYA

2019 Sales: $235m

Istanbul, Turkey

[*www.arkem.com*](http://www.arkem.com)

Chairman and CEO: Levend Kokuludag

Products: Monomers; hydrocarbon solvents; alcohols; ketones; esters; glycols; glycol ethers; chlorinated solvents; oleochemicals; specialty chemicals; cosmetics; pharmaceuticals; food ingredients; surfactants; plastics

Servcies: Sales and marketing; bulk storage; blending; formulating; drumming; packaging; labelling and other warehousing services

Assets: One deep-sea tank terminal at Gebze, Turkey with capacity of 84,000cbm; logistics company with 75 transport units and 600 ISO tank containers; four warehouses (two in Istanbul, one in Izmir and one in Rotterdam)

Trading sales: 3%

BUFA Chemikalien

2019 Sales: $230m

Hude, Germany

[*www.buefa.de*](http://www.buefa.de)

CEO: Ronald Ijzer

Products: Ethanolamines; ethylene glycol ethers; ethylene glycols; polyethylene glycols; propylene glycol ethers; propylene glycol; isopropyl alcohol; propionic acid; formic acid; caustic soda; solvents; aromatics; styrene; surfactants; oxo alcohols

Services: Formulating; warehousing; filling and bottling; blending; logistics; drumming

Assets: Six warehouses; 14 trucks

Trading sales: 30%

Superior Oil Company

2019 Sales: $226m

Indianapolis, IN, US

[*www.superioroil.com*](http://www.superioroil.com)

President: Kurt Hettinga

Products: Solvents; water-based cleaners; paint pre-treatment products; paint purge; thinners; heat transfer fluids; pressroom chemicals; fibreglass reinforcements; resins; catalysts; gel coats; corrosion inhibitors; surfactants; plasticizers

Services: Solvent recycling; blending; custom manufacturing; private labelling; waste disposal; acetone replacement systems; vendor managed inventory; regulatory consulting; bulk and package delivery

Assets: Eight full service locations; 55 trucks; 150 trailers; 250 bulk tanks; 55 blend tanks

Colonial Chemical Solutions

2019 Sales: $225.2m

Savannah, Georgia, US

[*www.colonialchemicals.com*](http://www.colonialchemicals.com)

Vice president: Rob Roberts

Products: Full line of organics and inorganics; aromatics; aliphatics; alcohols; acids; chlor-alkali; oleochemicals and specialty chemicals; methanol; heptane; caustic soda; glycerine; antioxidants

Services: Global sourcing; re-packaging; custom blending; just-in-time inventory

Assets: Six rail-served warehouses; multiple bulk tanks; truck and rail fleet; blend tanks

Trading sales: 20%

HSH Chemie

2019 Sales: $224.5m (200m)

Hamburg, Germany

[*www.hsh-chemie.com*](http://www.hsh-chemie.com)

CEOs: Stephan P Lohden, Frank Raabe, Stefan Rather

Products: Specialty chemicals for coatings, adhesives and building, personal and home care, food, feed and pharma, plastics and rubber, and industrial performance applications

Services: Technical consultancy; formulation advice; storage and logistics; sampling; financing; full compliance support; full marketing support

Assets: 12 sales office locations in Central and Eastern Europe

Trading sales: 10%

United Trading System UTS/ETC

2019 Sales: $218m

St Petersburg, Russia (UTS Purchasing HQ ...storp Sweden)

[*www.utsrus.com*](http://www.utsrus.com)

Managing Director UTS: Lars Hjorth; Managing Director ETC: Andrey Shkola

Products: Paint & coating chemicals; dry mixture & construction chemicals; plastics and polymer additives; rubber chemicals; resins and chemicals for composites; fibres; chemicals for detergents; cosmetics and household chemicals; oil & oilfield, lubricants and refinery additives & chemicals; food additives; specialties and chemicals of general application; pharmaceutical raw materials; ***agricultural*** chemistry

Services: Storage; mixing/blending; laboratories; tech support; developing certification

Assets: 13 offices and 14 warehouses; 40,000m2 of warehousing; 14,000m2 office space; 7 laboratories; 500 employees

Trading sales: 0%

Donauchem

2019 Sales: $215.6m (192m)

Vienna, Austria

[*www.donauchem.com*](http://www.donauchem.com)

Board member: Bogdan Banaszczyk

Products: Commodities and specialty chemicals used in food, pharmaceuticals, paint and construction, cosmetics and detergents, metals, printing, water treatment; customer specific compositions

Services: Mixing; blending; environmentally friendly consultancy and planning; technical consultancy; training sessions on safety and the law; waste disposal; consultancy on chemical law and REACH

Asstes: 12 warehouses

Trading sales: 20%

Bandeirante Quimica

2019 Sales: $213.8m

Sao Paulo, Brazil

[*www.bbquimica.com.br*](http://www.bbquimica.com.br)

CEO: Carlos Eduardo Marin

Products: Aromatics; aliphatic solvents; oxygenated solvents; ethanolamines; titanium dioxide (TiO2); surfactants; specialty resins; carbon black; tailor-made blends; UV monomers/oligomers; household and personal care chemicals; silicas; amines; ***agricultural*** chemicals; epoxy resins; glycols; mining chemicals

Services: Blending; agency sales (indent sales); formulation; technical assistance; storage; packaging

Assets: 6 branches; 95 tanks; 3 warehouses; truck fleet; 2 laboratories; 2,500 intermediate bulk containers (IBCs)

Echemi Group

2019 Sales: $211.6m

Hong Kong, China

[*www.echemi.com*](http://www.echemi.com)

CEO: David Zhang

Products: Food additives; pharmaceutical intermediates; paint and coating materials; rubber and plastic additives; fine chemicals

Services: Raw materials supply; research and analysis; marketing; logistics; warehousing after-sales services; e-commerce

Assets: 7 worldwide operations centres; 2 warehouses; 1 factory

Trading sales: 10%

Solventis

2019 Sales: $209.5m (186.6m)

Guildford, Surrey, UK

[*www.solventis.net*](http://www.solventis.net)

CEO: David Lubbock; Managing director: Nick Johnson

Products: Antifreeze; alcohols; brake fluids; esters; glycols; ketones; propylene glycols; deicers

Services: Blending; drumming

Assets: Storage and blending facilities in Antwerp, Belgium and UK

Grupo RNM

2019 Sales: $205.3m

Famalicao, Portugal

[*www.grupornm.pt*](http://www.grupornm.pt)

CEO: Ricardo Machado

Products: Caustic soda; hydrogen peroxide; sulphuric acid; hydrochloric acid; sodium hypochlorite; plastics (PE, PP, PVC, PS, PET, EVA); solvents; specialties; glycols; propylene glycol; glycol ethers; surfactants; silicones; methanol; epoxy resins; inorganics; specialty chemicals; sulfonic acid, SLES

Services: Storage of liquid and packed products; blending; standard and tailor-made packaging; stock control and telemetry; logistics operations consulting

Assets: Logistics complex at the Famalicao, Santo Tirso, Madrid, Valencia, Vigo, Cartagena, Lisboa with 65,000 square metres, with capacity for 40,000 tonnes of packed products and 8,000 cubic metres of liquids in 45 tanks; 5 tank terminals for liquids with 42,000 cubic metres and packed solids; own fleet of 55 trucks; 50 cisterns; 6 semi-trailers; 65 stainless steel isotainers of 26 cubic metres

Trading sales: 10%

Marubeni Specialty Chemicals

2019 Sales: $205.3m

White Plains, New York, US

[*www.marubenisci.com*](http://www.marubenisci.com)

President: Hidehiko Yoshida

Products: Industrial chemicals; specialty chemicals; paper chemicals; construction chemicals; cement additives; solvents; adhesives; plastics; food and beverage ingredients; feed and pharmaceutical ingredients; agrochemicals

Trading sales: 10%

ChemPartners

2019 Sales: $202.2m

Moscow, Russia

[*www.propartners.ru*](http://www.propartners.ru)

CEOs: Gaurav Sood, Constantin Rzaev

Products: Plastics; polyolefins; recycled polymers; processing additives; solvents; polyurethanes, MCAA; disinfection chemicals; pulp and paper chemicals; animal feed; water treatment chemicals; synthetic fibres; food and beverage ingredients; oilfield chemicals; fine chemicals; flexible packaging; chemicals for crude transportation; rubber chemicals, mining chemicals; paint and construction chemicals

Services: Blending; packaging; vendor managed inventory; contract manufacturing; international and local logistics; sourcing; surveying; market research; studying centre; zero waste services

Assets: 24 warehouses (rented); 1 office space (owned) E Trading sales: 15%

ChemGroup

2019 Sales: $200m

Cincinnati, Ohio, US

[*www.chemgroup.com*](http://www.chemgroup.com)

President: Marty Wehr

Products: Acids; alkalis; hydrogen peroxide; sodium hypochlorite; solvents and intermediates; glycols; glycol ethers; amines; surfactants; alcohols; water treatment chemicals; nitrogen products; white oils; borates; lime; specialty chemicals; gas-to-liquids (GTL) fluids and solvents

Services: Chemical and inventory management; blending; warehousing; technical and safety training; customised billing

Assets: 10 warehouses with over 450,000 square feet, over 2m gal bulk storage; 28 tractors; 18 straight trucks; 38 trailers; 12 tankers

K-Solv Group

2019 Sales: $200m

Houston, Texas, US

[*www.ksolv.com*](http://www.ksolv.com)

CEO/owner Russell Allen

Products: Aliphatic solvents; aromatic solvents; alcohols; glycols; glycol ethers; acetates; chlorinated solvents; ketones; base oils; white oils; acids

Services: Chemical distribution; chemical packaging; chemical blending; chemical laboratory; maritime services; emergency spill response; disaster response; hazmat response; industrial services; waste management; transportation

Assets: Texas: tote and drum warehouse tank farm; flare; nitrogen access; dock; Louisiana: distribution warehouse

WWRC Holding

2019 Sales: $200m

Singapore

CEO: Teoh Weng Chai

Products: Resins/intermediates; additives/catalysts; pigments/fillers/extenders; other chemicals/solvents; grinding media

Services: Technical service; storage

Assets: 8 warehouses

Gamma Chimica

2019 Sales: $194.8m

Lainate, Milan, Italy

[*www.gammachimica.it*](http://www.gammachimica.it)

President: Giuseppe Mearini

Products: Glycols; ethanolamines; fatty acids; intermediates; solvents; antifreeze; glycerines; sequestering agents

Services: Storage; packaging; blending; antifreeze production

Assets: Head office; warehouse of 54,000 square metres (15,000 covered)

Special Materials Company

2019 Sales: $194m

New York, NY, US

[*www.smc-global.com*](http://www.smc-global.com)

CEO: Adam Feldman

Products: Specialty solvents; paints and coatings additives; oilfield chemicals; phosphorus derivatives; water treatment chemicals; biocides; friction reducers; electronic chemicals; mining chemicals; flame retardants; textile additives; photo imaging chemicals; PCBTF; sodium hypophosphite; glutaraldehyde; scale and corrosion inhibitors

Services: Custom blending; relabelling; solution adjustments; neutralisation reactions; conversions; dilutions; storage; warehousing; bulk storage; consignment inventory; just-in-time delivery; 3rd party warehousing; technical sales and support; regulatory affairs expertise

Assets: 5 global production sites; 15 warehouses; truck fleet of 30 trucks - both bulk tankers and dry vans

Bang & Bonsomer

2019 Sales: $193.1m (172m)

Helsinki, Finland

[*www.bangbonsomer.com*](http://www.bangbonsomer.com)

CEO: Mikko Teittinen

Products: Specialty raw materials, additives and material technology solutions for coatings and construction, food, personal and home care, polymers and packaging, composites and polyurethanes

Services: Process chemistry solutions with engineering, remote control and digitalisation; manufacturing of industry intermediate products and functional blends; application laboratory services; R&D and formulations; blending; dissolving; packaging; warehousing; logistics

Assets: R&D centre; 8 application laboratories and technical centres; 6 manufacturing sites; 15 warehouses

Thommen-Furler

2019 Sales: $190.9m (170m)

Ruti bei Buren, Switzerland

[*www.thommen-furler.ch*](http://www.thommen-furler.ch)

CEO: Franz Christ

Products: Industrial chemicals (inorganics, organics, liquids and solids); ethanol; hygiene and surface cleaning products; activated carbon; intermediates; plasticizers; high purity solvents and reagents; electronic grade chemicals; industrial and automotive lubricants; marine and aviation lubricants; automotive fluids; car care products; AdBlue; wastewater treatment chemicals and installations

Services: Storage; blending; mixing; packaging; laboratory services; quality and control tests; hazardous waste management; tank farm management by telemetry

Assets: 7 dedicated sites for chemicals and hazardous waste handling; tank farms and warehouses for chemicals and hazardous waste; blending, mixing and filling installations; waste treatment installations; 57 road tankers and trucks for general cargo; 114 tank wagons and tank containers

Metafrax Trading International

2019 Sales: $184.1m (164m)

Lugano, Switzerland

[*www.metafraxtrading.com*](http://www.metafraxtrading.com)

Executive director: Marina Sivkova

Products: Methanol; hexamine; pentaerythritol and dipentaerythritol (including micronised grades); melamine; paraformaldehyde; phthalic anhydride

Services: Storage of liquid and solid chemicals; trans-shipment; blending; toll manufacturing; warehousing; packaging; deliveries by vessel, rail, container, truck and silo-truck

Assets: Head office in Switzerland; branch office in Austria; 2 manufacturing/warehousing sites in Russia, one in Austria; third-party warehouses in Netherlands, Poland, Russia, Spain and the US

Trading sales: 10%

Selectchemie

2019 Sales: $175m

Zurich, Switzerland

[*www.selectchemie.ch*](http://www.selectchemie.ch)

CEO: Peter Kaufmann

Products: FDF (finished dosage forms, medicine); generics; pharmaceutical active substances (APIs) and excipients; nutritional ingredients

Services: Regulatory support; development of generic dossiers; storage; lab trials

Assets: 3 warehouses (Hamburg, Germany; Zurich, Eiken Switzerand)

Trading sales: 5%

Barton Solvents

2019 Sales: $173.2m

Des Moines, Iowa US

[*www.barsol.com*](http://www.barsol.com)

President: David M Casten

Products: Aliphatics; aromatics; alcohols; glycol ethers; acetates; ketones; glycols; epoxy resins; surfactants; distilled spirits; specialty chemicals; USP/NF pharmaceutical ingredients; oils; lubricants

Services: Custom packaging; custom blending; delivery to customer or job site; waste services; laboratory services

Assets: 7 stocking locations; delivery fleet of 84 power units and 149 trailers

Transmare Chemie

2019 Sales: $171.8m (153m)

Antwerp, Belgium

[*www.transmare.com*](http://www.transmare.com),   [*www.transmare-chemie.com*](http://www.transmare-chemie.com)

CEO: Patrick Van Ende

Products: Chemicals and blends for the oil and gas industry; fine chemicals for health, personal care and home care as well as food and feed applications; industrial and high purity solvents; chemicals and pigments for paints and adhesives; reference fuels; plastics additives

Services: Personalised blends and formulation support; drumming and packaging

Assets: Class 2 storage facilities; 11 warehouses (Antwerp, Hamburg, Singapore, Malaysia, Algeria, Angola, Ivory Coast, Nigeria, Kenya)

Trading sales: 50%

Haeffner

2019 Sales: $170m

Asperg, Stuttgart, Germany

[*www.hugohaeffner.com*](http://www.hugohaeffner.com)

CEOs: Juergen Martin, Thomas Dassler

Products: Water treatment chemicals; paint, ink, coating, adhesive and resin additives; paint, textile and leather auxiliaries; food additives; feed additives; metal treatment chemicals; household and personal care ingredients; lubricant additives

Services: Mixing, blending and formulating; repackaging; contract packaging, warehousing of hazardous goods; just-in-time-delivery; application advice by highly skilled technical sales team; single sourcingAssets: 6 warehouse facilities across Europe with tank farm for acids/lyes/solvents and Hazard Analysis and Critical Control Points (HACCP) filling and blending area; 1 laboratory; 30 trucks

Trading sales: 10%

2M Holdings

2019 Sales: $170.0m (£127.9m)

Runcorn, UK

[*www.2m-holdings.com*](http://www.2m-holdings.com)

MBE: Mottie Kessler

Products: Triklone, Perklone and MEC Prime; SamSol; chlorine gas (cylinders and drums) for water treatment and chemical synthesis; surfactants/rheology modifiers; AdBlue; aerospace approved products; anti-corrosive environment friendly pigrments; oilfield chemicals; specialty personal care and cosmetics ingredients; hydrocarbons and oxygenated solvents; homecare and I&I ingredients; pharmaceutical excipients and APIs; precision cleaning solutions; Cool-Phos and Vaposol; phosphating (metal pre-treatment) chemicals

Services: Blending; packaging; storage; formulation and technical support with laboratory facilities; sample management; technical, regulatory and legislative expertise; toll blending; water treatment; pigment dispersion, development and formulation

Assets: Application laboratories; warehousing in UK, Poland, Brazil, Nordics, Benelux; own trucks

NORTEX

2019 Sales: $162.4m

Moscow, Russia

[*www.nortex-chem.ru*](http://www.nortex-chem.ru)

CEO: Vladimir Yakushin

Products: Isocyanates; polyols; epoxy resins; hardeners; synthetic rubber; natural rubber; phenolic resins; engineering plastics; polyolefins; polyester resins; synthetic fiber; PVC resins; plasticizers; antioxidants; titanium dioxide

Services: Storage; packaging; drumming; logistics

Assets: 6 offices; 12 warehouses; 3 trucks

Trading sales: 20%

The Plaza Group

2019 Sales: $162m

Houston, Texas, US

[*www.theplazagrp.com*](http://www.theplazagrp.com)

President: Randy Velarde

Products: Solvents; intermediates; elastomers; styrenics; polyethylenes; ag chemicals; lignosulfonates

Services: Marketing; logistics; storage

Asstes: 1 warehouse; 1 bulk storage tank; 101 railcars

Atlantic Chemicals Trading

2019 Sales: $157.2m (140m)

Hamburg, Germany

[*www.act.de*](http://www.act.de)

CEO: Ramin Ghaffari

Products: Vitamins; amino acids; sweeteners; energy ingredients; sports nutrition ingredients; preservatives; acidifiers; flavours and fragrances; plant extracts; feed additives; food additives; natural products

Services: Customising; global supply chain; storage

Assets: 13 offices worldwide; several warehouses worldwide

Trading sales: 10%

Harke Group

2019 Sales: $154.7m (137.8m)

Muelheim an der Ruhr, Germany

[*www.harke.com*](http://www.harke.com)

President: Thorsten Harke

Products: Home care and I&I chemicals; coatings; electronics/high purity chemicals; food ingredients; health and functional food ingredients; industrial chemicals; cosmetics/personal care ingredients; pharmaceutical excipients; plastics; rubber chemicals; specialty plastic films; specialty chemicals; polymers; water-soluble films; water treatment chemicals

Services: Reformulation; product development; regulatory advice; blending; mixing; contract encapsulation; contract packaging; refilling; sandblast gravure; pre-printAssets: Warehouses in different European countries; 2 production sites (Germany, Hungary); 10 packaging and encapsulation lines; filling stations

Trading sales: 10%

Grolman Group

2019 Sales: $153.8m (137m)

Neuss, Germany

[*www.grolman-group.com*](http://www.grolman-group.com)

Managing partners: Dirk Grolman, Florian Grolman; managing director: Mike Dorsam

Products: Pigments and dyes; mineral fillers and performance materials; binders; additives; actives and intermediates

Services: Formulation and testing

Assets: Laboratories; warehouses

ELTON Group

2019 Sales: $149.3m (133m)

Athens, Greece

[*www.elton-group.com*](http://www.elton-group.com)

CEO: Nestor Papathanasiou

Products: Industrial raw materials and specialties for coatings, adhesives, construction, detergents, cosmetics, pharmaceuticals, food, feed, beverages, water treatment, metal treatment, PU systems, textiles, paper, agrochemicals, rubber, plastics, refrigerants

Services: Local warehousing; full coverage of Greece, Bulgaria, Romania, Serbia, Turkey, Kosovo, Albania, North Macedonia, Cyprus and Ukraine markets; technical promotion and business development; inventory management

Assets: 9 warehouses (four privately owned); 2 laboratories; privately owned trucks and tank trucks

Keyser & Mackay

2019 Sales: $141.5m (126m)

Amsterdam, Netherlands

[*www.keysermackay.com*](http://www.keysermackay.com)

Managing partners: Gerard de Waal, Willem Augustinus

Products: Specialty chemicals; raw materials for coatings, inks, plastics, rubber, adhesives, sealants, construction, personal care, food, feed, pharmaceuticals

Services: Technical sales and marketing; local and central stockholding; sampling

Assets: Offices and warehouses in 7 European countries

Trading sales: Less than 5%

Rahn Group

2019 Sales: $137m

Zurich, Switzerland

[*www.rahn-group.com*](http://www.rahn-group.com)

CEO: Marcel Gatti

Products: Raw materials for inks, coatings and adhesives; personal care ingredients; flavours, fragrances and food ingredients

Services: Application support; R&D/customised products; regulatory affairs; guide formulations; international logistics; analytics

Trading sales: 50%

URAI

2019 Sales: $135m (120.25m)

Assago, Milano, Italy

[*www.urai.it*](http://www.urai.it)

President & CEO: Roberto Giuliani

Products: Specialty chemicals; pigments; additives; resins; paints and coatings chemicals; plastic and rubber chemicals; lubricant chemicals; personal care and cosmetics ingredients; food ingredients; laboratory equipment

Services: Technical sales and marketing; application development; quality; warehousing; regulatory services; supply chain management; after sales services; repacking; blending

Assets: 1 external warehouse

Trading sales: 0%

Bodo Moller Chemie

2019 Sales: $132.9m (118.4m)

Offenbach am Main, Germany

[*www.bm-chemie.com*](http://www.bm-chemie.com)

Chairman and managing director: Frank Haug

Products: Adhesives and bonding systems (epoxy, polyurethane, MMA, hotmelts); sealants; silicones; resins (basic, epoxy, alkyd, acrylic); casting and potting resins for electronics (polyurethane, epoxy and silicone based); hardeners and curing agents; composites (resins, gelcoats, reinforcements); mould-making materials (boards, pastes, casting resins); additives for coatings (pigments, light stabilisers, dispersing agents, thickeners); additives for plastics and rubber (pigments, stabilisers, masterbatches, stearates); additives for lubricants (corrosion protection, antioxidants, metal deactivators); chemicals and dyes for textiles; packaging and labelling adhesives

Services: Packaging; filling; testing; modification; blending and formulating; education and training

Assets: Application labs for adhesives, coatings and textile chemistry; headquarters in Germany; affiliates in Europe, Africa, Asia and US; local warehouses; production plant for polymer formulations

BARCELONESA DE DROGAS Y PRODUCTOS QUIMICOS

2019 Sales: $132.5m (118m)

Barcelona, Spain

[*www.grupbarcelonesa.com*](http://www.grupbarcelonesa.com)

CEOs: Enric Collell, Albert Collell

Products: Formulated blends for food and feed; agrochemicals; oilfield chemicals; mining chemicals; resins, curing agents and composites; metal-working formulations; chemicals for detergent, disinfection, home Care, personal care and pharmaceuticals; textile and leather chemicals; chemicals for coatings, inks, adhesives, construction, lubricants and paper; pool chemicals; water and waste treatment chemicals; polyols and polyurethanes; chlor-alkalis; acids and bases; metallic salts; solvents, amines and glycols

Services: Blending and formulating; custom and toll manufacturing; contract manufacturing; labelling and drumming; packaging; technical and environmental assistance; VMI (telemetry); agency services; bond warehousing for third parties; full logistics services including hazmat

Assets: 8 warehouses with palletised storage capacity: 70,000 square metres = 56,000 pallets, located in southwest Europe and northern Africa; distribution and sea tanks: 17.000 cubic metres; trucks; 80 people located in southwest Europe, northern Africa, Latin America and China; commercial agents in Turkey, Jordan, Iraq, India, Indonesia, Vietnam, China

Trading sales: 20%

Pride Chemical Solutions

2019 Sales: $126m

Holtsville, New York, US

[*www.pridesol.com*](http://www.pridesol.com)

President: Arthur Dhom Jr

Products: Alcohols; amines; esters; glycols; glycol ethers; hydrocarbons; ketones; mineral oils; petrolatum; polyols; oleochemicals; plasticizers; silicones; stearates; surfactants

Services: Blending; packaging; storage; NF USP Kosher repackaging; RSPO repackaging; ethyl alcohol denaturing and packaging

Assets: 3 warehouses; 12 tractor trailers; 5 straight trucks; 25 tank wagons; 400,000 gal tank farm

Faravelli

2019 Sales: $125.9m (112.2m)

Milan, Italy

[*www.faravelligroup.com*](http://www.faravelligroup.com)

CEO: Luca Benati

Products: Chemicals and raw materials for food, pharmaceutical, nutraceutical, cosmetic and various industrial applications

Services: Logistics and storage; regulatory support; formulation support through our labs; blending; repackaging

Assets: 1 plant; 2 labs; 10 warehouses

Trading sales: 25%

Arpadis Benelux

2019 Sales: $125.7m (112m)

Antwerp, Belgium

[*www.arpadis.com*](http://www.arpadis.com)

CEO: Laurent Abergel

Products: Polyurethanes; acrylates and monomers; solvents; glycols; adipic acid; HMD; specialty acrylates

Services: Drumming; blending; storage and transport through our third party partners

Tillmanns

2019 Sales: $125.7m (112m)

Milan, Italy

[*www.tillmanns.it*](http://www.tillmanns.it)

CEO: Stefan Vollmer

Products: Organic and inorganic pigments; binders; resins; waxes; preservatives; specialty chemicals and additives for coatings; plastics; adhesives and construction chemicals; specialty chemicals for the water treatment; functional additives and ingredients for food and feed; specialty casings

Services: Marketing; product formulation and blending; custom packaging; product evaluation in own laboratory; technical support team; green chemistry product solutions; warehousing and supply chain management; vendor managed inventory; fire class 4.1 category for storage of highly flammable products

Assets: 2 company owned and operated warehouses with total capacity of 45,000 tonnes; 2 laboratories; own truck fleet

Afriglobal Commodities

2019 Sales: $124.8m

Dubai, UAE

[*www.afriglobalonline.com*](http://www.afriglobalonline.com)

CEO: Maneesh Garg

Products: Polyurethane chemicals; paint chemicals; cosmetics chemicals; basic chemicals for detergent and food; TDI; polyols; methylene chloride; titanium dioxide; styrene acrylates; petroleum jelly; white oil; caustic soda; soda ash dense; lube additives; corn starch; liquid glucose

Services: Supply chain services

Assets: 3 offices; 5 large warehouses; 27 Trucks

Trading sales: 100%

CSC Jaecklechemie

2019 Sales: $124.8m (111.2m)

Nuremberg, Germany

[*www.csc-jaekle.de*](http://www.csc-jaekle.de)

CEOs: Robert Spath, Michael Spehr, Bernhard Schmid

Products: Industrial chemicals; acids; alkaline solutions; solvents; solids; specialties; coatings, adhesives and sealants (CASE) raw materials; high quality industrial parts cleaning chemicals; life science chemicals; water and environment chemicals

Services: Technical expertise and field service; warehouse and direct distribution; inventory management; blending and repackaging; proper disposal of chemical wastes; worldwide shipment; trucking

Assets: 2 storing, filling and trans-shipment sites; warehouse; 2 laboratories for quality assurance; 6 tank wagons for chemicals; 13 trucks; 26 company vehicles

IMPAG

2019 Sales: $123.5m (110m)

Zurich, Switzerland

[*www.impag.com*](http://www.impag.com),   [*www.impag.ch*](http://www.impag.ch)

CEO: Remo Bernardi

Products: Coatings additives; anhydrides; acrylates; polyols; flame retardants; polyurethanes; green solvents; detergents; base chemicals; cosmetic functionals and active ingredients; food ingredients; pharmaceutical/APIs; oleochemicals; metal treatment chemicals

Services: Global logistics; global sourcing; storage; technical support; regulatory support; financing; packaging

Assets: 6 sales offices across Europe; 1 tank farm for liquid goods; filling line for chemicals; own application lab

Trading sales: 20%

ProChema

2019 Sales: $122m

Vienna, Austria

[*www.prochema.com*](http://www.prochema.com)

President: Werner Figlhuber

Products: Additives and hardeners; acrylates and methacrylates; binders and resins; monomers; organic acids; polymers; polyurethane feedstocks; reactive diluents; UV curing monomers

Services: Pan-European sales network; market research; sales; financing; storage; supply chain management

Assets: 13 sites in Europe and Asia

Trading sales: 25%

Algol Chemicals

2019 Sales: $118.1m (105.2m)

Espoo, Finland

[*www.algolchemicals.com*](http://www.algolchemicals.com)

Managing director: Fredrik Hansson

Products: Base chemicals; coatings chemicals; construction additives; polymer additives; emission control materials; food and feed ingredients and additives; metal treatment chemicals; mining chemicals; pharma industry auxiliaries; personal care ingredients; detergent ingredients; soil remediation products; water treatment chemicals; transportation chemicals

Services: Blending; packaging; storage; logistics; HSEQ consulting; procurement; supply management

Assets: 21 warehouses; 2 blending and packaging lines

QUIMDIS

2019 Sales: $114.2m (101.7m)

Levallois-Perret, France[*www.quimdis.com*](http://www.quimdis.com)

President: Jean-Francois Quarre

Products: Food and feed ingredients/supplements; pharmaceuticals and veterinary APIs; cosmetics ingredients; essential oils; aroma chemicals

Services: Blending oils; compounding; sourcing

Assets: Headquarters in Paris area; factory in Grasse, France; 2 warehouses

Trading sales: 67%

Tilley Chemical

2019 Sales: $113.2m

Baltimore, Maryland, US

[*www.tilleychem.com*](http://www.tilleychem.com)

President: John Tilley

Products: Food ingredients; pharmaceutical ingredients; personal care ingredients; HI&I chemicals; ethanol

Services: Blending; packaging; product formulation

Assets: 4 warehouses; 28 tank trucks; 15 box trucks; 10 straight trucks

Penpet Petrochemical Trading

2019 Sales: $112.8m (100.5m)

Hamburg, Germany

[*www.penpet.com*](http://www.penpet.com)

General managers: Tim Meister, Christoph Meister

Products: Oxo-alcohols; melamine; solvents; plasticizers

Services: Blending; packaging; storage

Assets: 2 warehouses

Trading sales: 25%

Unipex

2019 Sales: $111.8m (99.6m)

Paris, France

[*www.unipex.com*](http://www.unipex.com)

President: Patrice Barthelmes

Products: Active & functional personal care ingredients; active pharmaceutical ingredients (APIs) and excipients; enzymes; amino acids; lactose;sweeteners; sugar; starch; fibres; plasticizers; surfactants; additives; silicones; titanium dioxide (TiO2); dyes and pigments; sports grounds polymers and resins

Services: CSR (Corporate Social Responsibility); warehousing; application labs; formulations; regulatory services; auditing; reconditioning

Assets: 2 owned warehouses in the Paris area

Trading sales: 6%

Essential Ingredients

2019 Sales: $111.6m

Atlanta, Georgia, US

[*www.essentialingredients.com*](http://www.essentialingredients.com)

CEO: Kris Maynard

Products: Personal care ingredients; home care chemicals; industrial and institutional chemicals; pet care ingredients

Services: R&D solutions; product development; technical support; dedicated customer service representatives; blending; repackaging; logistics solutions; regulatory team; sample inventory; multi-language personnel

Assets: 8 total distribution locations throughout the US and Canada (7 in US, 1 in Canada)

Taj Al Mulook General Trading

2019 Sales: $110.4m

Dubai, UAE

[*www.tajchem.com*](http://www.tajchem.com)

CEO and chairman: Irfan Siddique Mulla

Products: Polyurethane chemicals (TDI, MDI, polyols); lubricant additives (PPD, TBM, ZDDP, base oils); paints, inks and coatings; construction chemicals; oil and gas chemicas; solvents; PU machinery; fabrics

Services: Blending; repackaging; local warehousing; technical support; supply chain management; just-in-time delivery; inventory management

Assets: Extensive marketing network in GCC and Africa; 3 warehouses in UAE; 3 warehouses in Saudi Arabia

Trading sales: 40%

Neo Chemical

2019 Sales: $109.2m (97.3m)

Dzerzhinsk/Moscow, Russia

[*www.neochemical.ru*](http://www.neochemical.ru)

CEO Andrey Lipovetskiy, Director Vladimir Fedyushkin

Products: Epoxy resins, titanium dioxide, peroxide compounds, oil additives, food chemistry, polyisobutylenes, silanes, hardeners, solvents, fuel additives, flame retardants, base oils, hexene 1, raw materials for cosmetics and household chemicals

Assets: Packaging, storage, shipping, wholesale warehouse

Trading sales: 50.91%

Sea-Land Chemical

2019 Sales: $108.4m

Westlake, Ohio, US

[*www.sealandchem.com*](http://www.sealandchem.com)

President: Jennifer Altstadt

Products: Acids; amines; antioxidants; biocides; chlorinated paraffins; corrosion inhibitors; defoamers; dispersants; esters, emulsifiers; ethoxylated alcohols; fatty acids; foam control agents; industrial and transportation lubricant additive components; lubricity additives; polyalphaolefins; primary amino alcohols; natural petroleum sulfonates; surfactants; vegetable and animal oils

Services: Stocking; packaging and repackaging; product sourcing; market development; technical expertise; lubricant testing; logistics; small package to bulk deliveries; ISO9001:2015 standards; regulatory support

Assets: 10 warehouse locations in North America and Europe; 6 repackaging facilities; 1 testing laboratory

ADEKA POLYMER ADDITIVES EUROPE

2019 Sales: $107.0m (95.3m)

Mulhouse, France

[*www.adeka-pa.eu*](http://www.adeka-pa.eu)

CEO: Tsuyoshi Urushihara

Products: Polymer additives

Services: Masterbatching

Trading sales: 60%

ClearTech Industries

2019 Sales: $107m

Saskatoon, Saskatchewan, Canada

[*www.cleartech.ca*](http://www.cleartech.ca)

President: Randy Bracewell

Products: Water treatment chemicals; caustic soda; hydrochloric acid; chlorine; sodium hypochlorite; coagulants; flocculants; acids; alkalis; sulfites; defoamers; activated carbon; phosphates; surfactants; chemical feed systems

Services: Blending; packaging

Assets: 10 buildings in 7 cities across Canada

H.M. Royal

2019 Sales: $106.2m

Trenton, New Jersey, US

[*www.hmroyal.com*](http://www.hmroyal.com)

President: Joseph E Royal

Products: Kevlar aramid pulp; polymers (EPDM, SBR, FKM); silicones (LSR, HCR, RTV); rubber to substrate bonding adhesives; flame retardants (halogen and non-halogen); peroxides; resins (hydrocarbon and phenolic); precipitated calcium carbonate; precipitated silica; zinc oxide; lightweight fillers; carbon black; kaolin clay; calcium carbonate; talc; fumed silica

Services: Marketing; order fulfillment; storage; domestic and international logistics

Trading sales: 6.5%

C.H. Erbsloeh Group

2019 Sales: $103.3m (92m)

Krefeld, Germany

[*www.cherbsloeh.com*](http://www.cherbsloeh.com)

CEO: Christopher Erbsloeh

Products: Specialty chemicals for coatings, adhesives, construction, lubricants, pharmaceuticals, cosmetics, personal- and home care, rubber, plastics, electronics, water treatment, food and beverage

Services: Technical sales and marketing; application development; analytical testing and quality control; warehousing; regulatory services; supply chain management; after-sales services

Assets: 11 office locations; application and quality control laboratories; fully owned and operated warehousing and tank farm

Noahs Ark Chemicals

2019 Sales: $103.3m (92m)

London, UK

[*www.noahsark.eu.com*](http://www.noahsark.eu.com)

CEO: Bharat Bhardwaj

Products: Solvents; glycols; styrene; benzene; acrylates

Services: Blending; storage

Trading sales: 30%

PHT International

2019 Sales: $102.2m

Charlotte, North Carolina, US

[*www.phtinternational.com*](http://www.phtinternational.com)

President and Owner: Lihong Yu

Products: Pharmaceuticals; agrochemicals; consumables; electronic chemicals; personal care ingredients; fibers

Services: Custom manufacturing; in-house chemical development; quality control and regulatory support; strategic sourcing; logistics; sales; marketing; sample generation; contract research organisation; import/export services in the US and China

Assets: 100% owned Sancus Arc BioChem manufacturing facility

Harwick Standard Distribution

2019 Sales: $101.9m

Akron, Ohio, US

[*www.harwick.com*](http://www.harwick.com)

CEO: Ernest E Pouttu

Products: Polymers; rubber chemicals; plasticizers; process oils; flame retardants; activators; chemical and color dispersions; processing aids; organic peroxides; resins; vulcanising agents; colorants; adhesives; stabilisers; dry liquid concentrates

Services: Warehousing; bulk break; logistics; storage; import; export; technical support; regulatory support

Assets: 2 company owned and operated warehouses; 7 public warehouses; 1 truck

The Chemical Company

2019 Sales: $98.2m

Jamestown, Rhode Island, US

[*www.thechemco.com*](http://www.thechemco.com)

CEO: Robert N Roach, Jr; President: Robert N Roach IIIProducts: Polymer additives; coatings, adhesives, sealants and elastomers (CASE); flame retardants; silanes; water treatment chemicals; intermediates; acids

Services: Global procurement; packaging; imports; international customs management: EH&S; logistics and rail fleet management

Assets: Global network comprised of 41 sites; Regional offices in California, US / Colombia / Mexico City, Mexico and Nanjing, China; 10 storage facilities and 14 railcars; global warehouses; shore tanks

Staub & Co – Silbermann

2019 Sales: $96.6m (86m)

Nuremberg, Germany

[*www.staub-silbermann.de*](http://www.staub-silbermann.de)

Managing directors: Andreas Frank, Peter Stockmeier

Products: Industrial and specialty chemicals; acids and lyes; solvents; solid chemicals; cleaning agents; products for food/feed/pharma/cosmetics; water treatment chemicals; thermal transfer agents; ammonium; AdBlue

Services: Storage; mixing; blending; filling; packaging; polymerisation

Assets: 2 warehouses; 17 trucks

Trading sales: 30%

Extruplast

2019 Sales: $94.3m (84m)

La Rochelle, France

[*www.extruplast.net*](http://www.extruplast.net)

CEO: Dondainas Gilles

Products: Heating fluid; screen washes; engine coolants; gasoline; motor oil; solvents

Services: Packaging; blending; storage; recycling

Assets: Atex filling machine; blowmolding assets

Trading sales: 1%

Union Petrochemical Public Co.

2019 Sales: $94m

Bangkok, Thailand

[*www.unionpetrochemical.com*](http://www.unionpetrochemical.com)

Managing director: Perapol Suwannapasri

Products: Alcohols; aromatics; esters; glycols; gylcol ethers; ketones; monomers; PP and PE

Services: Blending; packaging; repackaging; storage; delivery and inventory management

Assets: 5 warehouses and 30 trucks

Chemsolv

2019 Sales: $92m

Roanoke, Virginia, US

[*www.chemsolv.com*](http://www.chemsolv.com)

CEO: L Glenn Austin

Products: Acetals solvents; aromatics/aliphatics; isoparaffins; alcohols; ketones; esters; glycols; heat transfer fluids; glycol ethers; pyrrolidones; thinner blends; acrylics; lacquers; enamels; flexo ink solvents; amines; ethanolamines; plasticizers; surfactants; acrylates; silicones; surfactants; metal-working fluids; oils; process oils and lubricants; phosphates; caustic soda; caustic potash; acids; HP lab reagents; biocides; quats; industrial and FG cleaners; diesel exhaust fluid

Services: Solvent formulating and blending; solvent distillation and purification; laboratory services; consulting; product safety and environmental; rail terminal service

Assets: 6 warehouses; 40 trucks; 50 trailers; 1.3m gal bulk storage

KALE KIMYA

2019 Sales: $92m

Kocaeli, Turkey

[*www.kalekimya.com*](http://www.kalekimya.com)

CEO: Birgen Kaleagasi

Products: Detergent additives; disinfectant and protection chemicals; emulsifiers; polymers; surfactants; pool chemicals; actives and antioxidants; paints; oils and esters; conditioners; protectives; perfume; silicones; UV filters; fatty alcohols; adhesives

Services: Storage; transport; production; blending; packaging

Assets: 5 warehouses; 4 trucks; 1 production facility; total 35,000 square metres storage; 1,000 tonnes bulk storage

Trading sales: 30%

Meade-King, Robinson & Co

2019 Sales: $92.0m (£69.3m)

Liverpool, UK

[*www.mkr.co.uk*](http://www.mkr.co.uk)

Managing director: Philip Tarleton

Products: Oleochemicals; waxes; glycerine; epoxy resins; castor oil; malic acid

Services: Storage; blending; repackaging; warehousing

Assets: 3 warehouses

Trading sales: 15%

Tanner Industries

2019 Sales: $90m

Southampton, PA, US

[*www.tannerind.com*](http://www.tannerind.com)

President and CEO: Stephen Brad Tanner

Products: Anhydrous and aqua ammonia

Services: Safety training; storage tanks; pump-out services; storage tank repairs and maintenance

Assets: 13 distribution locations; full fleet of tractors and trailers

TCR Industries

2019 Sales: $90m

La Palma, California, US

[*www.tcrindustries.com*](http://www.tcrindustries.com)

CEO: Sam A Rumfola

Products: Resins; pigments; additives; personal care ingredients; food ingredients; pharmaceutical ingredients; nutraceuticals

Services: Storage

Assets: 10 warehouses

Skystep Trading

2019 Sales: $90m

Limassol, Cyprus

[*www.skystep.eu*](http://www.skystep.eu)

Director: Oksana Spyrou

Products: Acrylates; oxo-alcohols; sulfur; sodium tripolyphosphate; soda ash; sodium sulfate; caustic soda; potassium hydroxide; potassium carbonate; potassium sulfate; sodium lignosulphonates; chromium compounds; acetone; methylene chloride; rubbers; phenol; isopropyl alcohol

Services: Sales and marketing; financing; extensive technical and customer support; logistics and documentation; transportation and forwarding of dry and tank containers; bulk shipping; handling and repackaging; storage and inventory management

Assets: Terminal in Novorossiysk, Russia; 2 offices in Limassol, Cyprus; 40+ highly-skilled employees

Trading sales: 80%

CHEM INTERNATIONAL

2019 Sales: $89.9m

Warsaw, Poland

[*www.chem-international.pl*](http://www.chem-international.pl)

CEO: Cezary Mielczarek; Board member: Pawel Tomaszkiewicz

Products: VAM; styrene monomer; IPA; BA; phenol; glycols; solvents; anhydrides; polymers; EPS; caustic soda

Services: Logistics support; intermodal solutions; storage; customised services and solutions; technical support

Mays Chemical

2019 Sales: $88.6m

Indianapolis, Indiana, US

[*www.mayschem.com*](http://www.mayschem.com)

President: Kristin Mays Corbitt

Products: Acidulants; alkalis; citrates; humectants; flavors; glycerine; glycols

Services: Shipping; warehousing; liquid blending; repackaging; reformulation

Assets: 2 warehouses; 1 warehouse/blending facility; 1 freight truck; 6 liquid tank trucks; 12 forklifts/related equipment

Nesstra Services

2019 Sales: $88.4m

Slough, UK

[*www.nesstra.com*](http://www.nesstra.com)

CEO: Alwan Hitti

Products: Polyurethane chemicals (polyol, TDI, MDI, additives etc); calcium carbonate; caustic soda; glycerine; hexane; hydrogen peroxide; methylene chloride; MPG; sulphuric acid; titanium dioxide; toluene; xylene; plastics (HDPE, LDPE, LLDPE, PVC)

Services: Storage and drumming of bulk chemicals; blending capabilities; technical support; supply chain management; maintenance

Assets: Polyurethane foam plants; cutting machines and spare parts; construction, mining and electrical equipment and consumables; tanks and warehouse space for storage of bulk and packaged chemicals in Rotterdam, Netherlands; warehousing in Durban, South Africa

Trading sales: 85%

Miles Chemical

2019 Sales: $84.5m

Arleta, California, US

[*www.mileschemical.com*](http://www.mileschemical.com)

CEO: Michael Miles; Chairman: Anthony MilesProducts: Acids; esters; lubricants; alcohols; flavors and fragrances; plasticizers; food additives; polyglycols; amines; glycol ethers; hydrogen peroxide; solvents; chelating agents; chlor-alkali; inorganics; surfactants; chlorinated solvents; thickening agents; ketones

Services: Manufacturing; blending; contract packaging; solvent reclamation; technical training; safety training; hazardous waste removal; customer product research

Assets: Total bulk storage capacity of 180,000 gal; total warehouse space of 280,000 square feet; 30 trailers; 32 railcars; 21 tankers: 6 Bobtails

AEGEAN FIRST COMPANY (AFCO)

2019 Sales: $82m

Athens, Greece

[*www.afco.gr*](http://www.afco.gr)

CEO: Christos Spanos

Products: Polymers; specialty chemicals; organic and inorganic chemicals; pharmaceutical ingredients; food ingredients; agrochemicals

Services: Packaging; storage

Assets: 8 warehouses

Trading sales: 6%

TRiiSO

2019 Sales: $82m

Cardiff, California, US

[*www.tri-iso.com*](http://www.tri-iso.com)

President: Jason Scott

Products: Paints; coatings and ink raw materials; adhesives and sealants ingredients; plastics and composites chemicals; lubricants and metalworking additives; polyurethane chemicals

Services: Logistics; warehousing

Assets: 1 office; multiple 3PL service providers

Cornelius Group

2019 Sales: $80.3m (£60.5m)

Bishops Stortford, UK

[*www.cornelius.co.uk*](http://www.cornelius.co.uk)

Chairman: Neville Prior; CEO: Darren Spiby

Products: Monomers; specialty chemicals; food ingredients; personal care ingredients; pigments; additives; resins; minerals; surfactants; adhesive materials; excipients; natural products; animal feed ingredients; medical device raw materials; coatings ingredients

Services: Global supply chain management; laboratory services; logistics; legislative/regulatory advice; distillation; chemical reactions and manufacturing; repackaging; R&D; sales and marketing

Assets: 9 warehouses; 5 laboratories; 2 manufacturing sites; 7 offices; 1 clean room

Ilario Ormezzano

2019 Sales: $79.8m (71.1m)

Gaglianico, Italy

[*www.ilarioormezzano.it*](http://www.ilarioormezzano.it)

President: Giancarlo Ormezzano

Products: Solvents; phenol; acrylates; base chemicals; pharmaceutical intermediates; hydrocarbons

Services: Storage of liquid and solid products; storage for third parties; blending; customized handling (packaging, mixing, filling and labelling); quality control; technical after-sales support; REACH support E Assets: 2 owned warehouses with a total of 85,000 square metres and storage capacity for liquid products of more than 7,000 cubic metres; 1 rented warehouse; 3 offices; 2 laboratories; 5 trucks

Trading sales: 20%

George S. Coyne Chemical

2019 Sales: $79.6m

Croydon, Pennsylvania, US

[*www.coynechemical.com*](http://www.coynechemical.com)

President and CEO: Thomas H Coyne Sr

Products: Acids; alcohols; amines; chelating agents; chlor-alkai; chlorinated solvents; food additives; glycol ethers; hydrogen peroxide; inorganics; ketones; polymers; specialty quats; surfactants; potable and wastewater treatment chemicalsServices: Blending; technical training; contract packaging (both dry and liquid); terminal rail to truck transloading

Assets: Over 300,000 square feet of storage in 6 warehouses; 27 trucks and over 50 trailers or tankers; over 250,000 gal bulk storage

Trading sales: Less than 5%

Skyhawk Chemicals

2019 Sales: $78.8m

Houston, Texas, US

[*www.skyhawkchemicals.com*](http://www.skyhawkchemicals.com)

President: Jill Knickerbocker

Products: Caustic soda; methanol; calcium chloride; sulfuric acid; anhydrous ammonia; aqua ammonia; KOH; urea; propylene glycol; hydrochloric acid; xylene; bleach; polyphosphoric acid; benzoic acid; ethylene glycol

Services: Blending; packaging; storage

Assets: 275 gal and 330 gal totes

Prakash Chemicals International

2019 Sales: $78.1m

Vadodara, Gujarat, India

[*www.pciplindia.com*](http://www.pciplindia.com)

Managing director: Manish K Shah

Products: Caustic soda flakes; TDI; caustic soda prills; benzyl alcohol; ethyl acetate; sodium sulphate anhydrous; cinnamic aldehdye; acetone; SLES; chlorinated paraffin wax; benzyl chloride; citric acid; liquid glucose; DEP; dextrose monohydrate; hydrochloric acid; white oil

Services: Blending; packaging; storage; labelling; logistics supply chain service ex-works to DDP; quality assurance; inspection; country specific documents compliance; Reach Registration, FAMI-QS certification

Assets: 2 manufacturing plants; 2 warehouses; 3 subsidiaries outside India

Callahan Chemical

2019 Sales: $75.3m

Palmyra, New Jersey, US

[*www.calchem.com*](http://www.calchem.com)

President: Gregory D Shetler

Products: Coatings, adhesives, sealants and elastomers (CASE); household, institutional and industrial chemicals; pharmaceutical/nutraceutical ingredients; personal care/cosmetics ingredients; food ingredients; functional fluids

Services: Bulk liquids packaging; custom blending; returnable containers, drums and totes; customised tote programmes; custom labelling; remote tank monitoring; vendor managed inventory; consignment inventory; committed inventory to forecast; mixed truckload deliveries; LTL quantities; JIT deliveries

Assets: 2 dedicated white rooms for NF, FCC, USP and Kosher packaging; 5,000 square feet of temperature controlled (hot/cold) warehousing; 400,000 square feet of environmentally controlled warehousing; 90,000 gal bulk storage; 9 warehouses; company owned and operated fleet of 12 trucks; tank farm; 2 regional offices

Aug. Hedinger

2019 Sales: $75.2m (67.0m)

Stuttgart, Germany

[*www.hedinger.de*](http://www.hedinger.de)

Managing director: Johann-Ludwig Raiser

Products: Raw materials for technical industries such as coatings/paints, lubricants, cleaning, adhesives, construction; starting materials and APIs for the life sciences industry

Services: Customised additional test methods and processes; laboratory testing and batch certification (GMP labs); pharmacopoeia standards (EP, USP, JP, CP, IP, etc); extended specifications; blending; labelling; packaging; storage; repackaging in 8 cleanrooms (class ISO 5)

Assets: 8 warehouses; 16 trucks (5 dedicated tank trucks)

Novasol Chemicals Group

2019 Sales: $75m

Kraainem, Belgium

[*www.Novasolchemicals.com*](http://www.Novasolchemicals.com)

CEO: Claude Fickers; Global Business Director: Francois-Xavier Coiffard

Products: Pharmaceutical and agrochemicals intermediates; carbonates; additives; DAAM/ADH, EMA, GMA; acrylates; methacrylates; sulfolane; hydroxy chemicals; water treatment chemicals; trimercaptotriazine; personal care chemicals; active ingredients; extracts and botanicals; clays; oils and butters; emollients; emulsifiers; preservatives; rheology modifiers; UV filters; conditioners; surfactants; humectants; polymers; solvents

Services: REACH lead registrant of many molecules; product mixing and blending; tailor-made packaging solutions

Assets: Local technical salesforce (11 offices worldwide); sourcing team E

Chemical Solvents

2019 Sales: $75m

Cleveland, Ohio, US

[*www.chemicalsolvents.com*](http://www.chemicalsolvents.com)

Owner: Ed Pavlish

Products: Aromatics; aliphatics; ethanolamines; purge solvents; acetates; silicones; plasticizers; organic solvents; oil and gas chemicals; chlorinated solvents; THF; NPB; cyclohexanone

Services: Custom blending; toll blending; hazardous and non-hazardous waste handling; storage; packaging

Assets: 4 warehouses; 2m gal storage tanks

Webb Chemical Service

2019 Sales: $75m

Muskegon Heights, Michigan, US

[*www.webbchemical.com*](http://www.webbchemical.com)

CEO: Brad Hilleary; President: Charlie Stevens

Products: HI&I chemicals; metal finishing chemicals; pharmaceutical ingredients; ag chemicals; water and wastewater chemicals; food ingredients; CASE; auto chemicals; investment casting

Services: Blending; packaging; storage; VMI; 20 drivers; own fleet

Assets: 6 warehouses; 40+ tankers; 15+ semi box trucks; 28 bulk tanks

Will & Co

2019 Sales: $74.1m (66m)

Badhoevedorp, Netherlands

[*www.will-co.nl*](http://www.will-co.nl)

Managing director: Jacques van Lindonk

Products: 1,4-butanediol and derivatives (THF, GBL); plasticizers and flame retardants; pigments; proteins; cosmetic and personal care ingredients; coating resins and additives; bio-based solvents and binders; impact modifiers for plastics; foaming agents for plastics; additive masterbatches; sulfamic acid; ferric chloride; engineering plastics and compounds

Services: Storage management; logistics; sales and marketing

Trading sales: 90%

Joss Elastomers & Chemicals

2019 Sales: $73.0m (65m)

Alkmaar, Netherlands

[*www.joss.nl*](http://www.joss.nl)

CEOs: Robert Slinger, Arnold Hofman, Bart ten KleiProducts: Synthetic rubber; natural rubber; process oils; silica; carbon black

Services: Warehousing; trucking; shipping; repackaging big bags and small bags

Trading sales: 60%

Metachem

2019 Sales: $72.1m

Sao Paulo, Brazil

[*www.metachem.com.br*](http://www.metachem.com.br)

President: Ricardo do Rego Freitas

Products: Food ingredients; base mineral oils; flame retardants; coating additives; feed additives; chemical intermediates; vegetable nutrition additives; electroplating chemicals; lubricant additives; dimer acid

Services: Storage; logistics

Assets: 5 warehouses; 1 head office

Maha Chemicals

2019 Sales: $71m

Singapore

[*www.mahachem.com*](http://www.mahachem.com)

Chairman: Tan Seow Hoon

Products: carbon black, construction material chemicals, resin, polymer, emulsion, additives, functional fillers, pigments, colorants, biocides, surfactants, analytical instruments, lab equipment and machines

Services: sales, marketing, distribution, warehouse storage, logistic, packaging

Assets: 14 warehouses, 15 trucks

Astro Chemicals

2019 Sales: $70m

Springfield, Massachusetts, US

[*www.astrochemicals.com*](http://www.astrochemicals.com)

President: Chris Diamond

Products: Solvents; chlor-alkali; pharmaceutical-grade chemicals; food-grade chemicals; adhesives; activated carbon; water treatment chemicals; wastewater treatment chemicals; mineral oils and petrolatums; acetates; heat transfer fluids; alcohols; citrates; phosphates; silicates

Services: Blending; packaging; storage; logistics

Assets: 2 warehouses; 12 trucks; 5 tankers; 12 12,500 gallon storage tanks; 10 positions for rail unloading

MOGoil

2019 Sales: $67.4m (60m)

Berlin, Germany

[*www.mogoil.com*](http://www.mogoil.com)

General director: Andreas Rogge

Products: Base oils; process oils; solvents

Services: Trading; storage; customs clearance; technical support; financing

Trading sales: 30%

Ricardo Molina Group

2019 Sales: $67.1m (59.8m)

President: Gemma Molina

Barcelona, Spain

[*www.ricardomolina.com*](http://www.ricardomolina.com)

Products: Specialty chemicals for coatings, building, adhesives, construction, lubricants, pharmaceutical, cosmetics, personal- and home care, rubber, plastics, water treatment, food and beverage, agro chemicals

Services: Technical sales and marketing, application development, quality, warehousing, regulatory services, supply chain management, after sales services, repacking

Assets: 3 labs, 1 warehouse

Connection Chemical

2019 Sales: $66.5m

Newtown, Pennsylvania

[*www.connectionchemical.com*](http://www.connectionchemical.com)

President: Frank Farish

Products: Caustic soda (liquid and dry); caustic potash (liquid and dry); industrial and institutional chemicals; compounding chemicals; ***agricultural*** products; water treatment chemicals; food and beverage ingredients; feed ingredients; pulp and paper chemicals; oil and gas chemicals; metal finishing and flux chemicals; phosphates; mineral acids

Services: Logistics; importing; inventory management; supply chain solutions; repackaging; dilutions; blending; outsourcing

Assets: 12 stocking locations in the US; strategic deep draft storage

Greenchem Industries

2019 Sales: $64.5m

West Palm Beach, Florida, US

[*www.greenchemindustries.com*](http://www.greenchemindustries.com)

CEO: John Lagae

Products: Acetates; acids; acrylates; alcohols; amines; aromatics; chlorinated solvents; ketones; glycerine; glycols; glycol ethers; nonyl phenol ethoxylates; phthalates; plasticizers; PCBTF; DMC; THF; d-limonene

Services: Logistics; warehousing; import/export; small packaging

Assets: 35 public warehouses

Chemisphere

2019 Sales: $63m

St Louis, Missouri, US

[*www.chemispherecorp.com*](http://www.chemispherecorp.com)

President: Matthew Schwent

Products: Beverage grade ethanol; denatured ethanol; aliphatic solvents; alcohols; aromatics; ketones; glycol ethers

Services: Toll manufacturing; custom blending; packaging; USP packaging; storage; railcar transloading

Assets: 1.4m gal tank farm storage; 14 car rail spur; 60,000 square feet of warehouse space; bulk tanker fleet

PROQUIBASA

2019 Sales: $61.7m (55m)

Barcelona, Spain

[*www.proquibasa.com*](http://www.proquibasa.com)

CEO: Ivan Sanchez

Products: Specialty and commodity chemicals; coatings, construction and adhesives materials; pigments and performance products; water treatment chemicals; household and industrial cleaning chemicals; lubricants and metalworking fluids

Services: Technical service; blending; manufacturing; toll manufacturing; bulk loading and storage; warehousing

Assets: Full service and wholly-owned facilities in Barcelona with tank farm (100 tanks) and 7,000 square metre warehouse; regional hub in Madrid with tank farm (25 tanks) and 2,000 square metre warehouse

LAVOLLEE

2019 Sales: $61.7m (55m)

Levallois, France

[*www.lavollee.com*](http://www.lavollee.com)

President: Herve Lavollee

Products: Specialty chemicals for coatings, plastics, lubricants, metal working, water treatment; ingredients for F&F, pharmaceuticals, food, personal care

Services: Storage; repackaging; VMI; outsourcing

Asstes: 2 labs (food and cosmetics)

SolvChem

2019 Sales: $61.6m

Pearland, Texas, US

[*www.solvchem.com*](http://www.solvchem.com)

President and CEO Jean-Pierre Baizan

Products: Solvents; organic and inorganic chemicals; epoxies; silicones; silicone emulsions; hydrocarbon resins; hydroxyl ethyl cellulose; titanium dioxide; acrylates

Services: Custom packaging; custom blending; toll manufacturing; container management programmes; export services; technical support; green chemistry product solutions; small container filling

Assets: 9 trucks; 24 trailers; 15 tankers

Emsa Tecnologia Quimica

2019 Sales: $61.2m (54.5m)

Barcelona, Spain

[*www.emsaquimica.com*](http://www.emsaquimica.com)

CEO: Jorge Grima

Products: Pigments; fillers; binders; inorganics; surfactants; minerals; additives; polymers

Services: Blending; packaging; storage

Assets: 4 warehouses

Airedale Chemical

2019 Sales: $61.0m (£46M)

North Yorkshire, UK

[*www.airedalechemical.com*](http://www.airedalechemical.com)

Managing director: Chris Chadwick

Products: Phosphoric acid; peracetic acid; hydrogen peroxide; acetic acid; caustic soda; manganese nitrate; polyaluminium chloride; diammonium phosphate; sulphuric acid; sodium hexametaphosphate (SHMP); phosphates; phosphonates; antifoams; water treatment chemicals; cleaning and detergent chemicals

Services: Contract manufacturing; small pack chemical production; waste management

Assets: 4 acre production and storage facility; 9 warehouse locations; 20 fully owned trucks; R&D/QC laboratories

Trading sales: 5%

Shamrock Shipping & Trading

2019 Sales: $60.9m

Limassol, Cyprus

[*www.shamrockoils.com*](http://www.shamrockoils.com)

Managing director: Sergey Galin

Products: Base oils (Group I, II, III); polyalphaolefins; naphthenic oils; re-refined base oils; additives; glycols; waxes; white oils; recycled oils; RPO (rubber process oils); petrolatum; bitumen; antifreeze; lithium hydroxide monohydrate; hydrogenated castor oil

Services: Supply chain and logistics; financing and trade finance; flexitank loading; market intelligence; storage; trans-shipment

Assets: Offices in Cyprus and UAE

Rowell Chemical

2019 Sales: $58m

Hinsdale, IL, US

[*www.rowellchemical.com*](http://www.rowellchemical.com)

President Tom Harris

Products: Caustic soda (sodium hydroxide); bleach (sodium hypochlorite); hydrochloric acid; sulfuric acid; caustic potash (potassium hydroxide)

Assets: Services: Storage terminal

Assets: 1 warehouse (Willow Springs, IL); 10 trucks (Rowell owned fleet)

Brainerd Chemical

2019 Sales: $58m

Tulsa, Oklahoma, US

[*www.brainerdchemical.com*](http://www.brainerdchemical.com)

CEO: Mathew A Brainerd

Products: Peracetic acid; hydrofluoric acid; sulfuric acid; nitric acid; refrigerants; aromatics; aliphatics; glycols; glycol ethers; high hazard acids; chlor-alkali; alcohols; formaldehyde; food processing sanitation chemicals; water treatment chemicals

Services: Packaging; blending; manufacturing/engineering services; contract packaging; toll manufacturing; logistics; warehousing; transloading

Assets: 4 production locations in Oklahoma, North Carolina, and Illinois; tank terminals; rail terminals; extensive company owned fleet of trucks and trailers, and bulk tankers

Walsh & Associates

2019 Sales: $56m

Saint Louis, Missouri, US

[*www.walsh-assoc.com*](http://www.walsh-assoc.com)

President and CEO: Ellen M Murphy

Products: Raw materials for CASE, HI&I, inks, personal care, oil and gas, chemicals, ***agriculture***, food and beverage, pharmaceuticals, plastics, green chemistry

Services: Manufacturing; blending; contract packaging; technical training; IFS certified warehousing

Assets: 8 warehouse locations; 30m gal liquid bulk storage; 1 tractor trailer

Buckley Oil

2019 Sales: $55.5m

Midlothian, Texas, US

[*www.buckleyoil.com*](http://www.buckleyoil.com)

President: Robert Rice

Products: Solvents; alcohols; aliphatics; aromatics; glycols; glycol ethers; ketones; base oils; finished lubricants

Services: Blending; packaging; toll blending; storage; delivery; custom packaging; transloading

Asstes: 4 warehouses; 20 trucks

Trading sales: 5%+

Solvachem

2019 Sales: $52.1m (46.4m)

Wroclaw, Poland

[*www.solvachem.pl*](http://www.solvachem.pl)

CEO: Elisabeth Luerenbaum

Products: Methanol; UCO and vegetable oils; alcohols and other solvents; regenerated solvents; polymers; base oils; aerosols; inorganic chemicals; washing agents and disinfectants; fillers and additives; colourants; oils and greases

Assets: 1 methanol tank; 5 warehouses; 2 customs warehouses; production facilities (UCO, washing agents and disinfectants)

Trading sales: 10%

TRInternational

2019 Sales: $51.3m

Seattle, Washington, US

[*www.trichemicals.com*](http://www.trichemicals.com)

CEO and owner: Megan E Gluth-Bohan

Products: Industrial, specialty, and fine chemicals for paints, coatings, adhesives, sealants, inks and dyes, polymers, composites and construction, metal-working, textiles, lubricants, household and industrial cleaning, water treatment, oil and gas, food and beverage, feed and ***agriculture***, pharmaceutical, cosmetics and personal care products

Services: Marketing; logistics; technical services; custom manufacturing; blending; contract packaging

Trading sales: 30%

Tarr

2019 Sales: $51m

Portland, Oregon, US

[*www.tarrllc.com*](http://www.tarrllc.com)

President: Skip Tarr

Products: High-purity chemicals, solvents, aromatics, ethanol

Services: Blending, packaging, storage, formulating

Assets: 4 warehouses, 6 class 100 Clean Rooms, 870,000 gal bulk storage, 3 rail spurs, 11 trucks

Trading sales: 0%

Valudor Products

2019 Sales: $50m

San Diego, CA, US

[*www.valudor.com*](http://www.valudor.com)

CEO John Tree

Products: ***Agriculture***/animal feed micronutrients; fertilizer ingredients; acids; inorganics; organic certification; industrial applications; coatings; oil & gas; water treatment

Services: Sourcing; distribution; storage; dry and liquid blending; product development; new product innovation

Assets: 16 warehouses; national distribution; regional offices

Trading sales: 0%

UCG (United Chemical Group)

209 Sales: $49.9m

Moscow, Russia

[*www.ucgrus.com*](http://www.ucgrus.com)

Chairman & CEO: Gennadiy Tolstobrov

Products: ABS; ASA; SAN; HIPS; PC/ABS; PBT; PMMA; PC; POM; SBS; SEBS; SIS; POE; EVA; HDPE; PPcopo; PA&AIM; road construction materials; oil additives and modifiers; base oils; fertilizers; liquid chemicals

Services: Distribution; logistics; packaging; storage; technical support

Assets: 8 offices, 9 warehouses

Trading sales: 3%

National Chemical

2019 Sales: $49m

Dublin, Ireland

[*www.ncc.ie*](http://www.ncc.ie)

CEO: Alan Looney

Products: Full range of chemicals, food ingredients and performance polymers

Services: NCC offer supply chain solutions from supply chain risk assessment, sourcing, accreditation, regulatory support, logistics and supply. E Assets: ISO13485 cleanroom medical compounding plant via JV Innovative Polymer Compounds (IPC)

Trading sales: 70%

McCullough & Associates

2019 Sales: $48.7m

Atlanta, Georgia, US

[*www.mccanda.com*](http://www.mccanda.com)

President: George McCullough

Products: Organic and inorganic pigments; dispersions; wax additives; fumed silica; carbon black; clays; specialty additives; matting agents; laboratory equipment; mixers; tanks; cast urethane systems; polyurethane dispersions; hydrocarbon resins; silicone dispersions

Services: Storage and logistics; formulation assistance; technical service; process engineering services

Assets: Outside bonded chemical warehouse

Carbono Quimica

2019 Sales: $47m

Sao Bernardo do Campo, Sao Paulo, Brazil

[*www.carbono.com.br*](http://www.carbono.com.br)

President: Vera Maria Miraglia Gabriel

Products: Aliphatic solvents; aromatic solvents; oxygenated solvents; epoxy resins; epoxy hardeners; coatings additives; paint driers; alkyd resins; pigments; glycerine; fatty acids; fatty alcohols

Services: Blending; packaging; bulk storage; laboratory services

Assets: 5 subsidiary branches; 10 trucks

WISTEMA

2019 Sales: $46.1m (41.0m)

Dielheim, Germany

[*www.wistema.de*](http://www.wistema.de)

Owner and managing director: Winfried Friedel

Products: Catalysts; chemical intermediates; cosmetics ingredients; toiletries and personal care ingredients; food ingredients; industrial chemicals; pharmaceutical ingredients; plastic additives; polymers; reprographic chemicals/ink chemicals; solvents/distilled solvents; water treatment chemicals; waxes

Services: Contract and toll manufacture; storage; waste management (waste disposal certified); salvage recovery and resale; REACH consultation

Assets: 3 warehouses

Trading sales: 60%

Chem One

2019 Sales: $45.9m

Houston, Texas, US

[*www.chemone.com*](http://www.chemone.com)

CEO: Terry Podlogar

Products: Feed additives; fertilizer ingredients; water treatment chemicals; food additives; industrial chemicals

Services: JIT inventory; pallet quantities; truckloads

Assets: Houston, Texas, headquarters and warehouse; independent facilities in Laredo, Texas and Tampa, Florida

EQUILEX

2019 Sales: $45.8m (40.8m)

Schiedam, Netherlands

[*www.equilex.com*](http://www.equilex.com)

CEO: Cees Verdel

Products: Higher olefins; alkylphenols; alkylbenzenes; ethanolamines; ethylene glycols; solvents (MEK, MIBK, hexane, MIBC, IPA, acetone, cyclohexanone); performance intermediates (AMS, maleic and phthalic anhydrides, DCPD); phenol; aromatics; tackifying resins; isophorone; diacetone alcohol

Services: Marketing; storage; packaging; Sea, rail and road transportation; custom formalities; Reach regulation

Trading sales: 15%

Jobachem

2019 Sales: $45.1m

Dassel, Germany

[*www.jobachem.com*](http://www.jobachem.com)

CEO: Julian Kahl

Products: Aluminum chloride; flavours and fragrances; plasticizers; UV/EB curing agents; monomers; oligomers; photoinitiators; specialty chemicals; UV filters; mixtures

Services: Blending; repackaging; storage; logistics; bonded warehousing; heating; refilling; customs clearance

Assets: 3 warehouses worldwide; 4 subsidiaries worldwide

Trading sales: 10%

Chemical Distributors Inc (Buffalo, NY)

2019 Sales: $45m

Buffalo, New York, US

[*www.cdibuffalo.com*](http://www.cdibuffalo.com)

President: Mark T Russell

Products: Acids; alkalis; food grade ingredients; reagent grade chemicals; solvents

Services: Blending; packaging; storage; laboratory testing

Assets: 12 trucks; 10 tankers; 114,000 square feet warehousing

SINPRO

2019 Sales: $44.9m (40m)

Lausanne, Switzerland

[*www.sinprosa.ch*](http://www.sinprosa.ch)

CEO: Alfred Frankel

Products: Industrial chemicals; resins; polyesters; pharmaceutical ingredients; construction chemicals; paints; inks; food and feed additives; pharmaceuticals; raw materials for food and feed

Services: Associated with a forwarding agent

Trading sales: 50%

Coast Southwest

2019 Sales: $44m

Placentia, California, US

[*www.coastsouthwest.com*](http://www.coastsouthwest.com)

President: Joseph C Cimo

Products: Surfactants; silicones; personal care ingredients; preservatives; oleochemicals

Services: Liquid blending; liquid bulk; storage; drumming; formulating

Assets: 7 locations; 6 trucks; applications laboratory

Ideal Chemical & Supply

2019 Sales: $43.5m

Memphis, Tennessee, US

[*www.idealchemical.com*](http://www.idealchemical.com)

President: Sam Block Jr

Products: Acids; alcohols; amines; chelating agents; chlor E alkali; food ingredients; glycol ethers; hydrogen peroxide; inorganics; ketones; personal care ingredients; polyglycols; solvents; textile care ingredients; water treatment chemicals

Services: Wholesale custom blending and packaging (dry and liquid); in-house QC and R&D labs; LTL and truckload quantities; single- and multi-compartment tanker deliveries; local warehousing and logistics; returnable and one-way containers; remote tank monitoring

Assets: Warehouses at 4 locations with combined 170,000 square feet of space; 1m gal liquid bulk storage; distilled spirits plant (DSP); 15 tractors; 23 trailers; 6 tankers

Gehring Montgomery / Trexan Chemicals

2019 Sales: $43m

Warminster, Pennsylvania, US

[*www.gehring-montgomery.com*](http://www.gehring-montgomery.com),   [*www.trexanchemicals.com*](http://www.trexanchemicals.com)

CEO: Mark S Bitting

Products: Resins; additives; waxes; metal-working additives; food additives; industrial chemicals

Services: Blending; repackaging; technical consultation; warehouse storage

Assets: 5 trucks; 8 trailers

Trading sales: 10%

A.+E. Fischer-Chemie

2019 Sales: $42.1m (37.5m)

Wiesbaden, Germany

[*www.fischer-chemie.de*](http://www.fischer-chemie.de)

General manager: Manuel Fischer-Bothof

Products: Caustic soda; solvents; hydrochloric acid; citric acid; urea; phosphoric acid; matting agents; pyrogenic silicon dioxide; precipitated silica; silicone oil; glycerine; caustic potash; sodium bicarbonate; hydrogen peroxide; activated carbon; sodium persulfate

Services: Storage; packaging; mixing; exporting

Assets: 4 warehouses for solid and liquid products; 16 trucks

Trading sales: 10%

Venus Chemicals Group

2019 Sales: $42m

Cairo, Egypt

[*www.venukim.com*](http://www.venukim.com)

CEO: Ahmed Alghoul

Products: Fragrances; surfactants; solvents; pine oil; gum rosin; gum base; maleic resin; glycerine; solvents

Services: Packaging fragrances

Assets: 10 jumbo cars; 5 warehouses

Trading sales: 60%

SAME CHEMICALS

2019 Sales: $41.0m (36.5m)

Barendrecht, Netherlands

[*www.samechemicals.com*](http://www.samechemicals.com)

Managing director: Cees-Jan Crezee

Products: Acetates; alcohols; aromatics; DCPD; glycols; hydrocarbons; ketones; styrene

Services: Bulk distribution; salvage trading; recycling; logistics; storage; inventory management; consignment stock; marketing; sourcing; Reach consultation

Assets: Offices in the Netherlands, Denmark, Poland and Spain

Vivion

2019 Sales: $41m

San Carlos, California, US

[*www.vivioninc.com*](http://www.vivioninc.com)

President: Michael Poleselli

Products: Acidulants; sweeteners; humectants; preservatives; chelants; hydrocolloids; surfactants; vegetable oils; antifoams; tableting aids; micronutrients; vitamins; minerals

Services: Formulation assistance

Assets: 5 warehouses

DutCH2

2019 Sales: $40.8m (36.4m)

Purmerend, Netherlands

[*www.dutch2.com*](http://www.dutch2.com)

Managing director: Steven Willekes

Products: Acetates; acids; acrylates; alcohols; amines; aromatics; chlorinated solvents; glycol ethers; glycols; hydrocarbons; ketones; monomers; vegetable oils; propylene glycol ethers; plasticizers

Services: Trading; export; drumming; warehousing; logistics; blending; packaging; storage; consignment stocks

Trading sales: 30%

Henry Hirschen

2019 Sales: $40m

Buenos Aires, Argentina

[*www.hirschen.com.ar*](http://www.hirschen.com.ar)

President: Miguel Hirschen

Products: Glycols; surfactants; amines; biocides; solvents; inorganics; food ingredients; pharmaceutical ingredients; oil/gas specialties; colourants

Services: Storage; packaging; blending; trading; same day deliveries; financing; tailor-made solutions to customers

Assets: Central warehouse in Buenos Aires industrial area, fit for liquids and solids and with secluded area for food/pharmaceuticals

Trading sales: 1%

Min-Chem/Lawrason’s/CK Ingredients Group

2019 Sales: $40m

Oakville, Ontario, Canada

[*www.min-chem.com*](http://www.min-chem.com),   [*www.lawrasons.com*](http://www.lawrasons.com),   [*www.ckingredients.com*](http://www.ckingredients.com)

President: David A Luciani

Products: Composite thermosets (roving, resin and peroxides); composite thermoplastics; rubber additive; adhesives; waxes; flame retardants; pharmaceutical ingredients; nutraceutical ingredients; food ingredients; mineral and industrial acids; water treatment chemicals; pool and spa chemicals; janitorial and sanitation chemicals; industrial specialty chemicals; winter ice melting products

Services: Manufacturing - blending and compounding; logistics

Assets: 3 warehouses in Ontario, Quebec, British Columbia

Van Horn, Metz & Co

2019 Sales: $40m

Conshohocken, Pennsylvania

[*www.vanhornmetz.com*](http://www.vanhornmetz.com)

President & CEO: Barrett C. Fisher

Products: Additives; specialty resins; extenders; pigments; dyes; base stock; silicones; surfactants; esters; thickeners; PAOs

Services: Dry blending; pigment treatment

Assets: 4 warehouses

Trading sales: 15%

Acid Products Company

2019 Sales: $38.6m

Chicago, Illinois, US

[*www.acidproducts.net*](http://www.acidproducts.net)

President: Jann Fisher

Products: Acids; caustics; dry chemicals; white oils; solvents; surfactants; cleaning chemicals

Services: Toll blending (pails, drums, totes, bulk); contract packaging (all bottle sizes); powder blending; LTL distribution

Assets: Two locations; rail; 10 trucks

SIP Speciality Oils and Fluids

2019 Sales: $37.4m

London, UK

[*www.sip.com*](http://www.sip.com)

Managing director: Stephen Spencer

Products: white oils and pharmaceutical oils; drilling fluids; process oils; specialty fluids for automotive and industrial use; sustainable and renewable base oils; lubricant additives

Services: Storage; logistics; blending; packaging; formulation

Linkers Chemicals & Polymers

2019 Sales: $37.4m

Dubai, UAE

[*www.lcp.ae*](http://www.lcp.ae)

Managing Director: Malik Pervez Zaman

Products: synthetic rubber, PVC, engineering plastics, plasticizers, latex, monomers, construction chemicals, animal nutrition, coatings chemicals

Services: market expansion, technical support

Trading Sales: 100%

QUELARIS Internacional

2019 Sales: $36.9m

Panama City, Panama

[*www.quelaris.com*](http://www.quelaris.com)

CEO: Paul Vanhauw

Products: Polyurethanes; rubber; coatings; personal and home care ingredients; adhesives

Services: Technical sales and service; local warehousing; immediate dispatch; repackaging

Services: 13 countries distribution network - Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Peru and Caribbean Islands

Trading sales: 13%

DROGAS VIGO GROUP

2019 Sales: $36.1m

Porrino, Pontevedra, Spain

[*www.drovi.com*](http://www.drovi.com)

CEO: Enrique F Casal Lareo

Products: Solvents, thinners and green solvents; organic and inorganic chemicals; paint and coatings raw materials; adhesives and sealants raw materials; pharmaceutical, cosmetics and agrochemicals raw materials; automotive chemicals; softeners and detergents raw materials; fillers and pigments; water treatment chemicals; food ingredients; lubricants and waxes; ink and printing chemicals; paper chemicals; mining chemicals

Services: Storage and marine logs -vessel reception; solvents recycling and reformulation; blending and formulations; packaging and bulk deliveries; logistics and outsourcing; quality/lab analytical services to third parties; JIT delivery and telemetry stock control to third parties; e-invoicing and e-b2b with customer platforms

Assets: 4 warehouses (bulk and packed storage); sea terminal; solvents recycling unit; 3 bulk tank cars; 5 packed trucks

Northspec Chemicals

2019 Sales: $35m

Toronto, Ontario, Canada

[*www.northspec.com*](http://www.northspec.com)

Principal/President: Noel ShahnazarianProducts: Epoxy resins and hardeners; aliphatic and aromatic urethanes and polyols; acrylic resins; pigments; additives

Services: Inventory management; logistics

Assets: 6 warehouse facilities across Canada; head office

Trading sales: 5%

Seeler Industries

2019 Sales: $35m

Joliet, Illinois, US

[*www.seeler.com*](http://www.seeler.com)

CEO: Steve Seeler

Products: Hydrogen peroxide; peracetic acid; glacial acetic acid; propylene glycol; sodium gluconate; caustic soda; hydrochloric acid; soda ash; DDBSA; sodium chlorate; phosphoric acid; quaternary compounds; other specialty chemicals

Services: Tank storage; railcar unloading; blending; liquid packaging; bagging; transloading; warehouse storage; property rental; trucking; laboratory services

Assets: 275,000+ square feet of warehousing; 5 trucks; 10 liquid and box trailers; 27 above ground storage tanks; 7 rail spurs of 2.5 miles of track for transloading; overhead rail trestle

Veckridge Chemical

2019 Sales: $35m

Kearny, New Jersey, US

[*www.veckridge.com*](http://www.veckridge.com)

President: Mark Veca

Products: Inorganics; acids; solvents; alcohols; amines; peroxides; salts

Services: Blending; packaging; warehousing; storage

Assets: 5 trucks, 3 warehouses, rail

Castle Chemicals

2019 Sales: $34.5m (£26m)

Manchester, UK

[*www.castlechemicals.com*](http://www.castlechemicals.com)

Director: Alan McCann

Products: Silane coupling agents; synthetic rubbers; latex additives; dithiocarbonate accelerators; specialty pigments for inks; predispersed rubber chemicals; construction chemicals and addmixtures

Services: Distribution via local storage facilities; advanced customer strategic stock management

Assets: Warehouse and storage facilities in UK, Belgium, Italy, US and Canada

Trading sales: 30%

BRUGUES

2019 Sales: $33.7m (30m)

Viladecans, Barcelona, Spain

[*www.brugues.com*](http://www.brugues.com)

CEO: Raimon Brugus Sintes

Products: Acetone; benzy; diacetone alcohol; ethyl acetate; formic acid; isopropyl acetate; isopropyl alcohol; methyl ethyl ketone; methyl isobutyl ketone; methoxy propyl acetate; n-propanol; n-propyl acetate; oxo alcohols; polyethylene glycol; propylene glycol USP

Services: Packaging; mixtures, solutions and dilutions; storage

Assets: Warehouses in Viladecans (Barcelona) with 8,000 square metres, and Alcaser (Valencia) with 6,000 square metres; 1 logistics warehouse in Igorre (Bizkaia); trucks adapted to ADR regulations (European regulations for the transport of dangerous goods), both for transporting packaged product and in tank

Trading sales: 20%

Independent Chemical

2019 Sales: $33.5m

Glendale, New York, US

[*www.independentchemical.com*](http://www.independentchemical.com)

President: Jonathan Spielman

Products: Caustic soda; paper chemicals; solvents; aromatics; cosmetics specialties; nutritional and pharmaceutical specialties; food specialties; hydrogen peroxide; surfactants; solvents

Services: Dry blending for food ingredients; pharmaceutical repackaging; liquid filling

Assets: 1 warehouse; 6 trucks; 3 tankers

Trading sales: 5%

Radchem Products

2019 Sales: $32.8m

Orland Park, IL

[*www.radcheminc.com*](http://www.radcheminc.com)

President: William M. Radostits

Products: Chemicals and solvents including but not limited to acetates, alcohols, aliphatic and aromatic hydrocarbons, glycol ethers, process and base oils, reuse solvents, resins and ketones

Services: Railcar, tanker, drums, totes and blending

Assets: Dedicated owned compartment trailers and dedicated equipment for specific products

Morais de Castro

2019 Sales: $32.3m (R130.0m)

Salvador, Bahia, Brazil

[*www.moraisdecastro.com.br*](http://www.moraisdecastro.com.br)

CEO: Andre Castro

Products: Surfactants; glycols (EO/PO); white mineral oils; caustic soda; sulfonic acid (LAB-S); inorganic acids (H2SO4, HCL, HNO3); sodium hypochlorite; personal care additives; food ingredients and flavours; rheology modifiers; oxygenated solvents; chlorinated solvents; biocides; sulfates (Al, Na, Cu, NH3); silicones

Services: Packaging/repackaging; storage; dilutions; imports (under contract); transportation

Assets: 2 warehouses (Bahia and Pernambuco); 15 trucks; 1 bulk storage facility (Bahia); 2 laboratories (quality control and food additives); packaging/repackaging facility (with white room)

Trading sales: 1%

Industrial Chemicals Corp

2019 Sales: $32.0m

Arvada, Colorado, US

[*www.industrialchemcorp.com*](http://www.industrialchemcorp.com)

President and VP Finance: Jamie Biesemeier-Wilkins

Products: Acetates; acids; aliphatic and aromatic solvents; alcohols; biofuel chemicalsl; CBD extraction chemicals; chelating agents; chlor-alkali products (caustic soda, KOH); detergent chemicals; glycols and glycol ethers; heat transfer fluids; hydrogen peroxide; ketones; metal finishing chemicals; oilfield chemicals; organic and inorganic chemicals; pharmaceutical chemicals; surfactants; water treatment chemicals

Services: Contract blending; proprietary blends; transloading; warehousing

Assets: 3 warehouses; 25 tankers; 10 tractors; 5 vans; 740,000 gal bulk storage; rail siding to accommodate 16 railcars

GJ Chemical

2019 Sales: $32m

Somerset, New Jersey, US

[*www.gjchemical.com*](http://www.gjchemical.com)

President: Diana Colonna

Products: Acrylates and monomers; high purity solvents; reagent chemicals; ketone; monomers; plasticizers; acids and anhydrides; aromatic solvents; chlorinated solvents; cosmetic preservatives; esters; glycol ethers; glycols; heat transfer fluids

Services: Testing; bulk storage; repackaging; liquid bulk handling; custom blending; purifying; stabilizing

Assets: 3 locations in New Jersey; 8 trucks; 25 tankers; 15 box trucks

Trading sales: 40%

McKinn International

2019 Sales: $32m

Singapore

[*www.mckinn.com.sg*](http://www.mckinn.com.sg)

Managing director: Chau Tak Vui

Products: Raw materials for adhesives, coatings, UPR, PU and TPU; plastics additives; flame retardants; acids and anhydrides; plasticizers; rubber additives

Services: Sourcing

Assets: 3rd party warehouse

Trading sales: 85%

R.E. Carroll

2019 Sales: $31.4m

1570 North Olden Avenue, Trenton, New Jersey 08638, US

www:recarroll.com

President: Robert E. Carroll, III

Products: Calcium carbonate, clays, blowing agents, alumina trihydrate, zinc oxides, plasticizers, foaming agents, barium sulfate, petroleum products (aromatic oils, naphthenic oils), magnesium oxide, stearates, soybean oils, lubricants, ASTM reference oils

Services: Repackaging, storage, capacity to efficiently repackage 6,000 - 12,000 gallons per week at several locations for aromatic, naphthenic, paraffinic base and process oils

Assets: Corporate office & warehousing (NJ), warehouse locations in OH, GA, TX. E

Brisco

2019 Sales: $30m

Sao Paulo, Brazil

[*www.brisco.com.br*](http://www.brisco.com.br),   [*www.briscopc.com*](http://www.briscopc.com)

CEO: Guillermo Castillo

Products: Styrene monomer; acrylates; acetates; plasticizers; maleic anhydride; phthalic anhydride; EPS; PS; ABS; PE; PP

Services: Drumming; blending; agency sales; trading; packaging

Assets: 2 warehouses; 5 trucks; 1,000 tonnes of storage in park tanks

Trading sales: 10%

GB-Chemie

2019 Sales: $29.8m (26.5m)

Messel, Germany

[*www.gb-chemie.com*](http://www.gb-chemie.com)

CEO: Jean-Pierre Pittack

Products: Amines; alcohols; inorganic compounds; bromine derivatives; complexing agents; solvents; organic compounds; phosphorus compounds; starch/starch derivatives

Services: Storage; blending; packaging; logistics

Assets: Several local warehouses

Trading sales: 25%

DAXX

2019 Sales: $29m

Houston, Texas, US

[*www.daxxgrp.com*](http://www.daxxgrp.com)

President: Jean Marie Diederichs

Products: Solvents; aromatics; glycol ethers; esters; alcohols; isocyanates; amines; specialty chemicals

Services: Blending; packaging; storage; railcar, tanker, isotank, vessel shipments

Assets: 1 warehouse; 4 trucks; 4 tanks

Trading sales: 20%

RISHICHEM

2019 Sales: $27.4m

Mumbai, India

[*www.rishichem.com*](http://www.rishichem.com)

President: Sanjiv Desai; Directors: Arvind Kapoor, Aditya Kapoor, Atul Shah

Products: Acrylic-based flow modifiers, matting agents and degassing agents; actives for personal care; anionic, nonionic, amphoteric surfactants; aromatic polyisocyanates; ASR- alkali water soluble resins; hydrocarbon resins; natural oils and extracts; fluoro surfactants; high boiling alcohols; MDI and polyols; microcrystalline waxes, bees wax and specialty blends; n-butyl chloride; specialty polyester resins; poly mercaptan epoxy hardeners; rheological modifiers; rosins and rosin esters; silanes and silicones; TiO2

Services: Blending; packaging; labelling; warehousing; inventory managementAssets: Technical application laboratory; company premises

LUMAR QUIMICA

2019 Sales: $26.9m (24.0m)

Barcelona, Spain

[*www.lumarquimica.com*](http://www.lumarquimica.com)

President: Lluis Ribera; CEO: Bruno Saillant

Products: Lubricant additives; antioxidants; corrosion inhibitors; metal deactivators; antiwear and EP additives; fatty acids; fatty alcohols; surfactants; friction modifiers; antifoam agents; viscosity index improvers (OCP, PAMA); pour point depressants; thickeners; solid lubricants; wetting agents; amines; tackifiers; biodegradable additives; food additives; PAO (polyalphaolefins); PAG (polyalalkyleneglicols); PIB (polyisobutylene); esters; silicon; PFPE; phosphate esters; corrosion inhibitors; waxes

Services: Storage; logistics; repackaging; analysis; technical training

Barrettine Group

2019 Sales: $26.5m (£20m)

Warmley, Bristol, UK

[*www.barrettine.co.uk*](http://www.barrettine.co.uk)

Group managing director: Steven Bailey

Products: Isopropanol; acetone; ethanol; hydrocarbon solvents; esters; aromatics; acids; caustic soda; insecticides; rodenticides; wood preservers; wood stains; paint strippers; cleaning chemicals

Services: Manufacturing; blending; bespoke formulations; contract manufacturing; packaging; storage

Assets: Manufacturing and mixing plant

Trading sales: 50%

JNS-Smithchem

2019 Sales: $26.2m

Paterson, New Jersey, US

[*www.jns-smithchem.com*](http://www.jns-smithchem.com)

Chief operating officer: Darren Jachts

Products: Resins; minerals; fillers; additives; pigments; specialty chemicals

Assets: 6 warehouses

Trading sales: 5%

KADION ESPECIALIDADES QUIMICAS

2019 Sales: $25.4m (22.6m)

Barcelona, Spain

[*www.kadion.com*](http://www.kadion.com)

CEO: Joaquim Guilera Sarda

Products: Speciality chemicals; additives; hyperdispersants; surface and rheology modifiers; defoamers and air release chemicals; UV stabilizers; antioxidants; photoinitiators; organic and inorganic pigments; aluminium, bronze and pearl pigments; colorants; soluble dyes for plastics and coatings; resins and polymers; nitrocellulose; epoxy resins; vinyls; aldehydes; acrylics; polyurethanes

Services: Technical sales and marketing; supply chain management; import and export; warehousing; customer and regulatory services

Assets: 2 sales offices and warehouses

Lake Chemicals and Minerals

2019 Sales: $25.1m (£18.9m)

Redditch, Worcestershire, United Kingdom

[*www.lakecm.co.uk*](http://www.lakecm.co.uk)

Managing Director: Steven Cartlidge

Products: Lake Engineering Solutions - corrosion control solutions; Lake Technical Specialities - adhesives and sealants, lubricants and metal working fluids, paints, surface coatings; Ubichem - excipients for tablet, capsule and suspensions, drug delivery modified lipids and phospholipids, advanced intermediates, European licensed APIs; Lake Personal Care - substantiated actives, sensorial, functional and tactile additives, rheology modifiers, oils and fats, extracts, emulsifiers and solubilizers; Salutivia - flavours, food ingredients, nutritional supplements, process aidsServices: chemical synthesis, distillation, purification, repackaging, sieving, blending, new product development, contract research and manufacturing, quality control, storage and distribution

Assets: head office, warehouse, two labs

TZ Group

2019 Sales: $24.9m

President: Fernando J Zavala

Houston, Texas, US

[*www.treza.com.mx*](http://www.treza.com.mx),   [*www.tzgroupusa.com*](http://www.tzgroupusa.com) and   [*www.tauchemicals.com*](http://www.tauchemicals.com)

President: Fernando J Zavala

Products: Caustic soda liquid and flakes; acetic acid; sulfuric acid; sodium hypochlorite; chloridric acid; liquid chlorine; sodium sulfate; sodium hydrosulfite; sodium bisulfite and metabisulfite; sodium silicate; sodium carbonate; sodium bicarbonate; calcium chloride; hydrogen peroxide; nonil phenol; LESSServices: Liquid and solid storage; packaging; dilution and blending; deliveries any quantity

Assets: 6 warehouses - 5 in Mexico City, Puebla, Merida, Villahermosa and Cancun, Mexico, and 1 in Houston, Texas, US; 36 trucks for deliveries; 15 tank trucks for liquid products

Trading Sales: 16%

SAMECA

2019 Sales: $24.7m (22m)

Porto, Portugal

[*www.samecapq.com*](http://www.samecapq.com)

CEO: Eduardo Moura e Sa

Products: Additives for food, plastics and rubber, coating and resins; solvents; inorganic chemicals; pigments; organics and inorganics; coatings; resins; personal care, cosmetics and detergents chemicals; effect chemicals; resins intermediates

Services: Storage for bulk and solids; packaging

Assets: Own road fleet; 6 trucks; 2 owned warehouses; 3 rented warehouses

Trading sales: 40%

Monarch Chemicals

2019 Sales: $23.1m (£17.4m)

Sheerness, Kent, UK

[*www.monarchchemicals.co.uk*](http://www.monarchchemicals.co.uk)

Managing director: Jon Hill

Products: ***Agricultural*** performance silage additives; acetic acid; caustic soda; citric acids; formic acid; feed additives; formates; glycerine; glycols; hydrochloric acid; nitric acid; propionic acid; sodium hypochlorite; sodium sulfide

Services: Warehousing; liquid and powder blending; dilutions; toll manufacturing; packed and bulk UK distribution; inventory management; supplier reduction; just-in-time delivery; global sourcing

Assets: 2 UK distribution locations with bulk and packed storage; offices; 4 purpose built trucks

Trading sales: 18%

ANTONIO TARAZONA (Industrial division)

2019 Sales: $22.5m (20m)

Silla, Valencia, Spain

[*www.antoniotarazona.com*](http://www.antoniotarazona.com)

President: Jorge Tarazona Soriano

Products: Urea; urea solutions; ammonia; caustic sosa; calcium nitrate; potassium nitrate; MAP; MKP; phosphoric acid; water soluble NPK fertilizers; ammonium sulfate; potassium phosphate; dicalcium phosphate; industrial additives

Services: Blending; packaging; storage; logistics

Assets: 50,000 square metre warehouse

Trading sales: 25%

Sulatlantica Importadora E Exportadora

2019 Sales: $22m

Rio de Janeiro, Brazil

[*www.sulatlantica.com.br*](http://www.sulatlantica.com.br)

CEO: Leonardo Roisman

Products: Chemicals for oil and gas, mining, glass, ***agriculture***, food and feed industries (organic chemicals, inorganic chemicals, solvents, emulsifiers, viscosifiers)

Services: Importing; exporting; packaging; blending

Assets: 4 warehouses; 20 tanks; 1 office building

Eagle Alcohol

2019 Sales: $21.7m

St Louis, Missouri, US

President: Daniel J Croghan

Products: Ethyl alcohol; beverage ingredients; industrial organic glycols; glycol ethers; surfactants

Services: Packaging; blending; storage

Assets: 60,000 square foot warehouse; 15 bulk tanks; 20 stainless steel tanks; 2 tractors; 2 box trailers

WhitChem

2019 Sales: $21.2m (£16m)

Newcastle-Under-Lyme, Staffordshire, UK

[*www.whitchem.co.uk*](http://www.whitchem.co.uk)

Managing director: Charles Hawley

Products: Resins/polymers; pigments; additives; mineral fillers/filter aids; textile processing/finishing/coating products; chemicals for adhesives and sealants, coatings and inks, construction and refractory materials, plastics and rubbers, textiles, ***agriculture*** and horticulture, filtration of liquids, metallurgy and engineering materials

Services: Storage of chemicals and minerals for customers across the UK and Ireland; industrially trained personnel; specialist technical support; project development; formulation advice

Assets: Sales office and warehouses in the UK

Gulf Coast Chemical

2019 Sales: $20.6m

Abbeville, Louisiana, US

[*www.gulfcoastchemical.com*](http://www.gulfcoastchemical.com)

Managing member: Jim Fusilier

Products: Glycols; methanol; ethanolamines; coolants; lubricants; antifreeze; heat transfer fluids; production chemicals; wireline lubes; specialty frac and completion fluids

Services: Blending; storage; laboratory services; chemical treatment programmes; operator training

Assets: 6 company operated facilities; 1 methanol terminal; 120,000 square feet warehousing; 500,000 gal bulk storage; laboratory facility; 22 delivery trucks; 2 tankers; 6 service trucks

Trading sales: Less than 10%

KEMAT

2019 Sales: $20.0m (17.8m)

Brussels, Belgium

[*www.kematbelgium.com*](http://www.kematbelgium.com)

Managing director: Simon Mason

Products: Polyisobutylene (PIB); proprietary PIB blends; polyalphaolefins (PAO); lubricant auxiliaries; natural oils; molybdenum disulfide; 12-hydroxystearic acid; rubber auxiliaries; natural rubber; synthetic rubber; polyisoprene synthetic rubber; titanium dioxide; carbon black; fuel additives; fuel performance packages with BASF technology

Services: Blending; bulk storage; drumming; outsourcing; packaging and repackaging; sourcing; warehousing

Assets: 75 iso-containers; warehouses with drumming, blending and repackaging capability; 5 offices globally; internal laboratory; transport fleet

Trading sales: 7%

The White Sea & Baltic Company

2019 Sales: $20.0m (£15.0m)

Horsforth, UK

[*www.whitesea.co.uk*](http://www.whitesea.co.uk)

Managing director: Alan Carradice

Products: Surfactants – nonionics, anionics, cationics, hydrotopes and green surfactants; fatty acids; oleochemicals; UV absorbers; pine tar; biocides and preservatives; personal care ingredients; lactates; phenol blends and crystals

Services: Storage; blending; sourcing

Assets: Head office

Trading sales: 20%

COMINDEX

2019 Sales: $19.1m (17.0m)

Barcelona, Spain

[*www.comindex.es*](http://www.comindex.es)

General manager: Ana-Cristina Arp

Products: Additives; acrylic dispersions; alkyd emulsions; biosolvents; castor and linseed oil and derivatives; corrosion inhibitors; epoxy resins; functional fillers; matting agents; molecular sieves; pigments; polyols; PU dispersions; reactive diluents; reinforcing fibres

Services: Technical assessments; technical visits with our principals; free customer training; free samples shipment E Assets: Headquarters; 1 warehouse

Biachem

2019 Sales: $19m

London, UK

[*www.biachem.com*](http://www.biachem.com)

Managing director: Bob Beaumont

Products: Caustic soda; surfactants; sodium percarbonate; sodium chloride; magnesium chloride; chlorine powder; chelates; sulfamic acid; sodium sulfate; phosphates

Services: Storage; blending; repackaging; dilution

Assets: All warehousing and transport subcontracted; offices in London and Ireland

Trading sales: 5%

Schibley Solvents and Chemicals

2019 Sales: $19m

Elyria, Ohio, US

[*www.schibley.com*](http://www.schibley.com)

President: Reed Schibley

Products: Organic peroxide initiators; surfactants; fatty acids; release agents; fiberglass reinforcements; resins; gelcoats; FRP equipment; solvents; chelates

Services: Blending; packaging; storage; trucking

Assets: 4 warehouses; refrigerated warehousing; hazardous material warehousing; 3 trucks; 5 trailers

Klaus F. Meyer

2019 Sales: $18.3m (16.3m)

Fussgoenheim, Germany

[*www.klausfmeyer.de*](http://www.klausfmeyer.de)

Managing directors: Martina Magnie, Frank Meyer

Products: Hydroxylamine sulfate; hydroxylamine hydrochloride; triflic acid; MEKO; nitromethane; isocyanuric acid; BHT; p-toluenesulfonic acid; n-isopropylhydroylamine; TMEDA; anthranilic acid; agrochemicals; pharmachemicals; specialty chemicals; catalysts

Services: Door-to-door-service; refilling of triflic acid; handling of dangerous goods; stockholding

Assets: 5 warehouses; own office in Shanghai-Puxi; laboratory for sample handling; isotanks

American Chemie

2019 Sales: $16m

Austin, Texas, US

[*www.americanchemie.com*](http://www.americanchemie.com)

President: Paula Kamdar; Vice President: Mike Kamdar

Products: Chemicals, ingredients and additives for sunscreens, personal care, HI&I (surfactants), food, nutrition, animal nutrition, paints, inks, catalysts, lube oil, greases, metal working, PVC lubricants, flame retardants, synthesis

Services: Logistics; imports; distribution including hazmat chemicals in iso-tanks; just-in-time delivery; hazmat certified; outsourcing; tolling; private labelling

Assets: 6 warehouses across the US

CFI World

2019 Sales: $15.8m (14.1m)

Robakowo, Poland

[*www.cfworld.pl*](http://www.cfworld.pl)

CEO: Klaudiusz Dominiak

Products: Cellulose ethers; SBS and NBR polymers; tartaric acid; redispersible powders; titanium dioxide; petroleum resins; self-leveling additives; styrene-acryl and acryl dispersions; antifoams; hydrophobic impregnates;coalescent agents; lithium carbonate; gum resins

Services: Blending; packaging; storage; raw materials laboratory tests

Assets: Warehouse; laboratory with full equipment for dry and wet applications

Trading sales: 5%

Saiper Chemicals

2019 Sales: $15.5m (Rs 1.11bn)

Mumbai, India

[*www.saiper.com*](http://www.saiper.com)

Managing director: IBV Raghavan

Products: Additives (amine neutralizer, adipates, propionates, saturated block polyethers); amines (ethanolamine, ethyleneamines, isopropanolamines); C4 chemicals (BDO, NMP, THF, MPDiol Glycol, TBAc,); coalescing aids (Texanol, OE 300, TXIB, Coasol, Coasol 290 Plus); glycol ethers (E-Series & P-Series); propylene glycols; pine oil based derivatives tall oil rosin, TOFA, DTO, rosin esters and rosin ester emulsions; specialties (1-2 diaminocyclohexane, 2-ethylhexyl acetate, 2-ethylhexylglycerin, caprylyl glycol, dimethyl succinate, di-n-butyl ether, isoamyl alcohol, vinyl-2-ethylhexanoate)

Services: Custom blending and repackaging; formulation; drumming

Assets: 2 offices; 3 warehouses (1 owned); blending/formulation unit

EMCO-Inortech

2019 Sales: $15.4m (C$20m)

Terrebonne, Quebec, Canada

Vice president, sales and marketing: Jean-Baptiste Moranta

Products: Specialty chemicals for coatings, adhesives, sealants and elastomers (CASE); resins; additives; pigments

Services: R&D

Assets: 2 offices; 1 R&D laboratory

Royale Group (AWSM, Shorechem, Royale Pigments)

2019 Sales: $15m

Paramus, NJ 07654, US

[*www.royalepigments-chem.com*](http://www.royalepigments-chem.com)

CEO John Logue

Products: Alkali fluoroborates, fluorides, metal fluoroborates, nitrates/nitrites, borates, specialty organic/inorganic fluorines, pearlescent fluorescent iron oxides

Services: Stock, supply chain management, consulting, blending, grinding

Assets: 5 warehouses, 2 converting locations

TECNOSINTESI

2019 Sales: $13.5m (12m)

Bergamo, Italy

[*www.tecnosintesi.com*](http://www.tecnosintesi.com)

Sales and marketing manager: Michele Angius

Products: Adipic acid (AA); ammonium polyphosphate (APP); acetyl tributyl citrate (ATBC); butanediol (BDO); cyclohexane-dimethanol (CHDM); diallyl phthalate (DAP); hexanediol (HDO); isophthalic acid (PIA); monobutyltin oxide (MBTO); monopropylene glycol (MPG); polyethylene wax; p-tert butyl phenol (PTBP); tartaric acid; trimethylolpropane (TMP); zinc oxide (gold; green and active)

Services: Trading; sourcing of specialties; storage; blending and repackaging; full service from sourcing to DDP delivery, including handling of emergencies

Trading sales: 70%

Stort Chemicals

2019 Sales: $12.2m (£9.2m)

Bishops Stortford, Hertfordshire, UK

[*www.stortchemicals.co.uk*](http://www.stortchemicals.co.uk)

Managing director: Richard Gilkes

Products: Resins; pigments and additives for coatings (paints, inks and adhesives); colorants for paints and thermosets; fluoro-surfactants; raw materials for flavors and fragrances

Services: Technical sales; storage

SMA COLLABORATIVES

2019 Sales: $10.6m

Cincinnati, Ohio, US

[*www.smacollaboratives.com*](http://www.smacollaboratives.com)

President: Saad Ashoor

Products: Anti-aging actives; emulsifers; extracts; aroma chemicals; peptides; vitamins; thickners; preservitives; natural ingredients; surfactant concentrates; natural oils; microbiome ingredients

Services: Custom blending; repackaging; formulations; sales in 5 US states

Assets: 3 warehouses; formulations lab; production facility

CB Chemie

2019 Sales: $10.0m (8.9m)

Baumgarten, Austria

[*www.cbchemie.at*](http://www.cbchemie.at)

CEO: Christian Braunshier

Products: Specialty chemicals for coatings and construction; thickeners; binders; pigments

Services: Blending; development of formulations; consulting; packaging; storage; stock control; vendor management

Assets: R&D laboratory

Trading sales: 5%

An Loc Phat International

2019 Sales: $10m

Ho Chi Minh City, Vietnam

[*www.anlocphat.com.vn*](http://www.anlocphat.com.vn)

Managing director: Harry Nguyen

Products: Synthetic rubber; rubber chemicals; silicone rubber; polyurethane; construction chemicals

Services: Import

Assets: 5 warehouses

Trading sales: 20%

ChemCeed

2019 Sales: $9.4m

Chippewa Falls, Wisconsin, US

[*www.chemceed.com*](http://www.chemceed.com)

President: Marimel Enderes

Products: Plasticizers; corrosion inhibitors; additives; solvents; fatty acids; alcohols; specialty chemicals; industrial chemicals; food additives

Services: Blending; packaging; labelling; storage; consignment; JIT delivery

Assets: 4 warehouses

Abbey Chemicals

2019 Sales: $9.2m (£6.9m)

Great Yarmouth, Norfolk, UK

[*www.abbeychemicals.co.uk*](http://www.abbeychemicals.co.uk)

Director: Tyson Bonham

Products: Monoethylene glycol; monopropylene glycol; butyl diglycol; monoethanolamine; acetic acid; ferric chloride; caustic soda liquor and pearl; copper sulphate; magnesium sulphate; potassium nitrate; calcium nitrate; boric acid; zinc sulfate; manganese sulfate; phosphates

Services: Storage

Assets: 3 warehouses; 6 trucks and 7 trailers; 5 ADR drivers; offshore marine base facility; 12 offshore tanks

Trading sales: 8%

CLARIQUIMICA

2019 Sales: $8.1m

Sao Paulo, Brazil

[*www.clariquimica.com.br*](http://www.clariquimica.com.br)

Products: Pigments and additives; pigment dispersions; paper and textiles chemicals; carbon black; iron oxide; dyes for paper and textiles

Services: Blending; packaging

Assets: Warehouse; 1 truck

Trading sales: 70%

QUIMICA MER

2019 Sales: $6.1m (5.5m)

Toledo, Spain

[*www.quimicamer.es*](http://www.quimicamer.es)

CEO: Javier Huerta Gonzalez

Products: Solvents, thinners and green solvents; paints and coatings raw materials; adhesives and sealants raw materials; aroma chemicals and cosmetics raw materials; softeners and detergents; emulsions and copolymers; antifreezing formulated products; epoxy resins; pharmaceutical and agrochemicals raw materials; organic and inorganic chemicals; aeronautic and automotive raw materials; water treatment chemicals; ink and printing chemicals; food ingredients

Services: Bulk storage; blending and formulations; packaging and bulk deliveries; logistics and outsourcing; laboratory analytical services to third parties; e-invoicing

Assets: 1 warehouse (bulk and packaged storage); 1 bulk tank car; 2 trucks

Petrico

2019 Sales: $4.2m (£3.2m)

Sandbach, UK

[*www.petrico.com*](http://www.petrico.com)

Managing Director/CEO: Andy Lamb

Products: Specialty chemicals; antifoams; rust preventatives; lubricant and fuel additives and packages

Services: Warehousing; packaging; logistics; procurement

Assets: European warehouses

KETSIN DE COSTA RICA

2019 Sales: $1.4m

[*www.ketsincr.com*](http://www.ketsincr.com)

CEO: Cesar Marin

Products: Titanium dioxide; carbon black; pigments; emulsions; alkyd resins; polyester resins; masterbaches; additives; plastics; polyethylene; solvents; aromatics; specialty products; food additives; sanitizers; caustic soda; consumer products; household and personal care ingredients

Services: Storage; packaging; safety stocks and blends

Assets: 2 warehouses; 2 transportation fleets

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JOURNAL : Farmers Weekly

The meat levy bodies for England, Scotland and Wales are launching a £1.2m national advertising campaign to try to encourage consumers to use more high-end cuts of beef.

Running for 12 weeks, the “Make it with beef” campaign will include TV ads, video, radio and social media content.

It aims to inspire consumers to create restaurant-style meals in the comfort of their own homes, using a variety of high-quality hindquarter cuts.

See also: UK and US meat sectors battle supply chain challenges

Since the coronavirus lockdown at the end of March and the closure of restaurants and pubs, there has been a sharp downturn in sales of steaks and roasting joints, and an uplift in cheaper products such as mince.

To meet demand for mince, processors are having to use higher-value hindquarter and steak cuts, which leads to a drop in the overall retail value of the carcass and a subsequent drop in potential returns to beef farmers.

Joint effort

A statement from the levy boards said: “This is a unique joint effort by AHDB, Quality Meat Scotland and Hybu Cig Cymru, which we hope will drive an uptake in steak and roasting joint sales in the run up to barbecue season.”

The campaign is being funded from the £3.5m pot of AHDB red meat levies ring-fenced for collaborative projects, which is managed by the three GB meat levy bodies.

This fund is an interim arrangement while a long-term solution is sought on the issue of levies being ***collected*** at point of slaughter in England for animals that have been reared in Scotland or Wales.

The campaign will be supported with “how to” videos and cooking tips, and influencer-driven content.

It aims to reach 85% of UK households in the coming months.

JOURNAL : Farmers Weekly

Good management and selection of gilts is fundamental for maintaining a productive herd.

Emerging evidence suggests the environment in which a gilt is reared during her suckling, nursery and finishing stages, as well as during her period as a maiden gilt, can have an effect on her lifetime performance.

What’s more, AHDB figures suggest it typically costs about £250 to rear each gilt, so putting the groundwork in to make sure they get past their first or second parity and reach their full lifetime potential is vital to get a return on that investment.

See also: Guide to maximising conception rates in gilts

Farmers Weekly spoke to Andrew Palmer and Pat Loten, knowledge exchange managers at AHDB Pork, about the key areas to focus on when it comes to improving gilt management and conception rates.

Selecting gilts

Before beginning the selection process, it’s important to ensure you have retained two-and-a-half times the number of replacement females needed.

This allows for dropouts during the selection process and ensures there is a big enough pool to pull replacements from at the stage you start to regulate their heats – about three weeks before service.

In terms of the selection criteria itself, key gilt requirements include:

A minimum of 14 functional teats

Good conformation

Sound dam history: Only select gilts from sows with the best reproductive performance. Look at numbers born, numbers weaned and her farrowing index, as this will be hereditary

Birthweight: Only choose good, strong gilts at birth that weigh more than 1kg (evidence suggests gilts born weighing less than 1kg produce 4.5 less piglets across three parities)

Another selection process should be carried out at weaning, pulling out any gilts that have not met the target weight.

It is also important to select gilts with good weaning weights to reduce post-weaning check. Ideally, the gilt should weigh about 5kg at 21 days old, and 7kg-plus at weaning

This target has to be flexible, as growth can be inhibited during the summer

This second selection double checks again for any conformation issues that have appeared since the first selection at birth – for example, dipped backs, ruptures/hernias or poor legs

Final selection should be made about at 140 days or 90kg.

Visually evaluate the legs, underline, vulva, ease of movement and overall conformation

Growth rates and fatness – or leanness – should also be taken into account during the final selection process

Feeding the gilt

Gilts that have made it through the selection process can stay within the regular grower/finisher group on the normal ration until they reach 80kg.

They should then be removed from the commercial flow and managed separately.

The use of a gilt ration is important to allow adequate growth rates, fat deposition and bone growth at this key stage.

As a result, a key component of the diet should be calcium phosphorus, as this is one of the main drivers for promoting bone strength and good growth rates.

Three weeks before their first service (when gilts weigh about 140kg), they should receive ad-lib quantities of feed to cause a reproductive flush, which subsequently improves egg numbers and egg quality.

Vaccinating the gilt

Vaccinations will depend on herd health status and the status of the incoming gilts. Any vaccinations should be given in discussion with your vet and in line with your herd health plan.

The most common vaccinations include erysipelas (x2), parvovirus and porcine reproductive and respiratory syndrome (PRRS).

Other vaccines should cover enzootic pneumonia, porcine circovirus disease (PCVD), clostridia, and E coli.

A controlled-exposure technique can be used to "bug up" the gilts to your farm's specific pathogens. As an example, old bedding could be used to allow them to build up an immunity to these pathogens.

Measuring gilt development

Gilt performance makes up 20-25% of a herd's total performance at any time. Good gilt management will help to optimise sow longevity by reducing the number of prematurely culled animals (culled before parity three)

Keeping track of changes in performance over time means you learn what works for your unit, in terms of herd management and environment, motivating yourself and the team to do more of this. It also provides early warning if performance starts to deteriorate.

As a general rule, during gilt development producers should be looking to monitor:

Birth weight (more than 1kg)

Conformation - good legs, udder line and general body shape

Weaning weight - target 7kg

Serve at 220-240 days,140-150kg liveweight with 18mm backfat

Conception rate - target 95%

Farrowing rate - target 5% more than the herd average for sows

Total piglets born alive - a gilt will generally produce one less piglet than a sow per litter, so target your herd average minus one (AHDB sow average = 14.84)

Born alive - target more than 12 piglets

Reared - target  more than 11 piglets

Preparing for service

Low birthweight will increase early removal from the herd due to anoestrus (lack of heat) before first mating, and gilts weighing less than 1kg at birth often produce fewer total born piglets at the first farrowing and consequent litters.

When preparing gilts for service, typical targets to look for include:

135-170kg liveweight

220-270 days of age

Body condition score of 3-3.5

Where a progestagen is used to control oestrus, there are a number of best-practice principles that should be followed to ensure at least 90%+ of gilts are cycling five to seven days after withdrawal.

Ensure the gilt has already reached puberty and do not start the programme if the gilt is already in oestrus

Try to feed the gilts individually or use a new oral doser; gilts can be trained with apple juice or cod liver oil

If group feeding, initially give 1kg of feed plus the progestagen per gilt; distribute, allowing sufficient space for the gilt to eat her allocation and then feed the remaining daily allowance once the treated food has been consumed

Once the progestogen has been withdrawn, gilts should be placed on ad-lib feeding and receive daily boar contact to stimulate oestrus as normal

From a stockperson’s perspective, it is important gilts are familiar with both the routine of moving to the heat detection/AI facilities and they are also allowed to explore the area, including meeting the boars.

Familiarisation will reduce stress, promote calm gilt behaviour and strong standing reflexes during insemination.

JOURNAL : Farmers Weekly

The drop in global and domestic energy markets makes it vital generators of renewable energy shop around for the best price on power sold to the grid.

Power purchase agreements (PPAs) are one of several routes to market for electricity sales, typically suited to farmers or landowners with installed generating capacity exceeding 100kWp and compulsory for those claiming renewable obligation certificates (ROCs).

Many supply companies offer standard PPAs, which allow electricity generators to lock into a guaranteed price for exported electricity, based on the wholesale price at the time of fixing.

See also: Farm buildings - know your permitted development rights

Fixed periods are typically three months to two years, with longer-term fixes usually more desirable when prices are high, and shorter periods when prices are down.

Current PPA prices have not been immune to the steep decline in wholesale energy markets, driven by low oil and gas prices.

Charles Ward, from consultancy New Stream Renewables, says a typical solar PPA price has almost halved over the past year to about £30-£35/MWh, excluding “embedded benefits” (see below).

Embedded benefits

Embedded benefit payments effectively reward suppliers for contributing to the local lower-voltage network and are paid on top of the fixed electricity price available through a traditional PPA.

Payments vary considerably depending on regional supply and demand factors, but can be worth £3-£15/MWh.

The Renewable Energy Guarantee of Origin certificate adds about £0.35-£1/MWh depending on generation technology.

Traditional PPA prices have therefore been overtaken by the main alternative for Feed-in Tariffs (Fits)-accredited installations – the Fits export tariff – and there seems little sign of any immediate turnaround, he says.

“The Fits export tariff was originally only offered by mandatory Fits licences (the "Big Six" suppliers), with prices initially at £30/MWh, which was below the wholesale price.

"However, with changes to legislation, we’ve seen more suppliers enter the market, and the export tariff level has risen with inflation to £55/MWh, which is now a considerable premium to a standard PPA.”

The Fits export tariff is separate from the Fits generation tariff, and offers an index-linked fixed tariff for 12 months on electricity exported to the grid. Ofgem sets the tariff and it is paid through electricity suppliers.

Contractual terms are similar to a traditional PPA, but they exclude additional payments for “embedded benefits”, apart from Renewable Energy Guarantee of Origin (Rego) certificates, which certify the energy as green.

Mr Ward cautions that anyone opting out of a Fits export tariff must allow 12- months before signing up again – similar to with a standard PPA.

Commercial factors determine the most suitable PPA for any business, and with many different deals available, it is worth shopping around at every renewal. “The difference between the best and worst deals could be worth £30,000 a year for a 500kWp anaerobic digestion site,” he says.

“It’s a very dynamic market that can see aggressive bidding for sites. Online portals do not necessarily cover the whole market and do not allow the human element of market timing and customer support, so it is well worth using a reputable intermediary with good market access.

“Always seek clarity about their fees and get them to provide a list of the companies they go to for a quote.”

Tips to get a good PPA deal

Shop around as many PPA providers as possible - don’t just renew with your existing supplier.

Use a reputable broker or intermediary with good market knowledge and proven track record.

Start early – three to six months before your current deal ends.

Compare deals equally, considering energy pricing, length of fixed period and value of embedded benefits (if applicable

If using a broker, check which companies they go to for quotes, and ask for full details about fees before committing – for example, is it a one-off upfront fee or a fixed fee per MWh deducted through the supplier?

Ensure companies are not binding you into a new agreement or committing you to use their service when getting a price quote.

Read paperwork carefully before signing.

JOURNAL : Farmers Weekly

Weaning calves can be a stressful event for both the cow and calf, but it is necessary to give the cow time to recuperate in time for the next breeding event.  There are steps that can be taken to minimise stress and reduce growth checks.

Katharine Shepherd from Bishopton Veterinary Group gives her advice for weaning suckled calves.

When should calves be weaned?

Feed supply and cow condition should determine when to wean. Calves should be at least five months old.

By 200 days old, calves should be getting 75% of their nutritional needs from sources other than milk. Therefore, feeding the calf directly will be much more efficient than feeding the cow to produce milk at this stage.

See also: How a ‘two-step weaning’ approach can reduce calf stress

If the cow is in poor condition, calves should be weaned immediately to allow the cow time to recover before beginning her next lactation.

Conversely, if cows are fat, delaying weaning can help to reduce some condition before the next calving.

Spring calving cows should be managed to gain condition over the grazing season, which can then be mobilised over winter. Spring-born calves should be weaned two to three weeks prior to housing.

Autumn-calving cows should be weaned at least one month prior to calving for the udder to recover and quality colostrum production to be achieved.

How can you minimise stress at weaning to minimise growth checks?

It is advised not to dehorn or castrate cattle within a month either side of weaning.

Ensure housing is well ventilated and stocking density not excessive. It is also helpful to clip a 30cm-wide strip along a calf’s back to help reduce sweating.

Calves should be vaccinated against possible respiratory diseases and clostridial disease prior to housing to ensure they have the best chance of not succumbing to growth-limiting disease or even death.

Calves from different groups will potentially have been exposed to different bugs and have different levels of immunity, therefore it is best to avoid mixing groups and ages.

Should you creep feed calves?

Creep feeding has many benefits that can make it cost effective in a lot of herds.

The use of creep feed can lead to:

Increased weaning weight

Reduced growth check at weaning due to reduction in stress

Reduced pneumonia at housing due to increased feed intake and reduced stress

Efficient feed conversion: 4kg of creep feed can provide about 1kg of weight gain.

If you are breeding replacement heifers to calve down at two years old, creep feeding can help to achieve the required growth rates.

When should you start to offer creep?

Timing will be dependent on forage availability as well as cow condition and the calf's breed, along with its growth potential.

Six to 10 weeks prior to weaning is a good time to start putting out creep feed. If bulls are going to be intensively reared, you may wish to start sooner – for example, 12 weeks before weaning.

Alternatively, if cows are in good condition or particularly milky and conditions for creep feeding are difficult, you will still see a benefit starting four to six weeks before weaning as this still allows the gut to adapt to hard feed.

A notable exception to this may be native-breed females, which can be prone to laying down fat and will be finished later.

Advice on transitioning from creep to a grower ration

After weaning, initially continue to creep feed along with the grower/finisher ration to smooth the transition. Make sure a good forage source is also available to reduce likelihood of acidosis.

If you are selling calves at weaning, it is useful to tell buyers what they have been fed so they can provide a similar concentrate.

What weaning method should be used?

I would recommend the use of a nose flap but not fence-line weaning. Several farms have reported reduced stress and noise from both cows and calves with the use of a nose flap for one week prior to separation.

However, an AHDB study showed fence-line weaned calves spent 65% of their time pacing and vocalising very close to the fence, indicating that being physically separated while still being able to see and hear the dam is a major source of stress.

Although this study did not find nose flaps to be beneficial (used for 17 days) either, I have plenty anecdotal evidence of farmers using nose flaps for a shorter period and seeing a real benefit.

Key performance indicators (KPIs) to consider at calving and weaning

1. Number of calves weaned per 100 cows and heifers put to the bull

Your target should be 94, although 90-92 may be a more realistic initial target.

Clearly, this target will be hugely influenced by the number of calves born.

You should look closely at these two KPIs in conjunction with each other.

A satisfactory number of calves born but not weaned suggests issues with the rearing process.

Keep records of the age of mortality to help guide you and your vet towards the most likely causes and areas to focus on for improvement.

2. Calving spread (the number of animals calved in the first three weeks as a percentage of the number of animals put to the bull)

A good target would be 65% in the first cycle and a further 30% in the second cycle.

A tight calving pattern demonstrates good fertility and will help with management tasks around weaning, as calves will be of a more similar age and size.

3. Cow efficiency (weaned calf weight, adjusted to 200-day weight, as a percentage of the dam)

The higher the percentage, the more profitable the dam is. Suggested target is 50%.

This KPI focuses on weaning weights relative to mature cow size and can be useful to help with culling decisions, as well as policy for selecting replacements.

JOURNAL : Farmers Weekly

A new Agriweld front-mounted cultivator offers growers the option of having a one-pass tillage and drilling system, rather than making two conventional passes.

The Mantis is a low-disturbance toolbar with legs spaced at 500mm and depth set via spacer clips on the wheel rams. There is a choice of low-disturbance points and a bank of discs can be added in front of the legs to stop trash gathering.

See also: Opico tackles arable weeds with interrow cultivators

Standard leg protection is via the firm’s new Snap-bar shear leg, which comes in four strengths and replaces the typical shear bolt protection. It speed up manually reseting the leg, while a fancier auto-rest version is also available.

Mounting the legs so close to the steering front wheels means they're subject to more strain when turning, so Agriweld has designed them to pivot slightly, helping with corners.

The Mantis is available in widths from 3m to 6m, with prices starting from £13,500. A 4m Mantis and 4m combination drill should be handled comfortably by a 280hp tractor.

JOURNAL : Farmers Weekly

After 12 weeks, we have come to the end of our busiest calving season ever. There have been tears, smiles and some frustration – isn’t there always? – but we made it.

Like many farmers during the spring, my life off the farm is put on hold for the arrival of the calves, and this year was no different.

Little did I know I wouldn’t be reunited with normality and a social life again afterwards either. For obvious reasons, this can’t be helped and won’t last forever, but it was a difficult adjustment to make.

See also: Amy Eggleston – Looking for virus silver linings

Farming is a full-on job at the best of times, and often it’s why we love it. But for many of us, working in isolation is not new.

Lots of my time is spent walking the fields, out with the animals or moving stock, all in solitude. Sometimes, this is great.

It gives me time to think, listen to podcasts or get some fresh air and exercise (like we don’t get enough of that).

Other days, a bit of company is needed. Even just some small talk can be a great comfort, especially after a difficult or long day.

It seems many people facing self-isolation due to Covid-19 have discovered how much they value and need company.

For those spending more time on their own, it is causing increased mental strain, and companies and charities are going to extra lengths to help those who are struggling with this loneliness.

For farmers, we need to look after ourselves year-round too, ensuring we talk when we need to, and know where to go for help (such as the FCN charity).

With Mental Health Awareness Week taking place from 18-24 May, it’s worth taking a minute to think about what we really do to look after ourselves.

Whether it’s getting home at a reasonable hour to see friends or family, or even just taking that time to relax, we have to prioritise looking after ourselves.

In a time of global crisis, the farming community has pulled together as usual and continued to work hard in order to #FeedTheNation.

Messages of gratitude for NHS workers and homemade rainbows have appeared in fields across the country, and many have taken inspiration from Captain Tom Moore with their own fundraising efforts.

It’s been heartwarming to see the effort made by individuals to go that extra mile. As a proud member of this community, I urge farmers to take time to look after themselves too.

JOURNAL : Farmers Weekly

The UK pig price has been virtually static this year, rising by just 1.5p/kg since the start of 2020.

The price, at 164p/kg, is 27p above the five-year average, buoyed by a world shortage of pigmeat after the catastrophic losses in China due to the African Swine Fever outbreak.

See also: Advice for selecting and managing gilts up to service

But can it remain stable in a world dogged by uncertainty? AHDB senior analyst Bethan Wilkins sets out three future challenges

1. Concerns over slaughter capacity

Self-isolation requirements under the coronavirus lockdown mean there are concerns that a lack of available staff at abattoirs could limit slaughter capacity.

UK pigmeat production in the first quarter of 2020 was 6% higher than last year as producers were encouraged to send pigs for slaughter earlier in March, in case capacity was limited by coronavirus.

Finished pig supplies have, therefore, tightened in recent weeks, also influenced by typical seasonal patterns and stagnating herd performance in late 2019.

With the pandemic ongoing, risks of disruption to slaughter remain. However, breeding herd expansion last year means slaughter levels should remain higher in 2020 overall.

2. Export competition and logistics

UK pigmeat exports (including offal) were stable in volume across January and February. However, higher prices meant the value of these shipments was up by 20% on last year.

This largely reflects strong Chinese demand. Nonetheless, the lack of export volume growth highlights challenges.

Large pork imports for Chinese New Year, coupled with the coronavirus lockdown, led to significant backlogs at Chinese ports and limited demand.

Although trade has started to move again more recently, container availability remains a logistical challenge, placing constraints on the volumes that can be sent.

On top of this, US pig prices collapsed following the closure of foodservice businesses and difficulties with slaughter capacity. Low-priced US pork has presented significant competition on the Chinese export market.

We would still expect to see our pork exports rise this year, but it is possible that the volumes and prices achievable are not quite as high as previously anticipated.

3. Changing domestic demand

Domestically, demand for pigmeat has also changed following the closure of most foodservice outlets under coronavirus measures.

Normally, about 14% of the pork consumed in Britain is out of the home.

Initial estimates suggest that pork has switched reasonably well into the increased retail demand, but it remains to be seen whether retail sales will entirely compensate for lost foodservice demand.

Nonetheless, in some areas the changing face of British demand, coupled with some export challenges, seem to have led to building stock levels, particularly of belly and shoulder cuts.

If supply chains struggle to move product, prices could come under pressure.

Stocks are also reportedly building in some key EU producers, such as Germany, where prices have declined. As a net importer of product from the EU, price trends in Germany will affect developments here.

JOURNAL : Farmers Weekly

Arla has cut its milk price from 1 May by 0.9p/litre following a reduction in the price of cream and other dairy commodities.

The change will see its standard price drop to 29.89p/litre for conventional milk and 38.93p/litre for organic milk, bringing the price back to where it stood before the 0.9p/litre rise in March.

The farmer-owned co-operative, which has some 2,500 producers in the UK, retains its position at the top of the milk price league.

See also: The benefits of using fresh semen versus frozen

Reduced demand

Commodity prices have been falling since the outbreak of the coronavirus crisis following the closure of food service businesses, which has reduced demand.

However, Arla is among the least-affected UK processors as it has a number of supermarket liquid milk supply contracts, including Asda's exclusive Farmer's Milk brand.

It is also the UK's biggest cheese producer, has its own brand of yoghurts, and makes Lurpak and Anchor butter.

Arla Foods amba board director, and farmer owner, Arthur Fearnall, said: “Because of the COVID-19 pandemic and the actions taken by governments to limit its spread, the dairy market has moved into unprecedented territory.

"Despite some short-term increase in retail sales, the closure of many food service businesses – alongside the spring peak in milk production and the uncertain global economic outlook – has caused significant reductions in commodity market prices across all categories in the space of a few weeks.

Following a meeting last week between Defra, farming unions and dairy processors, the government said it would take further steps to ease competition laws and allow processors to collaborate and more easily move milk supplies to where there is demand.

Arla's ***agriculture*** director, Graham Wilkinson, said the firm welcomed the opportunity for the industry to work more closely together at this time and build robust plans to navigate through the crisis.

JOURNAL : Farmers Weekly

Bean growers are being advised to monitor crops and weather conditions closely, as diseases such as chocolate spot could rapidly infect crops when the weather does break.

Becky Howard, Processors and Growers Research Organisation (PGRO) research and development manager, warns growers that if wet and humid weather conditions arise, crops could come under pressure from disease spread.

Currently, the dry weather means there may be low levels of potential threat from chocolate spot disease inoculum on the lower leaves of bean plants, but that could change.

See also: Kent grower hits 8t/ha yield with winter bean crop

Once chocolate spot has taken its toll, it is extremely difficult to overcome, which is why an early protective spray is essential, if wet weather conditions pose a real risk.

“We don't recommend growers to spray as a precaution. We only advise applications where necessary, which is why monitoring and keeping a close eye on weather conditions is key,” she says.

Dr Howard also highlights that where winter beans have been planted in the spring, the risk of disease may be reduced further.

Control

Winter beans that were successfully planted in the autumn are now beginning to flower and will enter the pod-development stage in the next few weeks, where control for chocolate spot should be applied during early flowering, if required.

“It's critical not to miss the first pod stage for chocolate spot control, which often occurs during mid-May,” she adds.

The prevention of disease spread to non-infected new leaves was previously controlled with the use of chlorothalonil-containing fungicides, such as Alto Elite, which is now set to be banned from 20 May this year.

Alternative chemical control includes Amistar (azoxystrobin), Folicur (tebuconazole) and Signum (boscalid + pyraclostrobin), with trials from the chemical firm Sygenta, showing the SDHI Solatenol also provides good control in a T1 application.

Dr Howard also highlights that to reduce resistance build up, one active should be used at a full-rate with a mix partner at a lower rate and in high risk situations cutting back the rates of products poses a risky strategy.

Rust

Rust outbreaks in bean crops also remain low, with no infections reported this season, explains PGRO research and development manager Becky Howard.

Periods of prolonged hot, dry weather over the summer has in previous seasons increased the threat of rust developing later in the growing season, predominately after flowering.

“Due to the mild winter, there may be a small amount of overwintered rust on volunteers, but there has been no reports of the disease on crops,” she says.

However, Dr Howard advises growers that the situation can change quickly, with rust build-up able to develop earlier in the season if weather conditions become hot and dry.

“In late May and early June, the risk of rust increases as the disease becomes more prevalent. Growers must ensure the disease does not begin to build up during pod fill, as this will rapidly defoliate the plants, leading to yield losses,” she says.

Similarly to chocolate spot, rust can be controlled using products containing either azoxystrobin or tebuconazole, which should be applied from mid-flowering onwards, with tebuconazole providing particularly good control.

JOURNAL : Farmers Weekly

A Rothamsted researcher whose work into pest-eating beetles has been badly disrupted by the coronavirus lockdown is appealing for help from farmers.

Kelly Jowett, whose PhD is co-supervised by Reading University, had planned to run a series of farmer workshops – but has instead been forced online to seek their opinions.

Ms Jowett is investigating the benefits of ground beetles in crop protection.

See also: How to increase beneficial insects in arable crops

She said: “With increasing restrictions on pesticides, and public opposition to chemical use, ***agricultural*** researchers are looking for new pest management options.

“Paramount to this is ensuring these are effective and applicable to real world situations.”

Ms Jowett hopes to discover which farm management practices can encourage ground beetle species that have a proven role in crop protection, while helping farmers.

20 minute survey

She has set up an online survey that takes less than 20 minutes to complete and is appealing for help across social media using the hashtag #BeneficialBeetlesSurvey

“I had originally planned farmer workshops to accompany the questionnaire, which may not be possible in my PhD timescale due to Covid-19,” she said.

“So I’m humbly requesting as many farmers as possible take part or help spread the word, so that I’m able to ***collect*** and analyse meaningful ***data***.”

The survey needs input from all sectors, as ground beetles are beneficial on all farm types.

Studies have shown that ground beetles eat a range of important crop pests and can control the populations of livestock pests too.

Ground beetles also support biodiverse habitats and provide food resources for threatened farmland wild birds.

The Beneficial Beetle Survey can be completed here.

JOURNAL : Farmers Weekly

Berkshire milling wheat grower Nick Philp is cutting his nitrogen fertiliser use by using a foliar product while increasing his chances of hitting breadmaking quality.

Feeding little and often with foliar nitrogen helps his crops thrive on his droughty soils, and he now has a 100% success rate in hitting milling protein standards across nearly 600ha of quality wheats.

Reducing nitrogen means less potential leaching into watercourses, which is set to be of heightened importance in a future more environment-focused farm policy.

“In the context of nitrogen use and climate change, this helps tick all the boxes,” he tells Farmers Weekly.

See also: How to make sure you hit protein target for milling wheat

Net zero farming

Indeed, lower nitrogen use will help reduce ammonia emissions and fit in with the NFU’s aim of net zero farming by 2040, while also working smarter on the farm by using fewer inputs.

Before his partial switch to foliar Mr Philp found that he was using more and more nitrogen fertiliser, up to 250kg/ha and more, to produce 13% protein milling wheat, with costs and environmental concerns rising while he was hitting premiums only about 90% of the time.

“Over the last two years we have had no problems hitting milling specifications with protein levels well over milling standards,” he says.

He is growing the varieties Zyatt and Skyfall for milling group Heygates to a minimum protein of 13%, and also the German “E” or top quality elite wheat variety Nelson to 14% protein. The miller offers buy-back contracts for this variety.

For breadmaking use millers generally looks for wheats with 13% protein, 250 hagberg and a specific weight of 76kg/hl.

Three-way split

Mr Philp has maintained his base 200kg/ha three-way split of a soil-applied urea/ammonium nitrate (UAN) liquid, and then replaced a further 50kg/ha dose at the flag leaf stage by three applications of the foliar product PolyNPlus.

This product is formulated with ureic polymers and a 3kg/ha individual dose is applied to the leaf rather than to the soils. It is sprayed on to the wheat with the T1, T2 and T3 fungicides, giving a total nitrogen usage of 209kg/ha.

Mr Philp says he is now considering reducing his base 200kg/ha level of nitrogen down to 180kg/ha, or even 150kg/ha, and still hopes to hit valuable milling premiums.

There is little material cost benefit in switching to the foliar products, but there are benefits to the environment, reducing passes through the crop, giving healthier crops and a better rate of hitting the milling price premium.

The old flag leaf application of 50kg/ha of UAN was applied as a separate operation using dribble bars on the sprayer, and sometimes an additional ear application was taking nitrogen use above 250kg/ha.

Standard breadmaking wheat quality targets

Protein content

13%

Hagberg (gluten quality)

250 seconds

Specific weight

76kg/hl

Big advantage

Syed Shah, an agronomist with crop consultant Niab, agrees that there is a big advantage in reducing the number of passes through crops, and in being able to apply the foliar nitrogen with a conventional sprayer.

“The foliar product can be applied with fungicides at the T2 and T3 stages and is taken up rapidly by the plants,” he says.

Mr Philp’s regime is to apply his base 200kg/ha of nitrogen in a three-way split by the end of April – 50kg/ha in early March and 75kg/ha doses in early April and again in late April – and then three PolyNPlus doses applied at T1, T2 and T3 along with magnesium, sulphur and potassium.

He is farming 1,200ha from his base at Church Farm, Waltham St Lawrence, between Reading and Maidenhead, on soils ranging from light sandy loams to silty clays in the Thames Valley, with half of the farm down to quality milling wheats.

Yields of these milling winter wheats average 8.5t/ha on soils which can suffer from drought in a dry spring, and this is his fourth year using foliar nitrogen.

Fungicide spend

Mr Philp’s plans for the future include reducing his fungicide spend, as the foliar nitrogen is producing healthier crops, while he is looking at testing his grain to check he is getting his crop nutrition right.

“Healthier plants lead to less stress and these tend to be less attacked by disease,” he says.

Dr Shah agrees and adds that there are signs that the use of foliar nitrogen has helped control mildew.

Advantages of foliar nitrogen

Benefits the environment by applying less overall nitrogen

Cuts costs by reducing the number of passes through crops

Healthier crops due to better nitrogen uptake in dry seasons

Better chance of hitting valuable wheat milling premiums

The foliar nitrogen product is marketed by BFS Fertiliser Services and group managing director Rosalind Platt says it has proved particularly useful in improving the uptake of nitrogen in dry springs. The product contains ureic polymers, sulphur and trace elements.

She points out that as PolyNPlus is applied to the leaves rather than the soil – as with solid and most liquid fertilisers – there is better uptake of the ***nutrient*** and a reduced chance of scorch.

JOURNAL : Farmers Weekly

A new on-farm measurement for dairy cow buildings, known as living space, has been developed to provide a better understanding of space allowances for adult dairy cows.

Researchers believe living space is a better way to measure cow space than the traditional definition, loafing area, which is ambiguous, lacks industry consensus and causes confusion among farmers, they say.

See also: 6 housing tips for better dairy production and welfare

PhD student Jake Thompson, from the University of Nottingham, visited 50 randomly selected farms in Great Britain once during the winter housing period of 2017/18 to investigate how much space housed dairy cows were given.

During visits he measured adult dairy cow accommodation and captured farm management information and farmer opinions on space allowances.

Most farms housed cows in cubicles, and herds had a mix of calving patterns: block and year-round.

The AHDB-funded study found farmer definitions for loafing areas and their opinions of loafing space importance were hugely variable, which was unsurprising given the lack of industry consensus, says Mr Thompson.

Results showed:

Farmers felt loafing space was essential for cow welfare with half of respondents scoring this eight out of 10.

Respondents differed on the definition of space with 42% of farmers saying they thought all passageways were classified as loafing space

Loafing space varied widely from 0.5 sq m  to 6.42 sq m.

Farms in the North of England and Scotland were in the bottom 50% for allocation of living space, while farms in the South West gave the most – possibly because farms with greater space tended to have outdoor loafing areas (these farms were located in lower rainfall areas).

Mr Thompson said the results were not surprising given that little research has been carried out into loafing area requirements and even industry guidelines for space requirements vary greatly.

Red Tractor recommends a minimum of 6.5 sq m total space per cow, and AHDB recommends 10.5 sq m per cow.

He concluded living space was a better measurement for the dairy industry to use because it makes it easier to compare space across farms with different cubicle housing set-ups.

For example, a farmer with a new shed containing 4-4.5m passageways – which is great for cow flow and above industry guidelines – would score poorly using loafing space guidelines because passageways are usually excluded from this measurement, he said.

In comparison, living space (see definitions box) promotes the use of wide passageways as a positive, but at the same time, would also increase for farms where farmers had modified traditional buildings by providing cows with outdoor space.

“Living space has a set definition which allows comparisons to be made between different housing layouts,” he added.

Cow space in numbers

6.5 sq m Minimum total space required per cow under Red Tractor assurance standards

10 sq m Recommended total space required per cow under RSPCA standards

3 sq m Red Tractor recommended loafing space requirement

Space and cow welfare

To ascertain what difference space actually makes to cow welfare, researchers at the University of Nottingham are now in the process of comparing two groups of cows: one group given 3 sq m of living space per cow and another group given double this.

They will assess and compare:

Reproduction (calving to conception time)

Production (yield and milk solids)

Behaviour (cows are fitted with sensors to monitor how they use the space)

Health and disease (lameness and mastitis incidence).

Results from the study will be available next year. If space does have a positive effect on cow welfare, Mr Thompson believes more research will be needed to find out how much space cows should be given.

“All of the information around loafing space is very ambiguous and we have all these recommendations, but none of them are based on any evidence.”

“Rather than pluck another number out of thin air and come up with another number farmers don’t really understand, we need to understand how it affects cow welfare and how the economics stack up.”

Definitions explained:

Loafing space: Non-feed, non-lying, non-passageway areas where cows can roam freely either indoors or outdoors. For example, indoor or outdoor concrete or woodchip pads not used for bedding.

Living space: a bespoke definition that includes the additional space available for dairy cows above the baseline requirement for movement and feeding, excluding lying areas.

It accounts for wider passageways and additional outdoor areas and therefore provides a useful estimate of true available space.

Accurately estimated using the formula: (total housed area per cow at maximum stocking density x 0.83) – (cubicle area per cow at maximum stocking density \*1.28) – 0.79

JOURNAL : Farmers Weekly

Buckinghamshire beef and arable farmer Richard Heady says his plans have been thrown into disarray after a cow tested positive for bovine TB at his farm.

Mr Heady, who runs WF Heady and Sons near Milton Keynes in partnership with his father and uncle, said the positive test “came like a bolt out of the blue”.

It’s the first time a cow has ever been found to have TB on the farm – and Mr Heady fears this could be the start of a “terrible journey”.

See also: Analysis: Can switch to vaccines work in bovine TB battle?

He told Farmers Weekly: “We have had the odd small bump on a cow before, but it’s never been enough to register it as a reactor.

“Anything minor we send off to slaughter and it has always come back as negative. You always know it’s a possibility [bovine TB], but when it does happen to you, you feel dumbfounded.”

The annual TB test was carried out on the herd of 120 beef cattle on 27 March. One nine-month-old Charolais cross Angus heifer tested positive for the disease.

“It was a home-bred beast that had not been mixing with any other cattle and was reared on the farm. The bull has been on the farm for two to three years, the cow for five years,” said Mr Heady.

Annual spring testing

The rest of the herd, including all the animals that were previously bought from Thame Market, tested clear.

Every spring after the herd goes clear, the cows are taken off to the quieter reaches of the 400ha mixed farm.

Mr Heady’s uncle also usually buys in more store calves from neighbours – which tend to be over 12 months old – to fatten on the farm’s fresh, home-grown grass.

It’s a relationship the Headys have built up over the years and it works well, allowing them to restock ahead of the summer.

But the positive TB test has scuppered these plans.

“We’re stuck with these cattle now,” said Mr Heady. “We’re low on cattle numbers and we have lots of grass and space. We are wondering how we can make the best of this situation.”

Mr Heady has no idea how the cow became infected. But he has recently seen badgers on his fields, which may have spread the disease to the animal.

“There are no badger setts on our farm, but I’m concerned that some of our badgers may be infected,” he said.

“As far as badger culling is concerned, I’m sat on the fence. It might be a necessary evil. But surely there is a better way to do it?”

Movement restrictions

Mr Heady is looking at different ways to raise income by letting out the fields to neighbours or making silage and selling it. He is also thinking about practical measures to “badger-proof” the farm.

The herd has been placed under movement restrictions until it has completed two consecutive clear tuberculin skin tests. Defra rules state that no movements of cattle onto a TB-restricted holding are permitted.

Buckinghamshire is part of the Edge Area that was established in 2013 as part of the government’s strategy to achieve officially bovine tuberculosis-free (OTF) status for England by 2038.

A total of 283 reactor cattle were detected in the county during 2018 – an increase of 63 reactor cattle from 2017, despite the total number of TB breakdowns decreasing from 36 in 2017 to 31 in 2018.

JOURNAL : Farmers Weekly

Farmers Weekly’s Britain’s Fittest Farmer competition will happen later in 2020 than it did in 2019 as a result of the coronavirus pandemic, which means you’ve got even more time to submit your entry.

This unique competition champions fitness and mental wellbeing in ***agriculture***.

It aims to get all farmers thinking and talking about their health to make sure they are in top condition to run their businesses.

See also: Find out more about Britain's Fittest Farmer competition

We caught up with last year’s winners to hear what they’ve been busy with, and how they’ve been keeping their fitness firing and their spirits strong in these testing times.

Fiona Penfold

“One of the best things I’ve ever done,” is how Fiona describes taking part in the 2019 Britain’s Fittest Farmer competition.

“It was a cracking day,” she says. “It was a lot of fun and I loved the sense of camaraderie.”

The Somerset farmer is a strong advocate of the physical and mental benefits of exercise.

“As soon as I go out for a run or do some obstacles, I feel more able to tackle problems and face challenges.

“Running and exercise clear my mind. It definitely makes me a better farmer.”

Fiona typically fits in 20-30min, three or four times a week, with running her go-to activity.

“Come rain, shine or snow, I’ll run,” says the 39-year-old.

“Running is brilliant, especially if I’ve had a tiring day and don’t want to do a form of exercise that requires brainpower.

“You just switch off and let your legs do the work.”

The farm is a great location to run and she’s built outside obstacles – such as monkey bars and climbing hooks – on which to test herself. “It’s like Ninja Warrior stuff, a real challenge.

“Nowadays, you don’t need to be physically strong to be a farmer for the vast majority of the time, but there are moments when I realise I have got a lot stronger because, when I do the obstacles, I’m constantly lifting my own bodyweight.

"I can lift an animal now that I wouldn’t have been able to a few years ago.

“Spending an hour travelling to a gym is wasted time – that’s an hour’s exercise I could have done, so I do all my exercise at home.

“As farmers, we’re lucky, we’ve got access to all this wonderful, open space.”

Fiona also enjoys playing rugby and is aware she’ll miss that this year, with the Covid-19 crisis likely to force games to be cancelled.

“It’s usually a chance to get off the farm and mix with non-farming people.

“If you exclusively live and breathe farming, it can be quite a dark place because there’s never a week goes by when you don’t have some trauma.

"Every job has its stresses and bad weeks, but farming can be particularly intense.

"My rugby friends talk about everything else other than farming, so it’s an important physical and social outlet.

"I find that really healthy, chatting about everyday things unrelated to our farming problems.”

Fiona, who pursued a career in sales and management after studying sports science at Swansea University, took on the 65ha farm full-time four years ago.

Life is busy, but she definitely plans to find time to enter the Britain’s Fittest Farmer contest again this year.

“I love competitions, but I’m not competitive to the point where I always have to win. I’ll be doing my best to hang on to the crown, but if I get beaten by someone better, so be it – good luck to them.”

What is Britain’s Fittest Farmer?

This competition is designed to get all farmers thinking and talking about their health – physical and mental – to make sure they are in top condition to run their farm businesses.

It aims to support farmers’ amazing work to put food on our plates and care for our countryside, by helping them ensure they are fit to farm.

We’re looking for farmers who make fantastic ambassadors for health and fitness in ***agriculture***, to help break the taboo of talking about mental health issues such as depression, eating disorders and rural isolation.

To find out more, see who has signed up already and apply yourself, go to the Britain’s Fittest Farmer website.

Sean Curtiser

The coronavirus crisis and Brexit are causing huge worries for farmers, making staying mentally and physically fit more important than ever, according to Sean Curtiser.

“These are testing times,” says Orkney-based Sean.

“It’s been financially tough for many farmers for a few years and there’s a lot of additional worry that goes with the job at present. Keeping fit and playing a sport or having a hobby is a great stress-release.”

The 31-year-old, who works on the family’s 750ha beef and sheep farm, has been a keen rugby player since he was a young teenager, later developing an interest in weight training to build his strength and condition for the game. He’s even converted a shed on the farm into a gym.

“I live in a small village so it’s not always easy to fit a visit to the town around my farming schedule, but because I now have the gym at home, I can just nip in there whenever the opportunity arises.”

He’s aware many farmers have intense lifestyles and huge workloads, from which they rarely get a break.

“We all need to relax and unwind, though, and spending time in the gym is how I do it.

“If I know it’s going to be a 14-hour day, I’ll get up an hour early and train first thing in the morning because I know I’ll be too tired when I come home at night.

"People ask how I find the energy to do it, but keeping fit and keeping strong gives me energy. Doing it in the morning puts a spring in my step for the whole day.”

Though Sean acknowledges it’s not always easy to find the time at during particularly busy periods such as lambing season, he urges everyone to try to find one hour every day to pursue a hobby or sport.

For him, these hours also act as useful thinking time.

“My whole day is planned before I even start it,” he says.

“It’s good for mulling over big decisions, too, although we’ve put those on hold until it’s clearer what’s happening in terms of coronavirus and Brexit.

“It would be too much of a gamble to change anything too much right now.

“The whole coronavirus situation is very sad, but I hope long term it will at least highlight to people in towns and cities how important British farming is and how we need to be a bit more self-sufficient.

“I don’t want thanks for what I do, as I love doing it, but farmers do need to get a sustainable price for their produce.

"So let’s take this rare opportunity to reconnect with the wider public and educate the nation on just how sustainable and ethical British farming is.”

Meanwhile, Sean’s urging people to enter this year’s Britain’s Fittest Farmer competition.

“I’m a competitive person, so it was great to compete against other farmers and I met some interesting folk. It was a fantastic experience.”

Britain's Fittest Farmer: Our sponsor and partners

Grenadier: Sponsor

Tough, rugged, agile – the new INEOS Grenadier 4X4 will share plenty of traits exhibited by the winner of Britain’s Fittest Farmer. That’s why we’re so pleased to be sponsoring this rural British physical challenge.

As an uncompromising, no frills, off-road vehicle, the Grenadier will provide all the capability, durability and reliability you need to tackle the toughest tasks on the farm. That’s why we see ourselves as the ideal partner for this true test of grit, endurance and strength.

For more information on Grenadier, pay a visit to their website.

Farm Fitness: Partner

Farm Fitness has rapidly become a burning beacon on the UK fitness scene, attracting spectators and participants from all over the country to come and take a swing at its almost alchemic blend of modified strongman, functional bodybuilding, calisthenics and blistering cardio efforts.

The gym, founded by farmer’s son Tom Kemp, was voted one of the best gyms in the world and 'coolest outdoor space' by Men's Health (PDF)

Tom has blended his farming background with his love of training to create a raw and exciting outdoor environment for people of all strengths and abilities to get fit.

The Farming Community Network: Partner

The Farming Community Network (FCN) is a voluntary organisation and charity that supports farmers and families within the farming community through difficult times.

The charity has helped thousands of people deal with a variety of issues, including financial difficulties, animal disease, mental health and family disputes.

Volunteers provide free, confidential, pastoral and practical support to anyone who seeks help, regardless of whether the issue is personal or business-related. FCN also runs a confidential national helpline and e-helpline.

JOURNAL : Farmers Weekly

Two brothers have won £350,000 worth of land following a dispute at the High Court over a farming inheritance.

Matthew and James Wills have together been awarded 20ha of Gilmoor Farm in Harrogate, North Yorkshire, plus the associated outbuildings and barns.

Both worked on the land for decades and were promised they would inherit it by the deceased, Anthony “Tony” Sowray, for many years, the court was told.

See also: Land and property: Why inheritance promises can end in court

The deceased’s estranged daughter, Claire Sowray, inherits the £150,000 farmhouse and will have to pay the costs of the litigation.

Mr Sowray owned and lived at Gilmoor Farm, which consisted of about 20ha comprising grazing land, a farmhouse and various barns and outbuildings, totalling about £600,000.

The case arose after Mr Sowray died without a will in place, automatically leaving the entire estate to his daughter through intestacy law – despite Matthew working on the farming estate for more than 20 years and James having been promised the plot of land where he had built his home.

Promised land

Matthew was heavily involved in the farm and had been promised the land when Mr Sowray died. As a result of this assurance, Matthew undertook all of the work on the farm.

James had a separate agreement with Mr Sowray that he would give him his Jeep in exchange for a plot of land – which he would receive on his death – where James already lived with his wife in a log cabin.

None of these agreements were made in writing.

In his later years, Mr Sowray began to develop more of a relationship with his estranged daughter, Claire, and made clear to Matthew that he intended to leave the farmhouse to her.

Mr Sowray died intestate in 2017, meaning his daughter Claire would inherit the entire estate.

The court heard that he and his daughter only met in person when she was 22.

Ms Sowray claimed that her father had intended the entire farm to be hers and that they had made business plans together for the farm.

However, the Wills brothers argued that by the time Mr Sowray became reconciled with his daughter, the promises he had made to them had made their livelihoods entirely reliant on them.

Mr Sowray was therefore not entitled or free to go back on the promises he had made.

Transfer of land

The brothers were successful in their claim for proprietary estoppel – a promise to receive an interest in land or property made by one person to another.

A judge ordered the transfer of the land to Matthew and the plot to James following the hearing at London’s High Court in March.

Speaking after the case, Paula Myers, of lawyers Irwin Mitchell, who represented the Wills brothers, said the case was “slightly unusual” as it involved long-term friends instead of family members.

“Tony had told them on many occasions that the land would one day be theirs,” she said.

“Many witnesses had to give evidence about the brothers working on the land and about the promises that were made to them over many years.

“It goes to show the outcome of a case must be determined on a case-by-case basis, and that there isn’t one-size-fits-all solution.”

The full judgment can be found online

JOURNAL : Farmers Weekly

Our regular round up of changes in the dealer network features some big news in the John Deere and Case-IH families, with major restructuring efforts taking effect across the country.

John Deere

Most people will be aware that John Deere is in the midst of a fairly serious restructure of its UK dealer network, which began before Christmas with Sharmans being unceremoniously dumped by the manufacturer.

See also: Early dealer moves and tie-ups in 2020

John Deere has since asked Ben Burgess and Farols to expand their areas on to the patch vacated by Sharmans’ five depots.

Ben Burgess will open a new outlet in central Rutland, while Farols will start a new depot in Newark to serve customers in Nottinghamshire, west Lincolnshire and Leicestershire.

Case-IH

Sharmans has been appointed as a Case dealer. The family-run dealership has a head office in Grantham and operates four further depots in Nottinghamshire, Lincolnshire, Leicestershire and Northamptonshire.

Meanwhile, Case recently served notice to its dealer of 29 years, Collings Brothers. It operates from two depots – Abbotsley in Cambridgeshire and Bridgstock, Northamptonshire.

Scotts

Scotts Precision Manufacturing has recently agreed a deal for Yorkshire and Humber to serve its customers in north Lincolnshire and Yorkshire.

Based in Beverley, the machinery specialists will take on servicing and maintenance for toppers, windrowers and Evolution separators.

Corvus

New UTV brand Corvus has wasted no time in appointing three new dealers, with Frank Gibson based in Kelso, Scotland, Johnston Tractors of Carlisle and Tom Taylor ATV in York all taking on sales and service for the bright orange buggy.

Trioliet

Dutch firm Trioliet has taken over the factory of Polish tractor and equipment maker Ursus in a bid to improve logistics.

This follows 25 years of Ursus supplying Trioliet with frames and components for its feed mixers.

Goodyear

More than 20 ***agricultural*** Protyre depots will stock and supply the new range of Goodyear tyres that were reintroduced to the UK last year.

Bobcat

Two new dealers have been appointed to Bobcat’s UK network.

The first is A&M Group based in Lower Lamphey in Pembrokeshire, which will take on the sales and servicing for customers in south and west Wales and Powys.

The second dealer is Truckmasters Handling, which has depots in Wisbech, Cambridgeshire, and Norwich, Norfolk. Both new dealers will be responsible for selling and servicing the seven-model range.

Vaderstad

John Deere dealer Ben Burgess has taken on the role of selling Vaderstad machines from its Norwich, Aylsham, Beeston, Newmarket and Ellington branches with immediate effect.

The dealer's new depot at Oakham will also stock the implements from 2021.

Kuhn

Essex dealer RC Boreham has been appointed by Kuhn Farm Machinery to stock and sell its full range of machines.

Boreham’s range also includes Deutz tractors, Polaris UTVs and Merlo telehandlers.

Sencrop

On-farm weather specialist Sencrop has acquired sensor firm Visio-Green in a move that will allow more than 10,000 farmers to connect to the company’s ***data*** platform.

Vicon

A development in Vicon’s dealer network is the addition of Vincent Tractors and Plant to sell both sprayers and balers through its depots at Fraddon in Cornwall, and Smithaleigh, south Devon.

The entire Vicon range will be available at Vincent Tractors’ north Devon depot of Holsworthy – a location previously occupied by former Vicon dealer WH Bond.

Claas

Claas has opened the extension to its parts logistics centre in Hamm, Germany.

The construction took two years and the new building covers about 11,700sq m.

Avant

Davies Implements will provide sales and service for the full range of Avant loaders and attachments throughout south-west Wales.

Spaldings

Lincolnshire-based dealership Spaldings has secured an agreement with Grimme UK to distribute the firm’s soil engaging parts along with associated equipment throughout UK and Ireland, in parallel with Grimme dealers.

Horsch

German company Horsch has appointed dealer Carrs Billington ***Agriculture*** to sell its full range of cultivators, drills and sprayers to customers in northern England and south-west Scotland.

CNH

The parent company of Case and New Holland, CNH, has purchased ATI Inc, an Indiana-based manufacturer of rubber track systems for high horsepower tractors and combines.

The acquisition has been assigned to the Case brand and will provide customers with access to further specifications such as track suspension and carriage options.

The SmartTrax machines in New Holland’s combine and tractor line up are built by ATI.

Belair

JVS Machinery has been chosen by Belair to be the sole distributor of its bedding machines, mixer and self-loading wagons in the UK.

The French manufacturer builds a range of livestock equipment and has tasked the dealer, based near Market Drayton in Shropshire, with selling and servicing its livestock products.

Kubota

Kubota has boosted its presence in India after the firm invested in tractor maker Escorts.

The Japanese company hopes this will give it a foothold in the competitive Indian tractor market.

JOURNAL : Farmers Weekly

Free satellite signals and plenty of competition between manufacturers mean simple ***agricultural*** GPS guidance systems are more affordable than ever.

For less than £1,000, firms such as Patchwork and Agricision can provide a tablet-based GPS lightbar that will help guide operators in arrow-straight parallel lines with a pass-to-pass accuracy of between 20 and 30cm.

That’s precise enough for spinning fertiliser on grassland or spraying off stubble fields, but when it comes to crop establishment, they’re a little too woolly to deliver tidy results.

Unsurprisingly, plenty of people have had a stab at using them for drilling, either in conjunction with markers or by upgrading to a system with a more accurate correction signal and focussing on the flashing lights like a hawk.

But while this can work well, it’s far from relaxing. Getting the proper benefit of an accurate GPS system means investing in some sort of automated steering device.

When teamed with a receiver that’s capable of picking up a correction signal with sub-10cm accuracy, the two will work together, providing constant, rapid adjustments that keep the tractor and implement on the correct path.

This technology isn’t available to many of the smaller players, so it generally means dealing with the key GPS providers such as Trimble, Topcon, Ag Leader and Raven. However, Dutch/Ukranian firm eFarmer does offer a DIY setup.

See also: 6 budget GPS guidance system options for farmers

Price

In all cases, there’s a significant jump in price from the most basic offerings, and buyers are introduced to a new world of unlock fees and annual subscriptions for correction signals.

These can seem hard to swallow, but the reduction in input costs from fewer overlaps generally results in quick payback times.

Most manufactures in this sector operate a modular setup so, once the initial investment has been made, it’s generally less expensive to add the kit onto other machines and access features such as variable-rate application and automatic sprayer section control.

Many people will also purchase a few extra components so that the system can be transferred from the drilling tractor to the sprayer and then to the combine.

GPS signals at a glance

Basic GPS – no differential correction means accuracy is 2-5m. Examples include GPS, Glonass and Galileo.

Differential GPS – free correction signals provided by Egnos and WAAS, with 30cm pass-to-pass accuracy (as used by most lightbar guidance systems).

High-performance differential GPS – more accurate subscription-based correction signals, provided by the likes of Omnistar, offering pass-to-pass accuracy of 15 to 2.5cm, depending on the amount precision a buyer needs.

RTK – the most accurate and consistent correction signal with repeatable accuracy of 2.5cm or less. It requires a base station or a subscription to access others.

Most manufacturers have their own networks and there are a number of independent options. The signal can be sent over short distances via radio signal and considerably further when using mobile internet.

For the purposes of this article, we’re concentrating on the large number of second-hand and new tractors in the UK that didn’t come out of the factory auto-steer ready.

This means they don’t have the necessary smart steering valves that aftermarket GPS units can plug into.

Although these valves can be retrofitted, the fee can run to many thousands of pounds, so in most cases it makes more sense to opt for a motorised system that attaches to the steering column.

Early versions of these were a little crude, but current models can deliver accuracy approaching that of integrated systems.

Below, we take a look at four setups from the main players in the UK, plus eFarmer’s FieldBee DIY option that can be ordered from the Netherlands.

Discounts are likely to be available on some of the prices quoted and many firms will offer to buy back older displays, which helps lower costs.

Trimble

Trimble’s ***agricultural*** GPS equipment is sold by Soil Essentials in Scotland and Vantage England and Wales south of the border.

Vantage England and Wales is a subsidiary of Cambridgeshire-based precision farming firm AS Communications and was formed purely for the Trimble side of the business. The Irish market is served by Vantage Ireland.

Display

Trimble offers four displays that are capable of receiving correction signals accurate enough for drilling. Prices for these start at £1,850 and go up to £4,595, but buyers will also need to pay an unlock/licence fee before the display can access more accurate signals.

So realistically, the fees for displays capable of drilling accurately range from £4,534 to £6,946.

According to Vantage, the GFX 750 is one of the most popular for this sort of setup as it has a large display, runs the newer-type Precision IQ software and can be upgraded in the future. It costs £6,141, including a licence for the firm’s Centrepoint RTX signal.

Signal

The first step up from the free Egnos signal is Trimble’s Rangepoint RTX that offers sub 15cm accuracy.

Apparently, some customers are able to drill successfully with it, but the Centrepoint RTX with sub-2.5cm pass-to-pass accuracy is the better bet.

This comes in ‘standard’ and ‘fast’ versions, with the latter offering a quicker convergence time for more precise work and year-on-year repeatability.

The next step up is RTK, which has an instant convergence time and no satellite drift, making it well suited to controlled traffic farming systems that confine vehicles to the same lines year after year.

The mobile version requires an additional GSM modem and has a £750/year subscription fee. Radio versions work over shorter distances and fees are at the discretion of the individual or firm that owns the mast.

Steering system

There are two steering systems on offer from Trimble, the simplest of which is the friction-drive EZ-Steer unit that’s been around for years. It’s basically a motor with a foam rubber wheel on the end that engages with the steering wheel.

It Is capable of driving accurately enough for drilling duties, but as it is still relatively expensive, many buyers go for the EZ-Pilot version that mounts directly to the steering column in place of the original wheel.

The EZ-Steer costs £2,500 with a GFX 750 display and the EZ-Pilot with Pro operating software is £3,396.

Guideline prices

System price: £13,358 – Including GFX 750 display with relevant licences, auto-steer system, one-year Centerpoint Fast subscription and installation (based on a Massey Ferguson 7618)

Optional extras: Transfer kit allowing system to be moved to another tractor – £1,361 (based on Massy Ferguson 7620)

Ongoing subscriptions: Centerpoint RTX fast correction signal – £650/year

Ag Leader

Ag Leader products are sold in the UK via Cumbrian dealer Precise Solutions, headed by Derek Johnson.

Display

There are two displays on offer, both of which are capable of RTK guidance.

The Compass is the entry-level model with a relatively small screen and limited functions, while the large, tablet-like In Command brings a few more features, such as a split-screen view that allows simultaneous monitoring of Isobus implements.

Both units have a field finder that automatically selects the field from a list when creating a new job, as well as the ability to record field sizes and boundaries.

Prices for the Compass unit start at £1,963 (guidance only) and with the hardware for RTK it jumps up to £7,883. Upgrading to the In Command display costs an extra £1,200.

Signal

The firm’s Terrastar-C Pro signal offers 2.5cm to 5cm pass-to-pass accuracy, meaning it is accurate enough for drilling. However, according to Precise Solutions, the relatively small jump in price to its RTK setup tempts many buyers to upgrade.

It also removes most of the worries of lost signal and time spent waiting to the receiver to acquire it. Buyers can connect to their own compatible base station or access Precise Solutions’ RTK network, which covers the UK and Ireland.

Annual subscriptions for this are £650, which includes ***data*** sim cards and remote support for the steering system. Those with In Command displays also get satellite imagery over the field.

Steering system

For tractors that aren’t auto-steer ready, Ag Leader offers its Ontrac 3 bolt-on steering unit. It has a ring gear that fixes under the steering wheel and there’s a clip-on drive unit to do the steering.

This setup means the original steering wheel can be retained and it makes swapping it to another vehicle pretty simple.

Guideline prices

System price: £12,990 – Including Compass display with relevant licences, auto-steer system, one-year Ag Leader RTK subscription and installation (based on a Massey Ferguson 7618)

Optional extras: Transfer kit allowing system to be moved to another tractor – £1,243 (based on Massy Ferguson 7620)

Ongoing subscriptions: Ag Leader mobile RTK signal – £650/year or a subscription to another compatible network.

Raven

Raven GPS systems are available in the UK through Dempsey Precision, which is run by Vince Dempsey.

Display

There are two auto-steer compatible displays from Raven – the 7in CR7 and the 12.1in CR12. Both work with the firm’s high-accuracy GS correction signal and with the relevant unlock codes and antenna they cost £1,680 and £6,410 respectively.

The CR12 includes more features than the CR7, but the smaller screen can have a number of upgrades, including unlocking the variable rate controller at a cost of £780. Both screens can be made Isobus compatible for a one-off fee of £820.

Signal

Raven’s GS correction signal offers pass-to-pass accuracy of 4cm or less, making it well suited to most drilling jobs.

An annual subscription is £1,230, but there’s the option of having it for three months at a cost of £495. In this instance, the system will still work on Egnos with 30cm accuracy for the rest of the year.

For those that want year-on-year repeatable accuracy, it can be upgraded to RTK.

Steering system

Raven offers a bolt-on steering wheel kit, but in most cases Dempsey Precision recommends fitting non-auto-steer-ready tractors with an integrated hydraulic steering valve.

This operates like a factory-fitted system and is actually slightly cheaper than the steering motor kit.

The valve and its ECU hydraulic driver unit costs £1,850, installation is about £900 and there’s roughly £250-worth of pipework, depending on where the valve is situated. Those that are mechanically minded can save a few quid by fitting the valve themselves.

Opting for an MD electric steering wheel system is £200 more, but the benefit is that it's simpler and cheaper to swap between machines. Basic transfer kits start at about £530.

Guideline prices

System price: £10,110 – Including CR7 display with retrofitted hydraulic auto-steer system, one-year GS signal subscription and installation (based on a Massey Ferguson 7618)

Optional extras: Hydraulic transfer kit, allowing the system to be moved to another tractor – £5,250 (based on Massy Ferguson 7620) including pipes and installation.

Ongoing subscriptions

Raven GS correction signal – £495 for three months, £1,230 for 12 months, £3,360 for three years, or £5,240 for five years.

Option to hire

For those that don’t want the capital outlay of a full auto-steer system, Dempsey Precision offers a couple of hire options, both of which it supplies with RTK correction signal.

For tractors that aren’t auto-steer ready, the owner needs to commit to have the system for a minimum of three years. Dempsey Precision will then install a hydraulic steering valve and charge a £1,500 subscription for the spring season and £1,500 for the autumn.

Those with an auto-steer-ready tractor only need to commit to six months at a time, at a cost of £1,500.

Topcon

Cambridgeshire-based guidance specialist LH Agro distributes aftermarket Topcon ***Agriculture*** equipment in Great Britain.

Display

Topcon offers two displays that are capable of auto-steer guidance accurate enough for crop establishment. The key difference between the two is screen size, with the X25 measuring 8.4in and X35 12.1in.

However, the X35 also has some extra features, mainly the inclusion of Task Control (section and rate control) for Isobus implements as standard. The X25 costs £2,665 and the X35 is £4,670.

Topcon’s AGI-4 GPS receiver is separate to the display and features a built-in steering controller. This is capable of controlling most new auto-steer-ready vehicles without any additional hardware.

The AGI-4 also houses the licence for the relevant correction signal. Configured for RTK, it costs £9,675.

Signal

Topcon’s medium-grade Topnet Global D correction signal offers 8-10cm accuracy, meaning it’s just about precise enough for drilling.

However, its activation fee is close to that of an RTK setup, so in most cases it’s worth upgrading and getting 2.5cm accuracy.

The firm has a network of base stations that covers most of the UK and these can communicate with the tractor via radio signal or the mobile phone network.

An annual RTK subscription costs £650 and, if required, this includes ***data*** and a roaming mobile sim card that works across all networks.

Steering system

The AES-35 electric steering wheel system is the firm’s simple option for converting tractors that aren’t auto-steer ready, and it slots onto the steering column in place of the original wheel.

The basic unit costs about £3,500, with some slight variation on price depending on the vehicle.

Various adapter bosses are available to fit most makes of tractor, sprayer and combine, and additional kits can be purchased so that it’s quick to swap between machines.

Guideline prices

System price: £12,975 – Including X25 display, AGI-4 RTK receiver with NTRIP modem and UHF radio, auto-steer system, one-year RTK subscription and installation (based on a Massey Ferguson 7618)

Optional extras: Transfer kit allowing system to be moved to another tractor – £595 (based on Massey Ferguson 7620)

Ongoing subscriptions: RTK signal (radio or mobile phone) – £650/year

eFarmer Fieldbee

Dutch and Ukranian precision ***agriculture*** firm eFarmer is one of the few smaller GPS providers than can offer a bolt-on kit capable of auto-steering a tractor to RTK accuracy.

It was formed in 2014 and now has a number of dealers across Europe selling its Fieldbee guidance systems. It is yet to have a dealer in the UK, although it is looking to appoint one.

In the meantime, it is possible to order the systems directly from the firm’s headquarters in the Netherlands and get support from there.

This does means buyers will need to fit the system themselves or enlist the help of an ***agricultural*** engineer, so there’s no easy option of getting the manufacturer to come out and sort any problems.

Display

Like some of the other smaller guidance system providers, Fieldbee runs all of its guidance through an Android app that can be installed on any compatible tablet or smartphone.

The basic version is free to download, but the full-spec option required for auto-steer is subject to a 119 (£104)/year subscription.

The buyer will need to provide their own tablet, but Android units can be picked up fairly cheaply.

Signal

Unlike most of the large GPS providers, Fieldbee doesn’t use medium-accuracy correction signals that command a subscription fee.

Instead, it uses free signals like Egnos for lower accuracy tasks and RTK where greater precision is required. The firm’s RTK setup is a two-tiered affair, starting with an L1 receiver that only gives accurate results in flat fields without obstacles.

Those are few and far between in the UK, so its recently introduced L2 receiver is the best bet where drilling accuracy is required – this costs 1,299 (£1,137).

Those that can access a local NTRIPP RTK base station (either owned by a neighbouring farmer or a network) can simply pay to access the signal.

But where there’s no option of this, or the buyer would like to avoid subscription fees, there’s the option of adding an L2 RTK base station that can be installed at the farm.

This can broadcast its signal over 2.5km via radio signal or 20km via mobile internet and costs 1,599 (£1,399). Pass-to-pass accuracy is said to be 1cm.

Steering system

Fieldbee’s steering system is the same bolt-on arrangement as used by a number of other firms, and is built by Agjunction (formerly Novariant).

This is by far the most expensive part of the setup and costs 5,699 (£4,986), including the fee to unlock it so that it works with RTK.

It clamps under the existing steering wheel and can be easily removed and moved to another vehicle.

Guideline prices

System price: 7,134 (£6,242) – Including receiver, auto-steer system and one-year subscription to premium software (this is a universal kit to suit most tractor models)

Optional extras: Fieldbee L2 base station to give subscription-free RTK correction signal – 1,599 (1,399).

Ongoing subscriptions: 119 (£104) for premium subscription to Fieldbee app, plus fees to access local NTRIP RTK signal if no base station is purchased.

JOURNAL : Farmers Weekly

Children are being asked to get creative and draw NHS rainbows that will be emblazoned on the side of a brand-new combine ahead of this year’s harvest.

The idea came from Thomas and Sophie Clayton of Greenheath, Suffolk. The contracting outfit is expecting a new Claas Lexion 750TT to be delivered in the next few weeks, and plans to wrap the shiny beast from head to toe in rainbows; the symbol that has become synonymous with the NHS during the coronavirus crisis.

See also: Coronavirus: Farmers can now get a virus test

The couple are asking children to draw their rainbows and send them in, ready for the machine to be wrapped in July.

There is also a Just Giving page for donations to the NHS and the Greenheath is pledging to donate a £1 for every acre the machine cuts this summer.

Rainbows should be on an A4 piece of paper, with the child’s name written on the rainbow, rather than on the side. Entries should be sent to Sophie Clayton, Toggam Lodge, Newfen Gravel Drove, Lakenheath, Suffolk IP27 9LN.

JOURNAL : Farmers Weekly

Well-timed machinery upgrades are central to a smooth-running contracting business, and that has meant several major fleet investments for Allan Wilson's Ross-shire contracting operation.

Farmers Weekly finds out what has changed for last year's Contractor of the Year winner, Allan WJ Wilson, which has forged on with machinery replacements despite a challenging winter.

Who are Allan WJ Wilson?

Allan, Alyson and Stuart Wilson run a contracting operation in Fearn, Ross-shire, offering cultivating, drilling, mowing, baling and combining services. Other work includes soil sampling, drainage work, hedgecutting and muckspreading.

What has changed?

We’ve spent a fortune this year. We managed to bring in five new guidance-ready John Deere tractors just before the lockdown – a 6175R, 6195R, two 6215Rs and a 6250R.

See also: Contracting app cuts down time spent on workers’ timesheets

They have replaced the five we bought in 2016 – two 6175Rs and three 6215Rs – which have all clocked more than 4,000 hours.

The old ones had Directdrive transmissions, but we’ve decided to swap to the Autopowr CVT. It wasn’t a big price jump and it will hopefully allow us to utilise a bit more of the tractors’ power.

The 6250R should be comfortable running the triple mowers and the extra power gives us the option of moving to bigger implements in the future.

However, this time we took them on a full-service deal over five years. Modern-day tractor repair bills are frightening and a couple of gearbox problems could completely floor us, so we wanted a bit of extra protection.

As well as the tractors, we’ve got a new combine – a 500-hour Claas Lexion 760 to replace the 570TT. The old machine was on 2,000 hours and caused a fair bit of trouble last harvest that resulted in some big repair bills.

In the process, we’ve upped header width to 30ft for a bit of extra capacity. We’ve still got the Lexion 550 as well.

The other major addition to the fleet is a new McHale Fusion baler.

The old one had made 55,000 bales so was due a change, and the new model has an on-board computer to record silage dry matter and total weight, which means we can give customers a print-out at the end of the job.

See also: Pulse-width modulation spraying – is it worth the money?

Anything else planned this year?

There’s so much uncertainty surrounding coronavirus and Brexit that it’s hard to make firm decisions right now.

However, farmers are unlikely to be buying a lot of machinery, so contractors might find themselves a bit busier over the next couple of years – provided they’re able to adapt to the demand.

For us, it’s a fine line between thinking ahead and not spending more money than we need to. Part of that involves regularly touching base with customers, getting involved in their decisions and generally keeping our fingers on the pulse.

How has it gone this season?

Like most of the UK, we had a very wet autumn and winter. However, it didn’t affect us too much – we already had the oilseed rape drilled and there isn’t much of a market for winter wheat around here.

Fortunately, we had a few side-line operations to keep the lads busy during the quiet period, including gritting and snowploughing.

Our three drills have just finished the spring oats and barley. We started on the lighter land on 6 March and, through the 1,800ha, only lost one afternoon to rain.

By the time this goes to print, we’ll have drilled the fodder beet with the Vaderstad Tempo and then it’ll be on to turnips.

Whether there will be a strong demand for silage is more questionable, and we’re braced for a reduced workload.

It’s also noticeable how quiet the phone has been with people asking for odd jobs. We haven’t done anywhere near the amount of horse paddock reseeding or topping that we’d usually expect.

The main lime quarry has closed as well, which has limited our spreading capacity. We can’t get gravel or pipe either, so drainage work has stopped – one way or another the coronavirus shutdowns have hit everyone.

From a contractor’s point of view, the lack of interaction with customers makes the job a bit lonelier.

No one knows how the year will turn out, but ***agriculture*** is a resilient industry.

JOURNAL : Farmers Weekly

Small and medium-sized businesses affected by coronavirus can apply for loans of up to £50,000 through the Bounce Back Loan scheme.

Businesses will be able to borrow between £2,000 and £50,000 when the scheme opens on Monday (4 May).

The government will guarantee 100% of the loan and there will be no fees or interest payable for the first 12 months.

See also: Coronavirus loan scheme: What farmers need to know

Loan terms will be up to six years, with no repayments due during the first 12 months, and the scheme will be delivered through a network of accredited lenders.

The government has said it will work with lenders to agree a low interest rate for the remaining loan period.

Information on how to apply has yet to be published, but is expected shortly.

Eligibility

Participants can apply for a loan if their business:

is based in the UK

has been negatively affected by coronavirus

was not an undertaking in difficulty on 31 December 2019.

The following businesses are not eligible:

Banks, insurers and reinsurers (but not insurance brokers)

Public-sector bodies

Further-education establishments, if they are grant-funded

State-funded primary and secondary schools

Any business already claiming funding under the Coronavirus Business Interruption Loan Scheme (CBILS).

If the business has already received a loan of up to £50,000 under CBILS and would like to transfer it into the Bounce Back Loan scheme, this can be arranged with the lender until 4 November 2020.

Funding lifeline

Martyn Dobinson, partner at accountant Saffery Champness, said this new scheme will throw a lifeline to many smaller rural businesses who have been unsuccessful in accessing CBILS funding.

“With the scheme to launch on 4 May, most telling will be how quickly the system can deliver cash payments and how receptive lenders will be to processing applications quickly and without the level of checks that have been evident for other schemes, and whether the system can cope with the number of applications anticipated,” said Mr Dobinson.

“For those seeking to access the scheme we recommend approaching your existing bank or lender first as this should further fast-track the application process.”

Think carefully

Andrew Robinson, partner at head of ***agriculture*** at Armstrong Watson, said the new loans appear simpler and easier to apply for, especially for smaller businesses in the ***agriculture*** and rural sector.

As the government plans to guarantee 100% of the loan, applications will be quicker because there will be no need for the bank to obtain security from the borrower, which is a huge advantage and a key difference to the CBILS, he said.

The main qualifying criteria seem more straightforward to meet with the Bounce Back loans than with the CBILS, he added.

The six-year loan period gives breathing space to see businesses through the crisis, with businesses then able to reschedule their borrowings when things return to normal.

“My concerns are whether the banks can operate at the speed required and what the underwriting criteria will be as, for example, at the minute there is no definition of ‘undertaking in difficulty’,” Mr Robinson said.

“Businesses should think carefully before taking any debt in to the business to ensure it is the right thing to do, and it is always worthwhile to speak with their professional adviser.

“As with a lot of the government schemes, liabilities are being kicked down the road and in 12 months’ time there will be a lot of businesses having to dig deep when repayments start to kick in.”

JOURNAL : Farmers Weekly

The AHDB has increased its consumer marketing campaign for potatoes to help offset flagging demand from the foodservice sector under the Covid-19 lockdown.

Consumer demand has changed since the lockdown was imposed on 23 March, according to the levy board.

The industry has seen wholesale closures of fish and chip shops and other foodservice outlets while retail purchases have risen, but fears remain that growers who supply the foodservice sector could suffer large financial losses.

See also: Coronavirus: How to apply for universal credit

To help support sales, the AHDB has increased consumer marketing activity through its lovepotatoes.co.uk site, social media, advertising, TV promotion and at retail outlets.

AHDB marketing manager Nicola Dodd explained: “Our campaign is based on reminding consumers of the versatility and value of potatoes, and how they can be incorporated into many dishes, both traditional and contemporary.

“A recent post on how to store potatoes at home was liked and shared over 10,000 times on Facebook and Instagram, as people looked at ways of keeping lockdown stockpiles fresh.”

The AHDB will also launch a trade portal next week, where wholesale buyers can post requirements for potatoes, and growers can register available stocks.

The aim is to help match up stocks as the balance of demand switches from foodservice to retail.

JOURNAL : Farmers Weekly

Chancellor Rishi Sunak has been urged to put his money where his mouth is and pledge financial support for struggling dairy farmers.

Mr Sunak is Conservative MP for the rural constituency of Richmond, in North Yorkshire, which is home to several hundred dairy producers whose milk is used to create iconic Wensleydale cheese.

In 2015, at the height of the last dairy crisis which saw farmgate milk prices plunge to little more than 20p/litre, Mr Sunak penned his own 10-point plan (PDF) to help dairy farmers.

See also: Dairy farmers supplying Freshways face financial ruin

“Without its dairy farmers, Yorkshire’s magical landscape would soon see its lush fields turn to scrub and its dry-stone walls go unrepaired,” Mr Sunak said at that time.

Not actioned

However, many of the points included in his plan still have not been actioned by the government – and if they were, it would make a huge difference to hard-pressed dairy farming businesses, especially now demand is affected by the coronavirus lockdown.

For example, Mr Sunak called for an end to milk being used as a “loss leader” by supermarkets, more retailers giving dairy farmers a fair price for their products, better labelling, more supply chain fairness and transparency, a working dairy futures market, more domestic production of dairy products and a government pledge to buy British.

Mr Sunak said back then there was “no magic wand” to solve the global problems with the dairy market. But he called for timely CAP payments and flexibility from banks to help vulnerable dairy farmers suffering cashflow problems.

Milk price cuts

NFU dairy board chairman Michael Oakes, who runs a dairy farming business near Bromsgrove, told Farmers Weekly he was encouraged to see that Mr Sunak expressed support for dairy farmers during the last dairy crisis. But, for many, he said the problems are worse now than in 2015.

“The chancellor is clued-up about dairy farming and I was impressed with him and the work he did for the dairy industry when he sat on the environment, food and rural affairs select committee,” said Mr Oakes.

“Currently, about a quarter of dairy farm businesses are unviable due to a fall in demand for their milk during the coronavirus crisis. About 500 to 700 farmers have had substantial price cuts, for example 5p/litre in the last two weeks from Medina, or deferred payments.

“They are faced with not being able to pay their bills or staff. How do you run a business when you have got no cashflow coming in?”

Defra offered a £10m support package for the fishing sector last week. But Defra secretary George Eustice has ruled out similar support for dairy industry, arguing that the current situation is “a temporary dislocation in the market affecting a minority of farmers”.

Mr Oakes added: “We are working hard to lobby the government to introduce hardship grants for struggling dairy farmers.

“The current schemes on offer are proving difficult for dairy farms to access. The hospitality grant does not apply to us: you cannot furlough the staff, you cannot furlough the cows.

“Dairy farmers need additional support and they need it now.”

Contracts 'need sorting out'

One dairy farmer in Richmond, who did not want to be named, said: “Rishi Sunak has been thrown in at the deep end as chancellor. He’s doing a good job, but he needs to look after farmers and dairy farmers.

“Our feed prices are going up and our farmgate prices are going down. We are now producing milk at below the cost of production. There is pain and some dairy farmers will go out of business.

“Some farmers are calling for a return of the Milk Marketing Board. I’m not sure about this, but contracts definitely need to be sorted out.

“It can’t be right that Arla farmers are getting 5p/litre more to produce the same product. Some of the other dairy owners are just creaming the profits off and fleecing the farmers.”

JOURNAL : Farmers Weekly

The coronavirus pandemic has rocked food supply chains, with British beef and sheep farmers facing disruption caused by irrational buying in supermarkets and the loss of the food service market.

But, for farmers who can sell directly to the consumer at farm shops and through online delivery, many have seen business increase, as shoppers turn to local produce in response to empty supermarket shelves and the most vulnerable being forced to self-isolate during the health crisis.

This eagerness to buy British meat, produced locally, is proving a big boost for the Pasture-Fed Livestock Association (PFLA), a group of UK farmers passionate about raising animals purely on grass, while improving biodiversity and capturing carbon on their land.

See also: Map: Find a farm shop near you

“It is an exciting experience to buy something direct and it is way more fun and rewarding than going to a supermarket,” says Jimmy Woodrow, head of consumer and supply chain at the PFLA.

“I hope that is what will make people continue these new relationships they have built up.”

Established in 2009, the association has grown to 585 members, 80% of whom are farmers with the rest being butchers and independent retailers. Its main aim is to increase the supply and market for 100% grass-fed meat.

Mr Woodrow is confident that, despite the inevitable dip in sales once the pandemic subsides and supply chains steady, new customers will see the benefits of continuing to buy this produce locally.

“I think there will be a new heightened ‘normal’ of sales in these channels,” he says.

“There is no loyalty with the supermarket and people should be saying ‘we were together in the bad times, so we are together in the good times’ – not least when you taste what you are eating. It is a different product.”

Consumer awareness

With debates raging in the news and on social media about climate change and red meat consumption, the PFLA is helping its members market their meat, by educating consumers about the low-input methods used to produce it as well as highlighting the nutritional benefits.

The association points to increasing scientific evidence, including work carried out at the University of Newcastle, that meat and milk from animals that have only ever eaten grass and pasture is different in nutritional quality – lower in saturated fat, a much healthier ratio of Omega-3 to Omega-6 fatty acids, and more vitamins and minerals.

“The issue that we’ve always faced is how do we get more people to become aware of what we are doing, because generally when they do, it just makes sense,” Mr Woodrow says.

“The role for me is about creating an environment and a structure within which enterprising farmers can succeed.”

This includes plans to create an online livestock marketplace where certified PFLA farmers can trade animals, a project that has been accelerated because of the pandemic.

“Farmers that have predominantly had restaurants as their sale outlet have struggled, so we are trying to divert those animals into other channels,” he adds.

“You’ve got finishing farms who can’t access store cattle and then you’ve got suckler herds who don’t have an outlet for their store cattle, so we are trying to connect some of these dots.”

Join the club

Membership costs £100/year and gives access to a forum where farmers, butchers and retailers can connect and share ideas and advice.

Certification costs about £300/year, which allows farmers to use the Pasture for Life (PFL) certification mark, which tells consumers the meat is 100% grass-fed.

Butchers and retailers can also be certified, which gives them access to joint marketing initiatives and promotional schemes.

Climate research group

A research group of Pasture-Fed Livestock Association (PFLA) members has been formed to look at climate change, tasked with ***collecting*** ***data*** on the positive work farmers are doing around carbon sequestration and biodiversity.

Peer-reviewed ***data*** is crucial in helping to prove that some livestock farmers are part of the solution to the climate crisis, not part of the problem, says Mr Woodrow.

“We are looking to take more ***data*** on all our farms so that we can start proving we are potentially carbon neutral already,” he explains.

“I want to get as many of our farms recording ***data*** so we can present something that is representative of the PFLA. But even on a single farm, if you have ***data*** to show your customers, I think that is also powerful.

“We have a very motivated and energised membership who are looking to prove these points.”

Case study: Deersbrook Farm, Essex

Anna Blumfield, a Pasture for Life (PFL)-certified farmer based near Braintree in Essex, sells grass-fed beef in her farm shop and butchery, which opened in December 2018.

She has 150 Sussex cows and five bulls and explains that the native breed is perfect for the 100% grass diet.

“The breeding is really important; they absolutely thrive on pasture alone.

“A lot of the other breeds, the continentals, need that grain to finish properly, whereas the native breeds finish beautifully on grass.”

They take longer to finish – between 24 and 30 months – but the farmer says it is worth it to unlock the full flavour and potential of the meat.

“They may take a little longer, which is why some people don’t continue with it [a 100% grass-fed system],” she explains.

“There is also increased cost on the slaughter for animals over 30 months, for testing and removing the spine.

“You do get the extra cost, so you add that slight premium on for the customer.”

Mrs Blumfield says that her PFL-certified beef carcasses achieve an 8% premium.

Environment

But there are other benefits of the system, she adds.

“It makes sense because of the environment; we want the soil to be as healthy as it can be, because better soil means better food for the cattle and their digestive system.

“That fantastic nutrition and energy passes on through the meat to the consumer, it follows on the whole path to produce the highest-quality meat.”

Sales have quadrupled since the coronavirus pandemic, with four staff working flat out in the shop to keep up with demand.

“People are eating local and seeing the benefits of it and the farmers who produce it,” says Mrs Blumfield.

“My husband, Phil, was out on his tractor and people were waving at him as he went down the high street. Normally, he might get tooted or cursed at.”

Pollution

The farm sits under a flight path to Stansted Airport and, since the lockdown began, with nearly all flights grounded, Mrs Blumfield has noticed the difference in air quality, which makes her question whether farmers are shouldering an unfair amount of blame for the climate crisis.

“I really hope there is research through organisations such as Greenpeace and the Soil Association looking at the benefit to the air and soil condition in the current circumstances, so people realise how we can help the global climate change situation and not to reopen all the airports as they were, and to restrict traffic levels.”

Regional approach to marketing

The Pasture-Fed Livestock Association (PFLA) is encouraged by the emergence of regional groups within the association, with farmers and butchers in the same area talking among themselves.

Acting chairman Fidelity Weston, who is a beef and sheep farmer in Sevenoaks, Kent, says this engagement with the butchers, who are the link to the consumer at the counter, could be the start of strong, local supply chains that are mirrored across the country.

“There is enough of us now from Kent, Surrey and Sussex, who want to start telling butchers why they should buy PFL [Pasture for Life] meat.”

There are more than 40 butchers signed up to the PFLA and the association wants to empower its farmers to speak to others, which will help grow the market for 100% grass-fed beef.

“Farmers are busy enough as it is and we end up being masters of so many different tasks, but we hope we can give members the confidence and right information to develop these relationships.”

A key part of this is explaining why the premium on the meat is worth paying, Mrs Weston says.

“To understand the health and environmental benefits, as well as the high animal welfare standards, we need to get these people out on to our farms so they can see.”

Mr Woodrow says that, while regional groups are no silver bullet, maintaining the strong sense of community that has carried the association through its first 10 years is vital for future success.

“On our forum, for example, when ideas are being discussed, most people know each other, which means they talk freely.

“It is far easier to get your neighbour involved in the PFLA than it is for someone centrally. It makes sense for local farmers to talk and trade, and that is going to cause a growth of certification and membership.

“It is an exciting time. It feels like there is real purpose behind what we are doing.”

JOURNAL : Farmers Weekly

The Coronavirus pandemic is likely to have long-lasting effects on many dairy businesses, with the closure of pubs and cafes leading to milk destined for foodservice becoming homeless.

This has had a ripple effect on the whole industry, with milk processor Muller asking suppliers to reduce supply by 3% in an attempt to balance milk intakes.

In the latest AHDB webinar (23 April), Oliver Hall, an Anderson’s business consultant; Tracey Towers, a vet from Lancashire-based Oakhill Veterinary Centre; and Piers Badnell, consultant for the Livestock Improvement Corporation (LIC), give advice to farmers who have been asked to reduce milk supply.

See also: Coronavirus: 4 tips for dairy farmers hit by slump in milk demand

1. Can you graze a proportion of your herd to reduce feed costs?

Many herdspeople running higher-yielding herds will be worried about losing milk, but cost savings must be considered

Work out your own costs: Feed and housing costs versus reduced milk yield (see example below in “scenario” box).

Target cows that are giving <30 litres and in-calf

If a cow hasn’t grazed seriously before it is going to be a shock – but it is actually hardest to train the person, not the animal

Typically, a cow will lose 10 litres due to the change in diet, environment and social group

If you provide good quality grass the cow will “bounce back” to 25 litres after 3-6 days.

2. Practical solutions for grazing

Don’t set stock cows, rotationally graze

Target feeding 15kg DM of grass a cow a day (100 cows will require 1,500kg DM a day or 1ha)

Aim for a 20-25-day rotation. This means you should be back in the first paddock you grazed within 20-25 days

On a 25-day rotation this would mean you require 25ha (stocked at four cows/ha)

Enter 1ha paddocks at 3,000kg DM and graze to 1,500kg DM

Four cows/ha requires a daily growth rate of 60kg for each rotation

If you don’t have a plate meter to measure grass, ensure you do not graze pasture until the three-leaf phase, so you don’t compromise re-growth

Ensure cows go out to grass with an “edge of appetite”

Don’t buffer feed unless you are short of grass or area

If you need to buffer feed, do so before afternoon milking. Milking causes a hormonal response to drive the cow to eat and drink, so this will maximise grass intakes.

3. Drying off cows

When you are feeding as one group be cautious of long dry periods as cows can lay down too much internal fat – for example, 10 weeks and over. That’s when you risk poor and costly transition.

If you are drying cows off earlier than usual, have you got the facilities to cope with this? The worst thing you can do is restrict feed intake in the last three weeks before calving

If you have a large variation in dry cow length, is your dry cow group big enough to manage as two groups? This would cheapen the ration for far-off dry cows (more than three weeks pre-calving) and it also allows you to better manage body condition.

4. Budget for an income drop

 Step 1: Work out what you want to achieve. Do you want to:

Protect the balance sheet or, failing this, minimise the reduction?

Protect profit?

Preserve cashflow?

Step 2: Work out profit and cashflow requirements

Use last year’s accounts to work out:

Drawings (including pension and life insurance)

Bank loan repayments (capital only, interest is included in the P&L)

Tax (as you will be paying for the previous year)

HP payments.

Step 3: Estimate your income

Consider milk, cull cow, calf sales, BPS and any other

Be realistic: use today’s prices but look at future markets as a reference point.

Step 4: Calculate your budgeted income minus required profit to give you target costs

This can be turned into a ppl figure by dividing it by the amount of milk you produce annually.

Work through all the cost lines in your budget with the target of achieving targeted costs.

Step 5: Can you make it balance?

If you can’t hit your target costs, consider:

Reducing profit demand by:

Lowering drawings

Asking lenders for a capital repayment holiday

Or:

Introduce private funds

Sell assets on the farm such as surplus stock, forage or machinery

Borrow the balance from your bank.

Tips

Avoid valuation increases. If you are rearing surplus stock, for example, consider selling them

Can you delay reinvestments in machinery, so you don’t spend this year’s depreciation?

Protect people and cows – these are non-negotiable

Ask suppliers for a price reduction

Lock in variables such as feed and fuel

Benchmark your costs to highlight areas where reductions could be made

Eradicate waste

Scenario

Milk reduction: If the milk price is at 27ppl then a reduction of 7 litres will cost £1.89 a cow

Feed cost: Feeding a 30 litre cow at 8ppl will cost £2.40, plus 4kg of concentrate at 18p/kg, or 72p. Total saving is £3.12

Housing cost: £1.50

Net: £2.73 (£4.62 minus £1.89)

JOURNAL : Farmers Weekly

Defra has reaffirmed its commitment to badger culling this year following calls from animal welfare groups to cancel the operation over the coronavirus.

“The government remains committed to achieving its long-term goal of eradicating bovine TB in England by 2038,” a Defra spokesperson told Farmers Weekly.

“Apha [Animal and Plant Health Agency] has recognised that Covid-19 will impact on delivery in the short-term. Contingency plans are in place to minimise the impact on TB control measures.”

See also: 18 areas of England apply for badger culling

Farmers Weekly understands that subject to licensing and authorisation by Natural England, the badger cull will still go ahead from September.

However, no licensed culling of badgers can take place before 1 June – the start of the open season. Up to 50 culling zones could be in operation this summer across the South West and many parts of the North West and Midlands.

In March, the government published its response to the independent Godfray Review of its 25-year bovine TB eradication strategy.

Defra envisages that the current intensive badger culling policy would begin to be phased out in the next few years, and gradually replaced by government-supported badger vaccination and surveillance.

However, the government’s position is unchanged in terms of its overall policy for badger culling, which remains a necessary and important part of the long-term bovine TB eradication strategy.

Letter to Eustice

The Badger Trust has written to Defra secretary George Eustice, urging his department to scrap the culls this year amid the coronavirus pandemic.

In his letter, the trust’s CEO Dominic Dyer warns there is a risk of cull contractors – operating as teams of shooters and trappers – spreading the virus in the wider rural community “as a result of working in teams and coming into contact with farmers and landowners, the police and members of the public”.

The NFU maintains that badger culling is working to reduce the incidence and spread of bovine TB.

The latest Defra figures, up to 15 April, show that 30,824 cattle were slaughtered in England in the 12 months up to the end of January 2020 – equivalent to a 6% fall year-on-year.

Over the same period, the number of new TB herd incidents fell 9% from 3,600 to 3,278. And the number of herds not officially TB-free in England fell from 3,004 to 2,608 (-13%).

JOURNAL : Farmers Weekly

Farmers in England are to be given an extra month to submit their 2020 basic payment and agri-environment scheme applications.

In a statement on Monday (27 April), the government confirmed that the window to submit applications for Basic Payment Scheme (BPS) payments and to make a Countryside Stewardship (CS), Environmental Stewardship (ES) and woodland revenue legacy payments will be extended by one month.

Farmers, land managers and agents now have until 15 June to apply for and make claims for these schemes.

See also: Coronavirus: Applying for farm support schemes

The Tenant Farmers Association (TFA) warned Defra it must not use the extension as an excuse to make late payments for farmers, especially since cashflow is already tight on many farms.

Defra said it had decided to extend the deadline by one month to allow for the disruption caused by the coronavirus pandemic and help customers to avoid financial penalties for late submissions.

Farmers and land managers are still being encouraged to submit their applications online for BPS and CS through the Rural Payments Service as soon as they are able to do so.

Defra says its Rural Payments Agency (RPA) has already received a “large number of applications”.

Monitor situation

The RPA says it will continue to monitor the situation carefully and provide further assistance to support farmers.

Applications for new CS Higher Tier and Mid Tier agreements are still being accepted ahead of their respective deadlines of 1 May and 31 July 2020.

RPA chief executive Paul Caldwell said: “We are fully focused on making vital payments to the rural community and helping customers submit their claims during this difficult period.

“We know the coronavirus is causing issues where farmers are unable to meet their targets, so we are making this extension to allow more time for the farming community to submit their applications and claims without penalty.”

Natural England and the Forestry Commission are continuing to provide advice by phone or video call for land managers developing Higher Tier applications in time for the 1 May application deadline, so that schemes can be progressed in the absence of a site visit.

George Dunn, TFA chief executive, said: “While there are some who would not have been able to make the 15 May deadline for BPS and stewardship claims given the current Covid-19 restrictions, it is disappointing that a more innovative solution was not forthcoming to keep the 15 May deadline for the vast majority of individuals while providing specific measures for those with difficulties.

“However, now that the decision has been made to move the deadlines to June, we must not see this being used as an excuse for making late payments under these schemes. It is essential for the cashflow of farming businesses that there is no delay to making payments.

“Many farmers are still awaiting payment of 2019 stewardship claims, which must also be resolved without further delay.”

Welsh farmers have already been handed a one-month extension to their Single Application Form deadline to 15 June. Similar announcements to BPS extensions could be made soon in Scotland and Northern Ireland.

For full details, see Gov.UK.

JOURNAL : Farmers Weekly

Farmers and land managers in England are to be offered bridging payments for unpaid claims on their stewardship agreements.

The interest-free loans will cover Countryside Stewardship (CS) and Environmental Stewardship (ES) 2019 payments to ensure farmers are paid for the important work they do to protect the environment.

Eligible claimants will received a payment in May of 75% of the current estimated value of their claims to help farm businesses with cashflow while the remaining processing work is completed on their claims.

See also: Coronavirus: Applying for farm support schemes

This follows the announcement by Defra of a one-month extension to the application window for farmers to submit their basic payment claims to allow for any disruption caused by the coronavirus pandemic. The new deadline to submit claims to the Rural Payments Agency (RPA) is 15 June 2020.

George Dunn, chief executive of the Tenant Farmers’ Association (TFA), said farmers would welcome the news of stewardship bridging loans to help support cashflow through the Covid-19 crisis.

‘Poor performance’

But he added: “It was clear that the RPA’s poor performance to date would have meant a significant shortfall in payments by the end of the regulatory window for payments in June.

“However, the RPA must ensure to continue its work to finalise claims so that, in the vast majority of cases, the remaining 25% of the payments can be delivered by the end of June.”

Defra has not released any updated figures on the number of 2019 CS and ES claims it has processed to date. In early March, almost two-thirds of farmers were still waiting for their CS cash.

RPA chief executive Paul Caldwell said: “These bridging payments will help to tide farmers and land managers over in May before their claims are paid.”

The RPA will be writing to farmers and land managers to provide an update on bridging payments and how they will be calculated.

No bridging loans will be made for 2019 BPS claims, as 99% of these claims had already been processed, Defra said.

JOURNAL : Farmers Weekly

UK dairy and livestock farmers could benefit from an ***agricultural*** aid package being put together by the EU.

Brussels has proposed an 80m (£69.9m) package to support the agri-food markets worst hit by the effects of the coronavirus pandemic.

Although Britain left the EU on 31 January it remains under its marketing policies until 31 December 2020. This means the UK is still eligible to take part in the Private Storage Aid (PSA) scheme.

See also: Coronavirus: Applying for farm support schemes

The scheme works through payments to processors and manufacturers to incentivise storage, covering some of the costs incurred.

Under PSA, ownership of the commodity remains in the hands of the producer, unlike intervention storage where the government buys it from the market.

With surplus produce removed temporarily from the market, supply is more closely matched to demand and prices may stabilise.

The aid would be divided across the farming sectors with roughly:

30m (£26m) for dairy

26m (£22.7m) for beef

20m (£17.5m) for sheep and goats.

Significant step

NFU Brussels office director Robin Manning welcomed the aid package as a significant step.

“These are important measures that are not taken lightly. They can stop prices spiralling downwards and help the market re-establish itself,” Mr Manning said.

Agreement on the assistance was achieved after sustained lobbying for aid backed by a joint letter from all 27 member states calling for the EU Commission to act, he said.

In addition to the PSAs, the commission has agreed to an exceptional derogation from EU competition rules for the milk sector, as well as flowers and potatoes.

AHDB analyst Kat Jack said this meant the milk sector would be allowed to collectively take measures to stabilise the market, for example, collectively planning milk production.

“[The EU Commission is] also allowing flexibility in the EU school milk, fruits and vegetables scheme to allow reprioritisation of funding towards crisis management measures,” Ms Jack added.

The measures should be adopted by the commission at the end of April, at which point full details of the proposals will be revealed.

Long-term problems

Once the storage period covered by the payments comes to an end, the product will come back on to the market.

And this could cause its own set of difficulties, according to milk industry expert Chris Walkland.

Although Mr Walkland said it was better than nothing to have PSA payments, he raised concerns that storage simply delayed the functioning of the market.

“It is a gamble to see if product stored now can be sold for more money in a few months’ time when it floods back on to the market,” he said.

Mr Walkland also called for further support for beleaguered UK farmers via a cash injection into their businesses.

“About 550 UK dairy farmers are in desperate straits right now – they have poor prices and face delayed payments.

“The PSAs are welcome but anyone assuming they alone will fend off this crisis is seriously deluded.”

PSAs sector by sector

The details of the package are yet to be ratified and could be subject to change, as member states need to discuss and vote on the proposals.

The products included must meet certain eligibility criteria including age and minimum amounts of product stored. Provided those criteria are met there is no upper limit for a country to submit.

The total tonnages offered will be shared out among the EU countries.

The proposals are as follows:

Dairy

For dairy the 30m total is to store skimmed milk powder (SMP), butter and cheese. This is broken down into:

Butter 14m (£12.2m) – 140,000t for three to seven months

Cheese 10m (£8.7m) – 100,000t two to seven months

SMP 6m (£5.2m) – 90,000t for three to seven months

The cheese sector is treated slightly differently, with tonnages allocated to EU countries at the outset. The allocation for UK product is yet to be announced, although it is widely reported to be around 4,500t.

Beef

The 26m is for a 25,000t allocation of steak-quality beef. A PSA scheme for beef has not been triggered since the latter years of the BSE crisis in 2002.

The proposed PSA is for steak-quality only because demand for higher-end cuts has plummeted. While mince is seeing increased sales for home-cooked meals, consumers are reluctant to spend on quality cuts.

As beef production continues the quantity of surplus steaks is mounting, putting pressure on prices.

Sheep

The 20m for sheep and goat meat provides PSAs for up to 36,000t. This is to support storage for up to five months with a minimum period specified of two months.

Nate Donnay, director of dairy market insight at commodity analyst INTL FCStone, said the 30m EU package for PSA was more of a gesture than a solution, but the EU Commission could end up spending 300m (£262m) on intervention purchases by the time the crisis is over.

He contrasted the scale of the funding with the $900m (£730m) being spent by the US government to buy dairy products over the next six months that will then be largely donated to food banks to support Americans in need.

A separate $2.9bn (£2.35bn) fund will be used to buy a wider range of foodstuffs.

However, Mr Donnay said even spending on that scale would still leave surplus product on the market until regular demand improved, meaning prices were likely to stay low until well after stay-at-home orders were lifted.

JOURNAL : Farmers Weekly

Farm staff should be using face masks in many instances to limit the spread of coronavirus, says health and safety adviser Oliver Dale.

A mask will not necessarily prevent the wearer from being exposed to the virus, because it is so small that it can travel between the fibres of many masks.

“However, there is an increasing body of evidence to suggest that the virus can travel further in the atmosphere than previously thought, and particularly so where it is projected by a cough or sneeze,” says Mr Dale, managing director of consultancy Safety Revolution.

The small droplets expelled from a cough or a sneeze may travel for up to six metres and may also hang in the air as micro-droplets for long periods.

Wearing a mask may restrict the projection of these droplets and so cut the amount of virus in the atmosphere, reduce its travel distance and potentially the volume expelled.

See also: Coronavirus advice for managing and keeping staff safe

Masks on farm – when and how?

Masks should be introduced for staff working in close proximity to others or to contractors – close proximity in this case is less than six metres.

They should be worn where vehicles or equipment are used or may be shared (even where decontamination and hygiene procedures are being practised).

Mask specification should be FFP3 or FFP2, generally available from the usual farm suppliers.

While all staff should be equally protected, employers should take care to ask workers if they have underlying health conditions which make them more vulnerable to other illnesses. Older workers are more likely to have existing respiratory conditions.

Do not reuse or share masks.

If availability is an issue, home-made masks could be used in certain circumstances where the main aim is to reduce droplet spread from the wearer. However, these should never be used as a substitute for appropriate protection for certain jobs such as cleaning grain stores or bedding stock, when appropriate industry-standard equipment should be used.

Soiled or damaged masks must be disposed of in a manner that avoids cross-contamination.

Ensure staff follow basic good hygiene practices as advised by the government.

Source: Safety Revolution

Wearing a mask also restricts the wearer from touching their nose and mouth, and so reduces the likelihood of them transferring any virus from their hands to those parts of their body where it may be more readily absorbed.

“In a workplace environment, employers have a duty to introduce all reasonably practicable measures to control the spread of the virus, regardless of any other guidance that may be issued to the general public in relation to their day-to-day contact,” says Mr Dale.

“This is a workplace health-and-safety issue and the provision and use of masks would be regarded as ‘reasonably practicable’, so employers should give this careful consideration,” he advises.

“Consider your own risk assessments in conjunction with government guidelines on physical distancing. Such masks form part of what is known as respiratory protective equipment (RPE).

Additional RPE may be required for certain workplace activities such as grain store cleaning.

As well as the legal obligation of the employer to ensure safe working conditions, employees also have a personal duty under the Health and Safety at Work Act to take care of their own health and safety, as well as that of others who may be affected by their actions at work.

This includes the specific risks to the business and their colleagues as a result of any failure to adhere to government guidelines.

JOURNAL : Farmers Weekly

Farmers who have put staff on furlough will be able to take advantage of the scheme until October, the chancellor has announced.

The scheme, which is costing the government an estimated £10bn a month, had originally only been scheduled to run until the end of June.

The move is likely to benefit diversified farm businesses in particular, with rural tourism and leisure enterprises standing idle following the nationwide lockdown.

See also: How diversified businesses are coping with lockdown

The government will continue to pay up to 80% of any furloughed employee’s salary, up to a limit of £2,500 a month until the end of July.

However, chancellor Rishi Sunak said that from August, the scheme would become more flexible, and allow furloughed staff to return to work part-time.

This will allow employers to bring back staff for whom there is only a limited amount of work without requiring them to immediately pay the full salary.

1/ The job retention scheme will be extended, for four months, until the end of October.

By that point, we will have provided eight months of support to British people and businesses. Until the end of July, there will be no changes to the scheme whatsoever. pic.twitter.com/gQznY4c2Ir

Rishi Sunak (@RishiSunak) May 12, 2020

Further details on the modifications will be announced before the end of the month.

Businesses have benefitted from more than £14bn in loans and guarantees to support their cashflow during the crisis, according to government ***statistics*** published today (12 May).

This includes 268,000 Bounce Back Loans worth £8.3bn and 36,000 loans worth over £6bn through the Coronavirus Business Interruption Loan Scheme.

JOURNAL : Farmers Weekly

Farm leader Minette Batters says she expects progress on a support package later this week for crisis-hit dairy farmers.

The package could take the form of a hardship payment, the NFU president told journalists during an online media briefing on Monday 27 April.

See also: Dairy farmers supplying Freshways face financial ruin

Some 1,800 dairy farmers are said to have emailed their MPs after turmoil in the supply chain due to coronavirus saw processors reduce prices for some contracts.

One in three dairy farmers had been “severely impacted” by the crisis, said Mrs Batters, with some producers forced to pour milk down the drain.

Price cuts

Processor Freshways – which supplies coffee shop chains and other foodservice outlets – was first to cut the milk price with a 2p/litre reduction in March.

The dairy processor has since said it would pay farmers at the end of April for half the milk produced in late February/March, with the balance paid in mid-May.

Meanwhile, Muller has withdrawn a planned 1p/litre price rise for May.

The NFU and dairy processors held a conference call with Defra earlier this month as they pressed the case for additional financial support for the sector.

The government said it would temporarily relax elements of UK competition law to support the dairy industry – but farm leaders said this was not enough.

Competition law

Defra said relaxing competition law would allow the industry to adapt to decreased demand from the hospitality sector and reduced ***collection*** by retailers which have had to close. E

It said the announcement would enable further collaboration between dairy farmers and producers so they could avoid their surplus milk going to waste.

This could include sharing labour and facilities, co-operating to temporarily reduce production, or sending milk to be processed into products such as cheese and butter.

Defra secretary George Eustice said: “Our dairy industry plays a crucial role in feeding the nation and it is essential that they are able to work together at this time.”

Loans available

He added: “We’ve heard loud and clear our dairy farmers’ concerns which is why we are further suspending competition rules law to allow dairy farmers to work together.”

Mr Eustice also urged farm businesses to access government-backed loans that were available from their bank to support them during the coronavirus lockdown.

The dairy sector is the UK’s largest farming sector, with milk accounting for 16.85% of total ***agricultural*** output in the UK in 2018.

Of this, approximately 50% of UK dairy sector output is fresh milk and, as such, accounts for a significant amount of UK processing capacity.

JOURNAL : Farmers Weekly

Property deals close to completion are progressing and land is still seeing strong demand, but much of the market is at a standstill.

Social distancing measures and the ban on non-essential travel, in response to the coronavirus outbreak, has put a stop to property viewings and pressed pause on the market.

However, agents are still getting enquiries from people wanting to buy land, according to Strutt & Parker’s English farmland market review for spring 2020.

See also: Several farms launch in spring despite pandemic

It shows that though the smallest acreage of land in the past 20 years was publicly marketed in the first quarter of this year (4,500 acres), the same number of farms were marketed in that time as during the equivalent period in 2019 and 2018.

Guidance dictates pace

The firm’s team is continuing to work on deals that were struck before the lockdown was implemented and prepare property to market later this year, says Matthew Sudlow, director and head of estates and farm agency.

“We have seen very few deals fall through, with most buyers still committed to their purchase,” he says.

“However, people are having to be flexible and patient about getting these purchases over the line. Completion dates are being pushed back in line with official government guidance that, if contracts have already been exchanged, all parties should work together to agree a delay if necessary.”

For property with a residential element that has not yet reached the point of exchange, the government advice is to delay the exchange until stay-at-home measures have been lifted, he says.

Alternatively, contracts should include provisions allowing for completion dates to potentially be extended, subject to movement restrictions or because there may be people in the chain who need to self-isolate.

Other challenges include delays in funds being released by banks because they are focused on getting emergency lending in place for businesses needing support as a result of the virus.

Bare land seeing success

“We were planning to launch a number of farms and estates with a residential element during April, May and June, but vendors have put these sales on hold for now, with the intention to launch as soon as restrictions have been lifted,” says Mr Sudlow.

“Some vendors selling bare land are choosing to go ahead with marketing now, with some success.”

There was good demand in January and February, supported by the historic lack of supply and an end to the political-related uncertainty, and many of these buyers remain active.

The team is also continuing to get new enquiries from people looking to buy land, despite the coronavirus, many of whom have rollover money to invest and others looking to invest in a safe asset, he says.

“Our view is that once the market does get going again, all parties will need to show continued patience when progressing sales,” says Mr Sudlow. “There will be a backlog to get through in terms of valuations and searches, and agreeing lending is also likely to take longer than it may have previously.”

Lockdown buying and selling advice

Vacant possession

Possession proceedings have been temporarily suspended as it is impossible to give vacant possession during lockdown.

Where vacant possession has been agreed, the terms of the contract between the buyer and seller need to reflect both parties’ circumstances and include:

Exchanging contracts with completion conditional on lockdown ending within a certain timeframe

An obligation on the seller to obtain vacant possession following completion, with the buyer retaining part of the purchase price until vacant possession is obtained.

Finance

Loan offers are time-limited, so where loan finance is being arranged, contracts with a delayed completion, especially one which is conditional on the lockdown ending, is a concern for both buyer and seller.

Use time wisely

Where a property has been in a family for generations, it is not uncommon for there to be some kind of title deficiency, boundary discrepancy or other issue that could hold up a sale.

Lockdown is a good time for landowners looking to sell to review their position, identify any potential issues and prepare for a future sale.

Source: Tim Olliff-Lee, senior associate, Wilsons Solicitors

JOURNAL : Farmers Weekly

Changes to coronavirus lockdown guidelines have renewed fears that an influx of visitors to the countryside could spread the virus.

Boris Johnson announced a partial easing of the lockdown in England during a televised address to the nation on Sunday 10 May.

The prime minister said: “From this Wednesday, we want to encourage people to take more and even unlimited amounts of outdoor exercise.

See also: Fresh advice on footpaths during coronavirus crisis

“You can sit in the sun in your local park, you can drive to other destinations, you can even play sports, but only with members of your own household.

“You must obey the rules on social distancing, and to enforce those rules we will increase the fines for the small minority who break them.”

Stay at home

The new guidance has met a mixed response, with some farmers and rural representatives pleading on social media for people to stay at home.

Coronavirus: Is it too early to open up the countryside to the public?

Yes

No

Made here

Cotswold farmer Liz Webster said visitors from outside the area already posed a health hazard.

[*https://twitter.com/abcpoppins/status/1259741976712413184*](https://twitter.com/abcpoppins/status/1259741976712413184)

Dorset farmer Justine Pike, of Downshay Farm, Swanage, said it was too soon to start relaxing travel restrictions.

[*https://twitter.com/downshayfarm/status/1259733103284813829*](https://twitter.com/downshayfarm/status/1259733103284813829)

Lake District National Park Authority chief executive Richard Leafe urged people not to visit Cumbria, which has one of the UK's highest rates of the virus.

“This could be very difficult for the communities of the Lake District and Cumbria,” he said. “Please don’t rush to visit us.”

[*https://twitter.com/LakesChief/status/1259549229967695872*](https://twitter.com/LakesChief/status/1259549229967695872)

South Lakes Police said people should take a long, hard look at their conscience before visiting the national park for exercise.

“We urge you to use common sense and to continue to exercise close to your own home,” it said. “We need to break the cycle of infection.”

[*https://twitter.com/SouthLakesPol/status/1259607891025281025*](https://twitter.com/SouthLakesPol/status/1259607891025281025)

Earlier, Bishop of Ripon Helen-Ann Hartley said the last thing rural communities needed was an overwhelming number of visitors.

She added: “Yes, the economy matters but the ‘countryside’ is not simply a place of recreation and retreat, it is where people live and work.”

The new guidance applies only in England – Scotland and Wales are maintaining their advice for people to stay at home unless travel is essential.

Confusing message

The Farmers Union of Wales (FUW) said the prime minister’s address was confusing and ambiguous – and failed to distinguish between Welsh and English changes to restrictions.

FUW president Glyn Roberts said: “There appeared to be no attempt to make it clear that the changes being announced only applied in England.

“Worse than that, the impression was given that the changes applied throughout the UK when this is simply not the case.”

Mr Roberts said the prime minister’s comment that “you can drive to other destinations” would lead people to wrongly assume they could visit Wales.

This would increase the risk of introducing the coronavirus to Welsh communities, he added.

“Our offices are dealing with members who are in the vulnerable category and are concerned that the large numbers of people coming through their farmyards and fields are placing them at risk.”

Relaxation 'must be properly managed'

The partial relaxation of coronavirus restrictions could help revitalise the rural economy, but must be properly managed, says the Tenant Farmers Association (TFA).

The TFA has welcomed the prime minister’s statement on planned measures to relax some of the restrictions put in place by the government to control the spread of Covid-19.

With disease indicators starting to move in the right direction, TFA chief executive George Dunn said the time was right to plan the process of moving from lockdown to a new normality

But Mr Dunn warned: “This must be undertaken carefully to ensure that we do not create a new surge in disease spread.

“While it may be some time before we see the reopening of restaurants, cafés and pubs, farm-focused attractions based in the outdoors could lead the way in getting things moving again.”

With appropriate social distancing, hand-washing facilities and people management, farm attractions could be at the forefront of the recovery heading into mid-summer.

“Subject to scientific and practical advice, farm-based attractions up and down the country could provide an early opening of the hospitality sector,” said Mr Dunn.

“Farm-based attractions offer many advantages, but will require careful management to ensure that they do not become overwhelmed with too many people attending at once.

“Keeping people outside in the sunshine, while enjoying hospitality, must be the way forward as we begin to relax the current restrictions.

“We may also need to move at different speeds, with England being in a position to move before Wales, for example.

“However, I would urge governments in all parts of the UK to be working with the farming community to achieve this.”

JOURNAL : Farmers Weekly

Livestock markets in Northern Ireland will reopen to farmers from Monday (27 April) as part of a gradual lifting of Covid-19 lockdown measures.

Marts across the province closed voluntarily to farmers on 23 March as the coronavirus pandemic worsened.

See also: Coronavirus: Applying for farm support schemes

As cases of Covid-19 are continuing to emerge, the Northern Ireland Livestock and Auctioneers Association (NILAA) said re-opening would be on a phased basis, with some restrictions continuing.

Measures

Numbers for sales will be limited and there will be a requirement for sellers to book slots for livestock entries.

Bookings slots will be allocated on a first-come, first-served basis.

Sellers will still not be allowed to enter the sale ring or office and will instead be asked to drop off stock.

Once stock is sold, sellers will be informed of the price achieved as quickly as possible.

Buyer numbers will also be limited in the sale ring to ensure social-distancing measures can be maintained.

Only buyers who have registered ahead of a sale will be allowed to attend.

The Department of ***Agriculture***, Environment and Rural Affairs (Daera) said its officials were satisfied the measures were robust and welcomed the planned reopening.

“Farmers are key workers and are continuing to provide food for us all in very challenging circumstances. Part of that food supply chain is the ability to trade and sell animals,” a Daera spokesman said.

The department has been reassured that robust operational protocols will enable mart operators to conduct business in a manner that is safe for staff, farmers and buyers, he added.

“Daera, therefore, welcomes the decision to recommence sales of primestock, cull animals and store stock on a gradual basis from the week commencing 27 April.”

JOURNAL : Farmers Weekly

People believe Britain’s ability to produce its own food is increasingly important, suggests a survey carried out during the coronavirus pandemic.

The public also have a more favourable view of farming – perhaps encouraged by the efforts of growers and livestock producers to feed the nation during the crisis.

See also: Government issues coronavirus advice for farms

Asked whether their view of British farming had changed in the past three months, 28% of respondents said it was more favourable, while 11% said less favourable.

And 51% said they felt Britain’s ability to produce its own food had become more important.

The independent survey of 2,036 UK adults was carried out by pollsters Censuswide on behalf of the NFU on 20-21 April 2020.

NFU director general Terry Jones said the findings showed people were “on our side” through what is a difficult time for the industry and the country as a whole.

Survey findings

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‘Very different’

Drawing a comparison with the 2001 foot-and-mouth outbreak, Mr Jones said the effect of the coronavirus pandemic is very different to previous crises suffered by the farming sector.

“Foot-and-mouth was a farming crisis with a national impact,” he told journalists during an online media briefing on Monday (27 April). “This is a national crisis with a farming impact.”

Coronavirus has seen the government designate ***agriculture*** an essential industry, with farmers and food chain staff deemed to be key workers.

The importance of food and farming was further highlighted earlier in the pandemic as panic-buying shoppers cleared supermarket shelves of essential items.

Panic buying

Earlier, Defra secretary George Eustice said panic buying had now ceased and 500,000 food parcels had been delivered by volunteers to people unable to leave their homes due to a clinical condition.

“In addition, the major supermarkets have agreed to prioritise delivery slots for those in this shielded group,” said Mr Eustice on Sunday (26 April).

“So far, over 300,000 such deliveries have been made, enabling people to shop normally and choose the goods that they want to buy.”

Many supermarkets have taken steps to increase delivery slots for online shopping.

The number of supermarket delivery slots had increased from 2.1m to 2.6m since the start of the coronavirus outbreak, said Mr Eustice. It was expected to grow further to 2.9m delivery slots over the next couple of weeks.

JOURNAL : Farmers Weekly

Yorkshire farmer, Angela Kirkwood, used her Nuffield Scholarship to travel the world in search of the answer to one key question: How can we grow the UK pig industry?

Prior to the UK’s membership of the EU, the breeding sow population was over one million. The country's pig industry has since seen a steep decline in numbers, resulting in the UK now being a net importer of pig meat.

At the same time, cost of production has risen due to ageing production facilities and restrictive environmental legislation.

See also: How slurry cooling techology can cut ammonia on pig units

UK pig producers also face challenges including high labour costs, animal health issues and volatile prices.

So, what does the future hold for the UK pork industry and what can producers learn from other countries?

Below, Angela shares her findings and highlights several key areas producers and the wider industry need to target to grow the UK pig industry.

1. Define strategic aims for production

The countries Ms Kirkwood visited which had buoyant ***agricultural*** industries had very clear goals. That has not been the case in the UK for a long time, she says, largely due to the Common ***Agricultural*** Policy.

The UK needs leadership from the top. A prosperous industry is built upon clear, simple and achievable strategic aims that bestow confidence and encourage growth in a sector.

Unlike the UK, countries with specific departments of ***agriculture*** are much more in tune with production aims and targets, meaning they can help growers achieve fair prices, produce affordable food for customers and build resilient businesses.

In the Philippines a change of government had resulted in a reduction of corruption within the food industry.

Pig smuggling and mis-declaration of imported pork products had previously put Filipino pig farmers at a competitive disadvantage.

The government reviewed regulation, declared imported pork, and carried out traceability testing to reduce food fraud.

The Philippines now has the fourth-largest sow population in Asia and pig farming is fundamental and vital to the economy and economic growth. Pig prices were buoyant at 132 peso/kg (£2.10/kg) while cost of production was 96 peso/kg (£1.50/kg).

2. Improve production inefficiencies and review compliance complexities

An accumulation of regulation has caused production inefficiencies and increased costs on UK farms.

The way in which rules and regulations are interpreted around the world are very different.

In the UK, while cross-compliance may make sense on its own, when other auditing bodies’ rules are added on top, such as Red Tractor, it becomes both complex and costly.

In the US, for example, the main focus was to be as efficient as possible and this is where Angela believes the difference between UK and US costs of production lies.

The pigs she visited were in very good health and condition – productivity and genetics were similar to those of the UK – but costs in the UK are much higher.

The USDA (United States Department of ***Agriculture***) has its own branding on food products. The ministry standards are highly regarded and trusted by US consumers and each state is accountable for the implementation of farm regulation.

In line with all the countries featured in Ms Kirkwood's study, the US production systems would be illegal in the UK and would not pass the country's welfare standards.

However, more efficient systems and a lower regulation burden offers US pork producers a cost-of-production advantage.

Examples of efficiency in the US included:

Processing facilities require pigs at 140kg liveweight – heavier pigs improve on-farm efficiency

Extra emphasis is put on ventilation to improve growth rates

Automatic irrigation systems empty slurry lagoons, reducing the cost of waste disposal

The use of gestation stalls is the norm and allows for individual sow care and optimum feeding – though it could be questioned if this allows the pigs to express their five freedoms.

3. Rethink your approach to welfare and biosecurity

"Animal welfare" is very difficult to define, it may be more productive to focus on what contributes to healthy stock.

Good animal welfare has been the aim for UK pork production since the sow stall ban in 1999. Unfortunately, this has resulted in the dramatic contraction of the UK pork industry.

The desire to have the highest animal welfare standards in the world has resulted in increased costs of production; lower productivity compared to competitors; and increased imports of cheap pork products.

In China there is a hard focus on good animal husbandry. Better husbandry has led to healthier animals, meaning the overall welfare of the pigs is also improved.

Other examples could be focusing on the reduced or better use of medicine, or optimising technology to offer the pig optimum nutrition.

Country border biosecurity also needs to be closely monitored; education of staff and visitors along with clear signage would also be advantageous. A similar border control system to that evident in New Zealand and Australia would reduce risk to the UK ***agricultural*** industry.

In New Zealand, surveillance of people and imports arriving at the country's borders ensures harmful pests and diseases are prevented from coming into the country.

4. Upskill workers to encourage more efficient labour costs

It is becoming increasingly difficult to employ reliable skilled labour in the UK.  Many farm businesses pay more than the national living wage and include other employment benefits, resulting in the industry having relatively high labour costs compared to the rest of the world.

While it wouldn’t do the UK pork industry any favours if the value of this wage was decreased, what it can do is ensure it is recruiting – and retaining – higher skilled employees.

Teagasc – Ireland’s ***Agriculture*** and Food Development Authority – has a hard focus on recruiting the next generation of young farmers by pushing land-based skills from a young age and teaching ***agriculture*** in schools.

5. Invest in environmental measures to increase long-term sustainability

While the UK does have high standards in terms of pig production, it is going to have to invest and modernise over the next five to 10 years to ensure long-term sustainable production.

China is already doing this. Pig producers are investing in modern, energy-efficient infrastructure, as well as initiatives such as solar energy systems to power production units. This is not only good from a sustainability point of view, but also financially.

This needs to be driven by the whole industry, not just the producers.

6. Build ‘Brand Britain’

Given the above tools, the pork industry will strive to become one of the major flagship industries for ‘Brand Britain’.

All of the countries Ms Kirkwood visited boasted their national flag on retail packaging and aimed to improve brand image and awareness with consumers.  In Denmark TV advertisements focussed on telling the story of Danish farmers. The Japanese were using key events such as the forthcoming Tokyo Olympics as a springboard to promote Japanese food.

Clear and regulated British branding and labelling of pork post-Brexit will offer a valuable tool to promote British food to the consumer.

JOURNAL : Farmers Weekly

Owners of ATVs and quad bikes are being asked to increase security following a significant rise in thefts during the coronavirus lockdown.

Police say rural thieves are using the quiet period to prey on vulnerable farmers and steal their kit.

In Hampshire alone, 21 ATVs were stolen over a 24-day period since the start of the coronavirus lockdown.

See also: Video: Quad bike theft – how to avoid being a victim

In one typical incident, thieves carried out an overnight raid on the Conholt Park Estate, near Andover, sometime between 12.50am and 1.30am on Monday 13 April.

They stole a green 750cc Suzuki King Quad bike and a red 500cc Suzuki King Quad bike.

Superintendent Andy Huddleston, from Northumbria Police, is also the national police lead for ***agricultural*** machinery and vehicle thefts.

He said: “Since going into lockdown due to Covid-19, overall vehicle crime is down by 40%, however, machinery thefts are on the rise, not everywhere, but significantly in several parts of the country, such as Hampshire, where 21 ATVs were stolen in 24 days.

“Within the past week, some great work by the National Vehicle Crime Intelligence Service and Surrey Police resulted in arrests and the seizure of a wagon loaded with a cross-section of ***agricultural*** equipment.

“However, the fact remains, like many crimes, we will not arrest our way out of these problems and the wider rural society all have a part to play.”

Tips to prevent the theft of ***agricultural*** vehicles

Mark with Cesar marking device

Fit a tracking device and mobiliser

Use preparatory devices, such as Quad Vice, to protect quads

Remove keys when not in use and store out of sight

Keep GPS-equipped tractors in secure buildings, or remove kits when not in use

Remove keys

Supt Huddleston said the farming industry needs to ask more of manufacturers, and he believes that all ATVs should be fitted with an electronic immobiliser as a minimum standard.

But he added: “I don’t think it is unreasonable to expect that, overnight, keys are taken out of machines that are worth in excess of £6,000, or in the case of telehandlers and tractors upwards of £40,000.”

***Agricultural*** vehicle theft claims cost rural insurer NFU Mutual £7.4m in 2019, up 26% year on year. ATV claims cost moe than £2.6m, up 10%.

JOURNAL : Farmers Weekly

The dry weather in Aberdeenshire has continued throughout April, with the annual total to date amounting to only 33% of average. This allowed spring barley drilling to start early on 20 March – early for us – and with a great effort by the whole team we were able to drill 808ha in 23 days.

Now that the crop is established, we desperately need some decent rainfall. We had 6mm last night, and a few showers are forecast later in the week, but really we could do with an inch or so over a few days.

See also: Herts grower puts hoe to the test in narrow-row cereals

While the spring barley still has some moisture at seed depth and has not yet been impacted by the dry conditions, the wheat is certainly suffering. When a plant is pulled up, the soil just falls off the roots and any damper parts of the field show how pale and thin the majority of the crop is.

With the 2018 drought still fresh in my mind, I have held back some nitrogen for now on both the wheat and spring barley. The rainfall over the next 10 days will determine how much, if any, of this will be applied.

It has been a strange spell with lockdown for coronavirus.  During drilling, we were lucky to be relatively unaffected, being able to get on with our jobs with only minor changes to working practices.

One of these was that I often took my bike when moving the loader and seed trailer. Cycling back really showed up how bad many of our road surfaces are and also, despite the reduced amount of traffic, how many bottles and other rubbish is being thrown into the verges. If only some of the many extra walkers out and about would pick some of it up!

During this time it is also frustrating to see some supermarkets importing beef, particularly steaks, when local processors need to find new markets for these cuts. Is this a failure of the supply chain, or an excuse to drive the price down? Either way it is not helping the UK beef sector and drives farmer mistrust of retailers.

JOURNAL : Farmers Weekly

Sheep farmers are likely to receive less money from British Wool this year after the marketing board admitted a slump in demand had left one-third of the 2019 clip unsold.

Disruption to the supply chain linked to the coronavirus pandemic has seen prices plummet this year at the farmer-owned co-operative’s fortnightly online auctions, with low clearance rates in the normally busy spring sales period.

China, the biggest processor and consumer of wool, had its economy shut down and has experienced disruption at ports following its gradual easing of lockdown restrictions, hitting demand.

See also: What happens to wool once it leaves the farm?

The announcement will be a blow to farmers who use the wool cheque to meet most of the cost of shearing.

British Wool CEO Joe Farren said “The severe, hopefully short-term, drop in demand for wool products, coupled with the huge global overhang in cross-bred wool stocks from the 2019 season, is likely to severely affect prices for the next 12-18 months.

“It will also make our longer-term objective of repositioning British Wool as a premium product more challenging. However, finding new demand for our wool in China at attractive prices will be a key driver of the early stages of recovery in British Wool prices," he said.

Average sale prices have fallen at every auction between February and April, with clearance rates below 50%.

British Wool does not buy wool from farmers, but acts as a middleman to sell it on their behalf, returning the money to them after deducting its costs.

The farmers’ annual cheque is a combination of an upfront part-payment for next year’s produce and the balance of what they are owed from the previous year, with the annual sales year beginning in July.

It achieved a sale price of £1/kg for the 2018 clip, with farmers receiving an average of 60p/kg – the same rate as the previous year – but well down on the 2014 payment rate of 105p/kg.

National Sheep Association chief executive Phil Stocker said: “Fortunately, most British sheep farmers are used to wool cheques covering shearing and handling costs and often not a lot more, with few farmers relying on wool values for a living.

“We do have a small number of sheep farmers who continue to do well out of wool, and who have managed to climb out of relying on what is essentially a global commodity market.

“In my opinion, this is the only way to remove ourselves from global economic impacts, and achieving this on a national scale is a big challenge.”

JOURNAL : Farmers Weekly

US meat processing plants have been ordered to stay open by president Donald Trump amid intensifying concerns in the country about food availability.

US pork analysts estimated that 36% of the country’s pig slaughter capacity was not in operation on Monday, raising fears that up to 700,000 pigs a day would have to be killed on farm, leading to a shortage of food.

These and abattoirs in other sectors have shut in recent weeks after they were identified as coronavirus hotspots, with the disease spreading rapidly among the tightly packed workforce.

See also: UK and US meat sectors battle supply chain challenges

The presidential executive order, which compels companies to stay open for national security reasons, may protect companies from being legally liable for workforce safety if they are found to have exposed staff to the coronavirus, but unions have said serious concerns remain about how to prevent the spread of disease in factories.

However, Mike Brown, president of the trade association National Chicken Council, said that companies were doing everything they could to keep people safe.

He said: “Companies began weeks ago enacting additional measures to keep workers safe, such as increased cleaning and sanitation of the plants, temperature checks before entering facilities, social distancing measures, installing plastic dividers between work stations, paid leave for sick or at-risk employees and issuing masks and other personal protective gear.

“While doing everything we can to keep employees safe and healthy, the biggest challenge has been inconsistencies among the states and many localities in enforcing Centre for Disease Control guidelines in plants that add to confusion and can lead to unnecessary shutdowns.”

Four political leaders from Iowa – the biggest pig producing state in the country – wrote to vice-president Mike Pence this week to ask for financial aid for any animals killed on farm, as well as assistance with disposal costs.

JOURNAL : Farmers Weekly

Soaring temperatures combined with the coronavirus lockdown ahead of Easter resulted in differing fortunes for meat and dairy products on the retail market.

Figures produced by the AHDB and market analysts Kantar WorldPanel showed roasting joints were hit particularly hard in year-on-year comparisons.

Easter is traditionally a strong point in the year for roast meals, as family gatherings centre around the Sunday dinner table.

In contrast, beef mince sales have continued at a high level. This is in part due to the spell of hot weather, with many households producing burgers for outdoor grills and barbecues, the AHDB suggested.

See also: Coronavirus: How financial support package will help farms

Lamb

During the week ending 12 April, volumes of lamb roasting joints sold, especially leg, were down 25% compared with the same period last year.

Shoulder volumes saw even greater losses and were down by more than one-third (36%) on figures for 2019.

The fall was attributed to the timing of the lockdown, reducing the opportunities for family gatherings and a roast lamb joint. Price was also a deterrent, said AHDB .

Average retail prices were up by £2.35/kg (29%) for leg and £4.81/kg (53%) for shoulder.

The AHDB pointed out that the current ***data*** week for 12 April 2020 covered the Easter period. However, the Easter break was a week later (21 April) in 2019.

The difference means year-on-year declines for lamb are likely to be more severe in next week’s ***data***, it warned.

Beef

Temperatures in some parts of the UK during the week to 12 April were up 12C on the same period in 2019. This is likely to have driven the increase in volume sold of burger and grills for barbecues, the AHDB believed.

As a result, mince volumes were up 29% on 2019. However, despite the year-on-year difference, mince has not gained further share of the beef category since the coronavirus lockdown.

Roasting joints suffered the greatest drop off in retail volumes purchased – down 65% or about 1,000t compared with the same week in 2019.

The AHDB attributed the fall to a combination of hotter weather, fewer Easter gatherings and an average price increase of a third.

Pork

Volumes of bacon and sausages sold for the seven days up to 12 April were up 18% and 48%, respectively, compared with the same week last year.

Roasting joints, for the same reasons as in the beef and lamb categories, suffered significant losses.

Total pork roasting was down 63% year on year, with the fall given further impetus by higher prices. Recent gains for chops, during late March and into the first week of April, have now subsided.

Volumes of mince continue to grow and were up 14%.

Dairy

The coronavirus lockdown may have had a positive effect on butter and cream sales in the same week, with year-on-year volumes up 37% and 59%, respectively.

AHDB analysts have suggested this upsurge could be down to a strong interest in home baking while people are forced to stay indoors.

Liquid milk volumes also performed strongly, with sales up by 24m litres – a rise of more than one-fifth (22%) on the same week last year.

Weekly volatility in demand has seen milk sales vary by as much as 24m litres a week, putting the supply chain under extreme pressure.

JOURNAL : Farmers Weekly

The AHDB is set to launch a marketing tool to help shift surplus potato stocks caused by a drop-off in demand since the Covid-19 lockdown.

Food service sector demand for potatoes collapsed when the measures forced the closure of commercial outlets such as restaurants and many chip shops.

AHDB Potatoes strategy director Rob Clayton estimated that food service sector demand was about 90% below normal levels.

See also: 10 ways to improve potato storage management

This has caused a surplus of potato stocks in stores across England. The latest figures (7 May) put the surplus at about 150,000t, down from a peak of about 200,000t at the end of March.

To help move some of the surplus, the AHDB has set up a website, to be launched next week once final security testing has been completed.

"The aim is to provide a matchmaking service between growers with surpluses in their stores and potential buyers," explained Mr Clayton.

Growers will be able to advertise what stocks they have in terms of quality and variety and how many trailer loads are available, he said.

In addition, the grower can set out what assurance schemes are adhered to and what treatments have been applied to the stocks.

At the same time, merchants, or other outlets looking for stocks, can post what demands they have.

"It is then down to the grower and buyer to establish a deal and delivery arrangements," Mr Clayton said.

More information will be available from the AHDB Potato website .

JOURNAL : Farmers Weekly

Welsh dairy farmers have welcomed the announcement of a funding package to help those hardest hit by closure of cafes, restaurants, pubs and hospitality venues.

Lesley Griffiths, Welsh government rural affairs minister, has confirmed that dairy farmers who have lost more than 25% of their income in April and May will be entitled to up to £10,000 to cover 70% of their lost income.

This will help ensure they can continue to operate without affecting animal welfare and the environment. Further details on the application process for the scheme will be announced shortly.

See also: Coronavirus: 4 tips for dairy farmers hit by slump in milk demand

It follows a similar support scheme announced by Defra secretary George Eustice for dairy farmers in England. However, governments in the devolved nations of Scotland and Northern Ireland have no plans for equivalent funding packages.

“The overnight loss of the food service market as a result of Covid-19 has affected many Welsh dairy farmers,” said NFU Cymru deputy president Aled Jones.

“We are pleased the Welsh government has recognised the impact this is having on many dairy farming businesses, and has now come forward with a hardship package for those affected most by the current market conditions.”

The funding will help address immediate cashflow problems faced by dairy farmers, some of whom have been forced to throw away milk because their processors have been unable to ***collect*** it. Many more have received massive price cuts to well below the cost of production and significant delays to payments.

Promotional campaign

NFU dairy board chair and South Wales dairy farmer Abi Reader said the announcement will be a comfort to dairy farmers who are currently facing the biggest losses over Covid-19.

She added: “We sincerely hope that this support, alongside the announcement earlier this week of the AHDB/Dairy UK promotional campaign backed by government across the UK, alongside the opening of Private Storage Aid by the EU and changes to competition law announced by the UK government last month, will help to provide some short-term stability to the Welsh dairy sector.”

Welsh Government has today announced a funding package of support for Welsh dairy farmers hardest hit by the exceptional market conditions brought about by #Covid\_19.

NFU Cymru Dairy Board Chair @AbiReader provides an update following the news. pic.twitter.com/NycXcvGtSu

NFU Cymru (@NFUCymru) May 9, 2020

Welsh Conservatives’ Andrew RT Davies MS, the shadow minister for rural affairs, said the announcement was “better late than never”.

Edwin Poots, Northern Ireland’s farming minister, said Stormont was considering a “different approach”, as the effect on its dairy farmers “may become evident more slowly, last longer and be more widespread”.

The Scottish government said it was aware that some dairy producers in Scotland have also been affected by the loss of markets in the service industry. Therefore, officials “would be meeting shortly with producers to explore what, if any, additional assistance might be appropriate for the sector in Scotland”.

JOURNAL : Farmers Weekly

Farm leaders have welcomed news that calves under 180 days are now temporarily exempt from bovine TB testing in unrestricted herds.

The latest exemption applies only where testing cannot take place safely under the current Covid-19 restrictions. Official veterinarians can also request backdating this measure to the start of lockdown on 23 March.

The new guidelines, which apply in both England and Wales, received ministerial clearance prior to this temporary exemption being implemented.

See also: How will TB tests work during the coronavirus pandemic?

Under the derogation, movement restrictions will not be placed on officially TB-free (OTF) herds if cattle under 180 days are left untested because the vet has judged that testing cannot be conducted in line with Covid-19 social distancing guidelines.

However, exempted calves would still need a pre-movement test if they are to move off a holding, where that move would normally require it.

‘Pragmatic’ approach

The Farmers’ Union of Wales (FUW) welcomed the joint announcement by the UK and Welsh governments, describing it as “pragmatic”.

“Many of our farmer members are in the Covid-19 high-risk category due to their age and it is therefore important that the rules around TB testing do not risk the health of our key workers producing food during this pandemic,” said FUW senior policy officer Hazel Wright.

“It is extremely difficult to maintain social distancing rules when testing young calves for bovine TB and this derogation is therefore extremely welcome.

“It will come as a huge relief to those farmers facing the conflict of adhering to TB rules while also trying to adhere to social distancing rules and protect themselves and their family from illness.”

A spokesman for the British Cattle Veterinary Association said: “ This temporary exemption is a really positive move and hopefully strikes a balance between keeping everyone safe, maintaining the food chain, and bTB surveillance, while allowing vets the flexibility to make informed testing decisions on farm, without the pressure of putting some farms under suspension.”

Farm vets take special measures over coronavirus

Farm vets are making special efforts to make sure they adhere to coronavirus restrictions when TB testing and treating cattle.

Social distancing rules requiring people to keep 2m apart are not always easy to maintain when handling livestock. But vets say they are still managing to take precautions to prevent the virus from spreading when visiting farms.

“It can be very difficult,” said Oliver Hodgkinson, of Trefaldwyn Vets in Montgomery, mid-Wales. “When you are dealing with adult cattle it is easier. If you go at the head of the cow and the farmer goes at the back end, then there is about a 2m gap.

“But when you have a sick calf, then it does become a lot more challenging. If we have to handle a calf and the farmer has to hold the calf, we try to do it in the open air and turn our backs to each other. It's about being sensible.”

Mr Hodgkinson – who was Farmers Weekly Livestock Adviser of the Year in 2018 – said he likes to be self-sufficient when TB testing. This means nobody else is at the front of the crush when he is dealing with each animal.

JOURNAL : Farmers Weekly

Companion cropping could offer growers struggling to grow oilseed rape a successful method of reducing cabbage stem flea beetle risk, enabling them to establish the valuable break crop.

The oilseed rape area is predicted to fall again this summer, as the pest has been resulting in many crops failing to establish.

However, there is some anecdotal evidence that growing a companion crop may help, and agronomy company Agrovista has been conducting a trial.

Based in Draughton, Northamptonshire, Agrovista is investigating the effects of growing berseem clover in conjunction with rapeseed in order to identify successful methods of establishing and growing the crop.

See also: Sheep grazing eliminates need for rapeseed growth regulators

The group’s farming systems research and development advisor, Niall Atkinson, explains how a range of seed treatment applications are also being investigated.

“The purpose of the trial isn’t to find one quick-fix solution, but to show how a combination of factors can work together to get rapeseed established successfully,” he says.

The trial

The trial consists of 18 treatment plots of the Clearfield variety Phoenix at 50 seeds/sq m, which were drilled on 29 August and received no post-emergence insecticide applications.

“We drilled the majority of plots using a HE-VA Evolution low-disturbance soil loosener complete with seeder unit and cultivator system with the remaining direct drilled using a Weaving GD drill,” says Mr Atkinson.

Each plot was 100m long and 30m wide, located within a commercial crop of oilseed rape, which acted as a control, but was unfortunately destroyed by flea beetle attack.

Half the plots were grown in a long winter wheat stubble, and the other half in a standard stubble length, with all straw chopped to create a mulch.

Three different treatments were established, which were a Lumiposa (cyantraniliprole) insecticide seed treatment, a biological seed treatment named Integral Pro, and a fungicide seed treatment.

Each plot was then established with and without a companion crop of berseem clover, with Mr Atkinson highlighting how the overall best establishment came from the plots, where both Lumiposa, Integral Pro and berseem clover were used together.

“The berseem clover is the overriding positive contributor, and supporting this with targeted seed treatments really does seem the way to go, protecting and boosting the oilseed rape seedling from the beginning, when it is most vulnerable to damage,” he says.

Berseem clover benefits

Mr Atkinson explains the benefits of using berseem clover and why companion cropping is forming an integral part of many growers’ oilseed rape production systems.

“The clover develops a fine fibrous root system which helps condition the soil, allowing more rapid and deeper root growth, meaning the rapeseed can get away quicker, so it’s less susceptible to pest attack,” he says.

He highlights why the plant acts as a good companion choice since it doesn’t compete with the rapeseed directly, as it only gets going above ground from October onwards and is also compatible with most, although not all, herbicide sprays.

Berseem clover offers many soil health benefits due to its ability to soak up excess nitrogen which is released back into the soil when the crop dies, when up 30-40 kg/ha of nitrogen can be released.

Another issue which companion cropping can help overcome is the inability of oilseed rape to host mycorrhizal fungi. Other plants growing in the rows can act as a host plant for the fungi, promoting soil health.

Adding other species to the companion crop mix could boost soil health further, but Mr Atkinson warns this strategy could be risky, as species which outcompete rapeseed could be mistakenly introduced, reducing the crop’s ability to withstand pest attack.

Removal

When it comes to removing companion crops, Mr Atkinson explains how the correct choice of variety is essential, for instance, selecting those with greater frost susceptibility.

“We grew the clover variety Tabor for easy removal, as it is extremely frost susceptible. The bigger the crop gets, the more susceptible it is to the cold,” he says.

However, last winter’s mild conditions and limited frost development posed the question of how the crop would be removed successfully, without the use of chemical control.

In the end, the winter deluge together with a few late frosts killed off the crop, meaning over-spraying was not required.

If no frosts are forecast, Mr Atkinson suggests an application of the herbicide Astrokerb (aminopyralid + propyzamide) in November to December could be used to destroy the crop.

“If companion crops have not been dealt with by late February to early March then a product such as Galera (clopyralid + picloram) could be used in early spring,” he says.

However, he warns there are tight timings for uses of this product as it must be applied before the green bud stage of oilseed rape.

Longer stubble?

There is a suggestion that leaving longer stubble or a carpet of chopped straw residue on the surface may help combat cabbage stem flea beetle, although Niall Atkinson adds that this needs further investigation.

One possibility is that the the stubble means there is no bare soil, which could be attracting the flea beetle, which can differenciate between green and brown. Possibly it helps with moisture conservation, or maybe it is a combination of factors.

The trial looked at establishing with a HE-VA into a carpet of chopped residue while the Weaving GD direct drill works better in the long straw stubble. "We literally snipped the heads off leaving a very long stubble, not unlike using a stripper header," says Mr Atkinson

Case Study: Companion cropping on the Hertfordshire/Essex border

Fourth generation farmer Peter Hitchcock is trialling a companion crop of buckwheat on 10ha of his oilseed rape crop this year, at Stocking Pelham Hall Farm on the Hertfordshire/Essex border.

The farm, which grows 830ha of combinable crops has been hit hard by flea beetle infestations since the loss of neonicotinoid seed dressing treatments in 2018, with just 55ha of the crop now planted, down from 200ha previously.

A range of techniques have been implemented on the farm to help combat the pest attacks, including early drilling, leaving cereal stubble as long as possible, using hybrid varieties for vigour and quick establishment and a full dose of nitrogen in the autumn.

“By leaving residue and direct drilling we hope to make it more difficult for flea beetle to find the oilseed rape, as the beetles can distinguish between green and brown colours,” explains Mr Hitchcock.

He now hopes companion cropping will help enhance successful crop production on his farm, where oilseed rape yields are currently averaging 3t/ha, but previously yielded 4t/ha, on his heavy hanslope clay soils.

Buckwheat

The companion crop mix was planted on 4 August last year, direct drilled with a Sumo DD drill with a seed rate of 9kg/ha for the buckwheat and 2.7kg/ha for the rapeseed.

Mr Hitchcock is impressed with how the buckwheat has performed so far, and says he regrets not planting more, as the companion cropped area is now a foot taller and in fuller flower than the main crop.

“It really has taken us by surprise. All winter we were looking at the buckwheat and were worried that it was not going to perform as we hoped, but now, you can clearly see a definitive line between the trial and our main crop,” he adds.

Mr Hitchcock believes the buckwheat acts as a distraction to the flea beetle by disguising the rapeseed. The plant also acts as a great scavenger of phosphate, making it more readily available in the oilseed rape’s rooting zone.

Next year, he aims to grow 85ha of oilseed rape and if the buckwheat performs well, which he expects it will, companion cropping will be rolled-out across the farm, leaving just a small patch of oilseed rape without a companion crop as a control.

“We are also considering adding berseem clover to the mix next year, to promote our soil health further with the help of the clover's strong rooting potential,” he concludes.

JOURNAL : Farmers Weekly

The recent rain in some parts of the UK has been very welcome, helping to revive stressed crops.

However, it also brings its own problems. In wheat, the emphasis move to septoria as crops race through their growth stages.

It also means weed flushes and managing fast-growing weeds in sugar beet crops with uneven emeregence could prove challenging, as smaller plants will be more susceptible to crop effect from herbicides.

However, not all areas have seen much rain.

In Scotland, conditions are still largely dry, with wheat hardly moving, while spring crops starting to show signs of stress.

East: Marion Self

Prime ***Agriculture*** (Suffolk)

Gentle rains have been a game changer for drought-stressed crops.

Winter and spring crops alike needed the rain.

Poorly rooted winter cereals and slow, patchily emerging spring crops are already responding to moisture and more available nitrogen.

Weeds are also germinating, but there is comfort knowing that herbicides will be more effective in these conditions.

See also: The drastic action growers can take to save oilseed rape

Winter wheat growth stages vary according to drilling date, but even December-drilled crops are now at the T1 timing (final leaf 3 emerging).

T1 fungicide sprays have been tailored according to drilling date, variety and yield potential and now we wait to see the weather pattern and disease development until the next timing (most likely at flag leaf emergence).

Until the recent rain, yellow rust has been the predominant disease affecting many varieties, sometimes with high pressure where unexpected.

In September-drilled wheats, the flag leaf tips are appearing and the next fungicide spray will be timed to protect this leaf.

Winter barley crops are rallying after a difficult start and now coming into ear.

These are receiving a final fungicide including an SDHI plus azole, with chlorothalonil for additional ramularia control.

Winter beans are pleasing and receiving a fungicide mix with foliar nutrition.

Uneven sugar beet

In dry, cloddy soils, sugar beet establishment has been uneven.

In some cases, herbicides have been delayed until further emergence after the rain and now we race to control fast-growing, difficult weeds.

Where plant sizes within the crop vary, be careful not to damage the small beet with heavy-handed herbicide mixes.

Also, spray early or late in the day to avoid hot, sunny conditions that will increase scorch risk to the crop.

At the same time, aphid populations are high, and often beet with just two true leaves are at or close to the treatment threshold (one wingless aphid per four plants up to the 12-leaf stage).

Early virus infection at this stage of the crop could be very damaging.

Plan the spray strategy to accommodate safe intervals between broad-leaved weed, aphid and grassweed treatments.

It could be tricky – in some crops, all inputs are pressing.

As spring barleys approach early stem extension, they will be ready to receive herbicide and fungicide treatments.

It is a busy time for the sprayer, often moving between many different crop types, making planning, logistics and sprayer hygiene particularly important.

North: Mary Munro

AICC/Strutt and Parker (Perthshire)

It has been an extraordinary month.

April turned out to be the sunniest on record for the UK, and in Scotland, it was the third driest on record, too.

The contrast with the winter months could hardly be starker, and crops are now drought-stressed.

Winter wheat has got particularly stuck, and has hardly moved through the growth stages.

Rain in the past few days may bring it on a bit, but for many places, the rainfall barely dampened the ground.

The most forward crops in my area are at a good growth stage 31, and T1 sprays are going on now.

Most are sitting at growth stage 30, turning yellow, with cracks appearing in the ground.

The one advantage of dry weather is the lack of rain splash to wash septoria up the plant, but it is becoming more evident in the lowest leaves, and my T1 recommendations are based on the expectation of a change in the weather.

All varieties are susceptible to a greater or lesser degree.

It is such a major disease for us here that a decent SDHI plus azole mix with the precious last stocks of chlorothalonil is a given.

Yellow rust

The yellow rust that was much in evidence at T0 has disappeared – whether due to well-timed fungicide or natural plant resistance is a matter of debate.

Weeds have been a bit of an issue, with some unusual things such as chervil appearing, and very slow germination in all crops.

I have a lot of cereals following oats this year and have had to brush up on the options for removing the volunteers.

Fortunately, it is less of a headache than trying to kill barley in wheat, which was last year’s dilemma.

The spring cereals are looking good but a little stressed now.

Some manganese and sulphur early with the weed spray should help, but they really need a soaking of rain.

Some of our local potato irrigators have been busy watering spring barley, but the potatoes have now been planted and not surprisingly the reels have moved.

However, I am not rushing into spring crops until more weeds have emerged and there is a target to hit.

South: Richard Harding

Procam (Sussex)

Most of the Downs have seen a very useful amount of rain and the benefit to crops was clearly visible the very next day.

In some cases, the rain has been heavy enough to provide rain splash and would have easily spread low levels of septoria in the base of the canopy up to newer leaves of winter wheat, which are at last looking more promising. Or are from the road, at least.

Walking most crops, they are either thin or contain various sizes of bare patches.

The rain has already encouraged a good flush of weeds to emerge and crops are being prioritised for treatment as required.

T1 fungicide timing, particularly for later-drilled winter wheat, is proving very tricky and highly variable this year.

For earlier-drilled winter wheat, which has a higher risk of septoria infection and yield loss, it has been important to time the T1 fungicide at 75-100% emergence of leaf 3.

The few crops drilled up to the end of October have largely received their T1 spray of isopyrazam + epoxiconazole with CTL, where available, within the past 10 days.

However, most wheat was drilled from November to February, and the risk from septoria is currently much less, particularly where drilling took place in the new year.

Reduced fungicide spend

Here, the winter wheat fungicide spend will be greatly reduced.

These crops are being treated like spring crops, and so are a few backward crops of winter barley, too.

Anything drilled from November onwards is likely to be ready to spray now or within the next week.

For any winter wheat drilled in December or January, the period between T1 timing and T2 is going to be much shorter as the crop develops much more quickly.

Awns are now easily visible on winter barley crops and this is the very final stage for any growth regulation and applications have now been completed or will have in the next day or so.

Most T1 fungicides were applied in the past two weeks, which is an indication of how fast development has been.

But it also means that a T2 fungicide of benzovindiflupyr + prothioconazole will be applied with ears just emerging depending on varieties and disease pressure.

However, disease levels in barley are very low, except for some brown rust that can be found in hybrid barley.

Early-drilled maize has emerged well from warm, moist soils, and drilling will be completed this week.

The seed-beds produced this spring are excellent, and pendimethalin has been applied or planned for pre-emergence as there is good levels of moisture for activity.

West: Antony Wade

Hillhampton Technical Services (Herefordshire/Shropshire)

Who would have thought that after the previous six month’s rainfall, we would be hoping for a showery week to help our spring crops get established.

Spring crops that were established either by min-till or no-till where moisture was conserved in the seed-bed have seen the best establishment, while some power-harrowed crops have struggled with low moisture levels in the ***collection*** of golf ball clods.

In those crops, the past week’s rain might just be the saviour.

These crops are going to really motor through the growth stages now, so we are gearing ourselves up for regular sprays during May.

Spring oats are especially susceptible to phytotoxic effects so require multiple separate passes for herbicide, plant growth regulator and fungicide; trace elements will be applied to try to minimise the effects of pesticide inputs.

With many clients having a larger proportion of spring cereals, it is going to be important to try to maximise yields and biostimulants, and trace elements will be used to reduce stress in fast-growing crops so that nothing is limiting yield.

Spring beans

Spring beans have emerged well. Weevil notching was concerning at one stage, but with cooler weather and rainfall, they have outgrown the threat without the need for insecticide, which I am always keen to avoid having to use.

Grassweeds are emerging fast so a graminicide plus phosphite may be the first post-emergence spray we do.

Spring linseed it is a similar situation. They have outgrown the flax beetle holing and are now growing away.

We hope the pre-emergence Callisto (mesotrione) will suppress the initial weed flush, allowing a post-emergence herbicide to be delayed until the crop is stronger.

Maize plantings have started, but some have been delayed by the recent rains so will be planted in the coming weeks.

Although I don’t look after many potatoes, many growers have taken advantage of the dry weather and many fields are planted up.

Winter cereals are at a complete range of growth stages, some on the same farm.

Some September-sown wheat had leaf 3 almost fully emerged on 15 April so are ready for their first fungicide.

October-drilled crops were at the more traditional 23 April timing.

But I have some February-drilled crops that are still at the tillering stage with nothing applied to them as yet.

Winter barley crops have gone from T1 to T2 in less than three weeks.

By the time this goes to print, most T2s will be applied at the paintbrush stage.

Crops are relatively short so I’m hoping the decision not to apply any late plant growth regulator will not be regretted.

JOURNAL : Farmers Weekly

The extremely challenging season continues and the recent rains have resulted in the expected flush of weeds, aided by dry soils cracking  which is enabling seed to germinate at depth. Dry conditions are also limiting the efficacy of residual herbicides.

This lack of residual herbicide activity is having an impact on bean growers, with only one post-emergence option for broad-leaved weed control.

On the disease front, septoria remains a risk in wheat, although the bigger challenge in the coming days is the 20 May cut-off for using chlorothalonil. Not only is this the loss of a vital product, it also leaves growers with a much-reduced winter cereal area and significant unused stocks of the fungicide.

East: Ben Pledger

Farmacy (Bedfordshire/Hertfordshire)

The recent welcome rains have started flushing weeds in winter wheat, with cotyledon stage seedlings now appearing out of cracks produced by the dry weather.

See also: Rust control advice to achieve high-protein milling wheats

With not a lot of chemical weed control included in the winter wheat T1 fungicide spray, tank mixing of herbicides at T2 will be more prevalent this season where crop canopies allow penetration to the weed.

Although T1 fungicides may have only recently been applied, the temptation to delay the T2 timing to allow the boots to split and get some active ingredient on to the emerging ear should be avoided. The flag leaf and leaf 2 contribute to more than 60% of yield, and to leave these unprotected is a big gamble.

Septoria is present on some lower leaves, and the wetter, warmer weather will have accelerated its progress up the plant towards the upper, unprotected canopy.

Fluxapyroxad or benzovindiflupyr will form the base of the T2 fungicide mix, and will be tailored to individual varieties depending on their ratings for septoria and rusts.

Where stock exists on farm, chlorothalonil will be added to the mix to protect against septoria, keeping in mind the 20 May cut-off for this active ingredient.

Herbicide cut-off

Growth stage cut-off timings for herbicides should also be observed when adding them to the mix. Prothioconazole will feature on milling varieties to start fusarium control.

Sugar beet crops are at differing stages in the region, mainly driven by seed-bed moisture at drilling.

In places, where land had to be worked late on to produce a fine seed-bed suitable for beet, valuable moisture was lost and seed ended up sitting in dry seed-beds until the recent rains. This has left some fields with growth stages varying from cotyledon to six true leaves.

Weed emergence has been as protracted, and with hot daytime temperatures last week, and now cold nights as well as thresholds for aphids having now been met in a large number of fields, sequencing an insecticide in with herbicide timings and intervals has been tricky, to say the least.

North: David Martindale

Arable Alliance (Yorkshire)

The prolonged dry weather continues to cause a lot of stress – among crops, growers and advisers.

A splash of rain in early May, ranging from 4mm to 10mm typically, gave a few hours of hope, as there was just enough to finally wash in the fertiliser.

Reality soon returned, though, with many spring crops looking thin and patchy and some winter oilseed rape crops seemingly disappearing on heavier land.

The season of extreme wet followed by extreme dry is certainly taking its toll. Seeking positives is difficult this year. However, one positive is that the dry weather has, so far, kept disease pressure low for important pathogens such as septoria tritici, mildew and rhynchosporium.

In winter wheat the flag leaves are emerging so attention is now focused on the T2 fungicide timing. There is the temptation to cut back on fungicide input at this time due to conditions being so dry.

This could well prove to be false economy, though, as the T2 fungicide looks to protect the top two leaves in the canopy which together contribute 60-70% of final yield.

Also, rain will return at some point, so late-season disease pressure could still increase, meaning protecting these top leaves is crucial.

Thankfully there will be little requirement for large eradicant activity from the T2 timing for septoria tritici control, so fungicides with good protectant qualities will be the main focus.

Yellow rust pressure has been high this year with T0 and T1 fungicide choices targeting this disease. These earlier fungicides have worked well and any spray misses in fields have now turned yellow.

Maintaining protection against yellow rust at the T2 timing will be a key consideration with product selection this year.

Winter barley

Awns are emerging on winter barley and T2 fungicides are currently being applied. With little rain since the T1 timing, new crop growth has remained relatively clean, with the T2 fungicide protecting against late season disease pressure such as brown rust.

Unfortunately, the wet winter and dry spring has not helped tiller development, with ear numbers lower than ideal.

With barley less able to compensate for lower ear numbers compared with wheat, this is another sign of reduced yield potential. Crops which are thick and competitive remain few and far between.

The earliest spring barley crops are now at early stem extension and T1 fungicides are being applied. Like their winter counterpart, crops have not been able to tiller as well due to the dry spring and poor nitrogen uptake.

Normally herbicides are applied prior to the crop closing in, to provide competition against weeds for the rest of the season. This year many crops will not be thick enough to do this so there may be late weed flushes to cause later problems.

Where crop establishment has been patchy, herbicides and fungicides are being delayed for the time being.

Spring beans have established the best of all the spring-sown crops. Pea and bean weevil activity has been high as crops have been slow to grow in the cool, dry conditions.

In the worst-affected fields the U-shaped notches have been seen on the outside of every single leaf which has given a very ragged appearance.

Pre-emergence herbicides have not worked as well due to soils being dry for so long.

Some deep germinating weeds such as charlock and oilseed rape are now emerging which are having to be controlled with bentazone – the only active ingredient available for post emergence broad-leaved weed control.

West: Neil Potts

Matford Arable (Devon)

The 2020 season continues to be a tricky one from both a climatic and a cropping point of view. I asked a colleague the other day how he was, and received the reply, “clinging to the wreckage”, which succinctly sums up this season.

Winter crops are all over the place, with planting dates and nitrogen timings having played a crucial role.

Those that received their first top dressing early enough to have worked well before the dry spell have by and large pulled themselves together pretty well. However, delayed top dressings have left crops looking hungry and very slow to start growing this spring.

Consequently, I now have winter wheat crops planted in October that range in growth stage from just at 31 to others that are at 39. Disease levels are very low following six weeks of dry weather, but many of the lower, non-productive leaves in the bottom of the crops are carrying the remnants of what was quite a severe septoria infestation as we came out of the winter.

Whatever we choose to do at flag leaf, it will only become evident with the benefit of hindsight whether it was the right thing to do or not.

Winter barley crops that had a delayed first top dressing are now looking OK, but are in general far too thin, having shed tillers through the dry spell as a result of being short of nitrogen. Those crops that had early N or are being grown on fertile sites are now looking like they could yield fairly well.

Winter oilseed rape crops are also extremely variable and again this has largely been down to nitrogen timings, although some crops failed to establish optimum plant numbers in the autumn and subsequently suffered with the continuing wet through the winter

More maize

There is a much larger than usual area of both spring barley and forage maize planted this spring. We have had a large area of maize planted pretty early this year, with quite a few crops emerged in April, which is quite unusual.

With an arctic blast forecast at the time of writing we can probably expect to see some temperature-stressed crops in the next week or so. The spring barley crop has by and large gone into some very good seed-beds and is looking full of potential at present, but will require more rain soon if that potential is to be filled.

Where seed-beds were allowed to dry out before planting the spring barleys have emerged very unevenly and these, more than the other crop, will require adequate rainfall and soon.

I have been doing this job more years than I care to mention and cannot remember a season where Mother Nature has pulled nearly all the strings and we have been left in her wake, being able to exert little influence over what is happening. This has been exacerbated by product revocations which have taken away some of our tools.

Chlorpyrifos springs most readily to mind, as significant areas of crop have been lost to leatherjackets this season and we have been left powerless to prevent it happening.

Good luck to all with what is left of this challenging season.

South: Tod Hunnisett

AICC (Sussex)

I’m supposed to write 300 words. However, I’m going to write a lot fewer, but make them very big.

Chemicals Regulation Division (CRD),

We have just four days to empty our sheds of chlorothalonil!

Can’t you be slightly less dogmatic?

Loads of love – Tod

JOURNAL : Farmers Weekly

The recent warm weather has seen pest and disease pressure rise, with yellow and brown rusts being the current threats in wheat crops. This has led to tweaks to the fungicide strategy for the upcoming T1 sprays.

Brown rust pressure has also risen in winter barley crops in the north-west, prompting similar adjustments to the T1 spray. However, the more notable milestone is that the cut-off date for using chlorothalonil is fast approaching, with less than three weeks remaining for this key fungicide.

Maize drilling is now under way and thoughts turn to weed control, as early competition can have an impact on yields.

South: Iain Richards

Agrii (Oxfordshire)

A good 20mm of mid-April rain really helped crops deal with the late spring drought. It was just in time to help our spring barley establish in reasonable shape.

With linseed and spring OSR now in we are drilled-up with a far larger area of cropping than we ever thought possible a month ago.

See also: How ethylene can help control sprouting in potato stores

Spring barleys on our lighter ground are looking nice and even as they fair motor along, having received all their nitrogen and an early plant growth regulator to encourage rooting and prolong tillering.

Giving us typical yield responses of 8%, early growth regulators will be even more important for the crops on heavier ground, only just coming through from mid-month drilling.

Equally vital here too will be phosphite, manganese where the seed wasn’t dressed, and magnesium.

T1s are imminent for our October-drilled wheats which are well into leaf 3 emergence and three weeks on from their T0s. This and the dry weather has kept septoria well under control.

Rust threat

However, both brown and especially yellow rust are easy to find and enjoying the dry weather and enough dew. With so many of our current varieties so susceptible, they are a major concern.

So we’re basing our T1s on our tried-and-trusted bixafen + prothioconazole + spiroxamine co-formulation, supported by a strobilurin in many cases.

As well as providing the best rust defence, of course, the combined physiological effects of an SHDI and strobilurin will be especially welcome if the dryness persists.

It also means we can save fluxapyroxad and Solatenol for our T2s, rotating our SDHIs and azoles and saving our main septoria guns for May so we’re well-prepared for the almost inevitable return to wet weather.

T1s for our later drillings – all of which were in by mid-December – are still a week away. As their T0s were focused on plant growth regulation and nutrition, and their lower leaves are so much more important, these may need to be more robust. But that all depends on the weather and the degree of potential they show.

In addition to the most appropriate fungicides, the balance of our plant growth regulator programme will be going on at T1, together with copper and magnesium in most cases.

Tissue testing has shown the lowest copper levels I’ve ever seen. With plenty of broad-leaved weeds coming through in open crops, many of our tank mixes will be fairly complex.

OSR continues to be a very mixed bag. The bulk is flowering strongly and has already set 15 good main raceme pods. The dry weather has enabled us to hold off on our mid-flowering spray, which could also be valuable in dealing with a recent build-up in seed weevils.

We’re less optimistic about the backward OSR that really hasn’t appreciated coming straight out of waterlogging into a bone dry, N uptake-restricting spring and has needed a pollen beetle spray to safeguard its green buds.

Even so, we have far lower levels of flea beetle larvae this season and we know how well the crop can compensate, given half a chance.

East: Sean Sparling

AICC/SAS Agronomy (Lincolnshire)

Since a torrential drizzle which soaked us with 0.4mm on the 20 March, I have recorded no wet stuff at all. Unsurprisingly, then, we’re moaning about how we could really do with a drop of rain.

In winter wheat, the yellow rust which is showing in some unlikely varieties takes no finding and is flourishing in the mild days and dewy nights.

Septoria is similarly moving and, like nits in children, will happily spread from leaf-to-leaf contact on the many and frequent windy days.

Growth stage 30 is now widespread even in the more backward-looking pieces (never assume!) and, with leaf 3 emerging quickly, T1 is upon us. Where epoxiconazole is used, as per Chemicals Regulation Division (CRD) guidance the 83g/ha maximum is being adhered to.

Direct drilling now appears to have been the way to put in spring cereals, with crops tillering evenly.

Where power harrows and the like were employed, we achieved little more than stirring golf balls in a bucket. A layer of concrete, a film of dust and assorted clods ranging in size from Brussels sprouts to cricket balls mean the latter are through in clumps, stripes and patches.

Not ideal, but we can only do our best with the conditions and timescale we’re given.

BYDV

Unusually high numbers of winged barley yellow dwarf virus (BYDV) vectors have needed treatment in some areas, but with the spiders, ladybirds, hoverflies, wasps, lacewings and other predators building rapidly, further treatments will do more harm than good.

Let the predators do their job.

Slowly emerging fields of peas and beans were also savaged by pea and bean weevils, but now as long as crops are outgrowing the adult feeding damage, bravery and constraint should be exercised.

Sugar beet is emerging well with the early drillings now sporting four leaves. Herbicides seem to be doing little to the emerged weeds, but a drop of rain would change that overnight – pre-emergence herbicides have come into their own and fields are noticeably cleaner where applied.

There is no sign yet of the dreaded one myzus persicae nymph per four plants threshold.

But as I once again spend the spring crawling about on my hands and knees in every beet field I walk, I find myself wishing I’d worked harder at school!

West: Stephen Harrison

AICC/Southwest Agronomy (Avon)

Spring 2020 has certainly proved the need for field-specific advice. A host of growth stages and plant populations means that fungicide and plant growth regulator recommendations have rarely been so varied.

Septoria pressure is currently low following the dry April. T1 mixtures have centred on an azole plus chlorothalonil on later-established high-resistance varieties. More forward crops are receiving an SDHI component in the treatment.

Growth has been slow with a lot of applied nitrogen yet to be taken up. Do not be lulled into a false sense of security regarding growth regulators: the forecast rain will cause a huge growth spurt much as we saw in the brown rust spring of 2007.

The ramularia threat has led to a change in strategy in winter barley. It has become our standard approach to apply a second plant growth regulator and chlorothalonil at the early flag leaf stage. This fits usefully with any necessary wild oat treatments.

Maize drilling

Maize drilling is well under way. However, will drill operators please heed the personal protective equipment (PPE) requirements for handling maize seed with ziram anti-bird treatment.

Pre-emergence treatments largely based on pendimethalin are planned. Early weed competition is challenging to maize and even in dry times we see consistently good effects on fat hen and chickweed.

The earliest spring barley is approaching mid-tillering. Few broad-leaved weeds have emerged in the dry conditions, so a single spray of fungicide and herbicide will suffice.

Second fungicide timings will be beyond the 19 May chlorothalonil cut off. Therefore we will adopt a similar ramularia strategy to winter barley.

Ignoring the usual grassweeds, one of the more challenging weeds in winter cereals has been groundsel.

Sulfonylurea herbicides control it well while small, but it grows so quickly that any slip in timing, thereby letting it flower, means control is next to impossible.

I started my agronomy career in 1980 and throughout the years, chlorothalonil has been a great ally. It seems unbelievable that this article is the last time I will ever write about it.

I do not expect the new fungicide actives on offer will remain as cost-effective as chlorothalonil in another 30 years.

North: Helen Brown

Hutchinsons (Cumbria)

Who’d have thought a month ago that my next Cropwatch piece would be a cry for some rain? But here we are after an extremely dry April shouting for rain and I am eagerly watching the forecast in hope that by time you read this we will have at least had enough to settle the dust.

Winter crops are varied from growth stage 31 up to 39 in some winter barleys. Lack of rain has reduced rhyncosporium risk in winter barleys.

However, the recent warm conditions are ideal for brown rust which I have spotted in many winter barleys. I have edited my T1 fungicide applications to account for this shift.

We are starting to see some big differences in wheat varieties at our regional trial site, which was drilled late into poor conditions and then struggled through a very wet winter.

This is giving us a great opportunity to see how the varieties perform under pressure. There are some stand-outs for vigour – which for me include Extase, Skyscraper and Gleam.

Spring drilling

Spring drilling is fully under way in Cumbria. Spring barleys are varying from being still in the bag up to 3-4 leaf stage.

Reducing the amount of soil movement and trying to cultivate/drill and roll in one day where possible is essential to preserve moisture when establishing spring barley crops in these conditions. There is limited spring weed germination in crops so far due to lack of moisture.

Maize drilling is also under way and soil conditions are nice and warm. However, the dry seed-beds bring concern over pre-emergence efficacy, which is important when using film. Where growers are not using film, I have moved towards a post-emergence herbicide programme, since the pre-emergence will have limited efficacy in these dry conditions.

Docks are currently around the ideal size for control in grass swards and, due to their large taproot, are still reaching water and actively growing.

However, the hot, dry conditions mean grass may be stressed and making sure to use chemicals which are softer on the grass, for example fluroxypyr, is beneficial in this situation.

JOURNAL : Farmers Weekly

A farmer in Cumbria has died after an accident involving a quad bike near his farm.

Tributes have been paid to Martyn Mawson, a beef and sheep farmer, who was pronounced dead at the scene following the accident on Sunday 3 May.

Cumbria Police was called by North West Ambulance Service at about 11.30pm to the fells near a property on the A591 between Bothel and Keswick.

Mr Mawson, 52, was a respected member of the farming community in Cumbria and leaves behind his wife and two sons.

JOURNAL : Farmers Weekly

Farmers could save thousands of pounds on their electricity and gas bills if they shop around for the best deal. Now, Farmers Weekly can help you do that.

With farm incomes constantly under pressure, farmers have to keep a sharp eye on their business costs.

So Farmers Weekly has launched a new service to help farmers reduce costs in one important area – energy bills.

Farmers Weekly Energy Switch combines smart technology with human experts to navigate the complex business energy market and find the best deals on electricity and gas for your farm.

Visit Farmers Weekly Energy Switch now.

The savings can be sizeable, particularly in sectors such as dairy, pig and poultry, which are particularly heavy users of electricity.

The average dairy farm in the UK spends about £30,000/year on electricity alone, so any significant reduction can make a real difference to the bottom line.

But most farms could probably get a better deal on their electricity and gas, if they had the time and the expertise.

Of course, farmers have been able to shop around and switch electricity and gas suppliers for decades.

But that’s a lot harder to do for business customers than it is for consumers.

The business energy market is much more complex – and less transparent – than the consumer sector.

Some farm businesses get caught out by contracts with attractive headline unit rates, without realising the full impact of other charges.

Because of this complexity, the automated energy-switching services that work well for consumer energy customers are not suited to business energy customers – you need a human expert involved.

To deliver this service, Farmers Weekly has teamed up with the leading player in business energy switching – Bionic.

It has 13 years’ experience of finding better business energy deals, and its team of almost 200 experts has already helped more than 250,000 business cut their energy bills, with an average saving of £725/year.

Farm businesses, which can be heavy users of electricity and gas, could save far more.

To find out more, and see how much you could save on your farm energy bills, just go to the Farmers Weekly website and click on the “Energy Switch” link on the top menu.

Farmers Weekly Energy Switch: How it works

Finding a cheaper deal for your gas and electricity is a simple, three-step process:

Step 1: On our website, enter your business address. We’ll use industry ***data*** to understand your energy usage.

Step 2: One of our experts will use this information to search for the best deals available on the market to suit your specific energy usage. They will then present their findings back to you in a short phone call – usually no more than 10 minutes.

Step 3: If you then decide to switch providers, we’ll take care of everything to make the change. And you don’t have to worry about better deals emerging in future – we’ll keep monitoring the changing energy market, finding you the best deals year after year.

JOURNAL : Farmers Weekly

Dairy farmers have hit back at calls by vegan organisations for the UK government to encourage them to leave the industry and transition to plant-based farming.

A ***collective*** group of vegan advocacy organisations in the UK has written to Defra secretary George Eustice, asking that dairy farmers should be given help to make the switch.

The letter (PDF) claims that demand for dairy has dropped significantly since the start of the coronavirus pandemic – and that this has forced a number of dairy producers to dump milk.

See also: What to do if you’re a victim of vegan activist incursions

“The UK dairy industry is clearly in decline,” the letter states. “There are now fewer than 9,500 dairy farms in the UK compared with 13,000 10 years ago, and it has been predicted there will be fewer than 5,000 by 2025.

“On the other hand, the UK market for dairy alternatives has grown by 150% in six years. Plant-based business is positively booming.”

The vegan ***collective***, which includes the Vegan Society, Animal Aid, Viva! and Peta UK, states that instead of the government providing financial help for the dairy sector, it should support for “a progressive transition over to more sustainable, healthier and planet-friendly, non-animal-based ***agriculture***”.

“We strongly believe that financial assistance should be focused on supporting farmers to move to this more sustainable and compassionate alternative,” the letter states.

Farmer reaction

However, UK dairy farmers have reacted angrily to suggestions that their industry is in decline and accused the vegan groups of disseminating “misguided” information.

Ben Paterson, a dairy calf rearer and relief milker based in Cheshire, said: “Demand for dairy isn’t down. Other than the 3% drop in production that farmers have been asked to do because of the coronavirus, I don’t see the demand on the supermarket shelves is down.

“I go into the Co-op stores and since the start of the pandemic, all the milk has been selling out on shelves and then being re-stocked.

“The reason some farmers are having to pour away milk is because of the likes of Costa Coffee being shut. It’s a supply chain issue rather than a decrease in demand.”

He added: “Milk goes into so many things – chocolate, cream, ice cream, etc. I just don’t think we can grow enough crop to make oat milk sustainable enough to feed the nation.

“When you look at these other countries where they are making almond milk, the people are kept in terrible conditions, far worse than we keep our cows in.”

End user change

Richard Pilkington, who runs the Aintree Holsteins herd in Hope, near Wrexham, said: “My neighbour was up in arms because she could not get milk from her local shop.

“It’s not the case that there has been a drop in demand for milk. The end user/place of consumption has changed and we cannot get the milk to the market that wants it at the moment.

“Because of the closure of the foodservice and hospitality sectors, it has been difficult to redirect our milk in a hurry. If there had been some planning, we would have been okay.”

Demand for milk and dairy products remains strong, says AHDB

Any suggestion that the dairy industry is in decline is not supported by the evidence, the AHDB has said, as demand for milk remains strong.

AHDB strategy director for dairy Paul Flanagan said: “A total of 98% of UK households continue to buy dairy products and recognise the important role it plays in a healthy, balanced diet.

“In fact, our latest research shows that in April, sales of dairy products were up 9.2 per cent compared with 2019 – driven by milk, of which an additional 38 million litres were sold compared with last year. This is the highest volume of milk sold in April in at least five years.

“The challenges facing the dairy industry today due to coronavirus are not the result of a decline in demand from consumers, it is the loss of foodservice, with restaurants, pubs, cafes and tearooms, which normally consume oceans of milk and other dairy products, closing overnight.

“And while figures show there are fewer dairy farms in the UK, through efficiency gains production levels remain the same. Dairy has always been, and I am confident will continue to be, an integral part of people’s lives.”

JOURNAL : Farmers Weekly

Kuhn's Mergemaxx burst onto the scene at Agritechnica 2017, offering farmers an alternative method for rowing up crops in front of foragers and balers.

One of the first to put in an order was Norfolk contractor Dick Barnes, who swapped a twin rotor rake for a 9.5m Mergemaxx.

The machine is now going into its second season with the busy contracting outfit, so we asked Mr Barnes how it has fitted in and if he has any regrets about buying one.

Farm facts: D H Barnes, Forncett St Peter, Norfolk

Contracting, plus 100ha home farm

1,200ha grass for dairy and beef herds

200ha whole crop

1,000ha maize harvesting

520ha maize drilling

40,000 square bales

800ha sugar beet

What did you have before?

We had a Kuhn twin rotor 9.5m rake that was a good machine and served us well, but due to our flinty soil, there were quite a few stones creeping into the swath.

This was not only having a negative impact on the quality of the crop, but the annual bill for wearing forager parts was alarmingly high.

See also: Video: Abimac front rake helps solve contractor’s labour shortage

The flints were really tearing the internals to bits. We were going through multiple sets of knives per season along with shear bars and spout liners.

Why did you look at a merger?

The land we farm and contract on is a 25-mile radius around Forncett St Peter in south Norfolk, so we encounter everything from light land full of flints to reclaimed marsh on the Norfolk Broads. Our main aim was to stop pulling stones into the swath.

I’d been on the search for an alternative to a rake for around three years, and after seeing the Mergermaxx at Agritechnica in 2017, I put in my order.

Kuhn didn’t think there would be much interest from the UK and my eagerness must have caught them out as I didn’t actually get the machine until early 2019.

Did you look at anything else?

Yes, we looked at a four-rotor rake before buying the merger. We wanted something bigger than our twin-rotor to make meatier swaths on the lighter second and third cuts, as the chopper was working below its capacity.

However, the extra rotors meant the length of the machine increased quite a bit and we felt this would have been awkward when travelling along some of the narrow lanes.

Though the merger hasn’t got a steering axle like the four-rotor rake, we don’t feel it needs it. The beds are 3.5m long so, including the drawbar, it's far shorter than a big rake.

How was the first season?

We carried out a lot of work for energy companies last year, so the merger was kept busy. This season we have dropped a bit of that work to focus more on beef and dairy farms.

The biggest thing we have benefitted from is the merger’s versatility. We can easily bring 9.5m of crop into one row on heavy 6t/ha first cuts, which is more than enough for the Claas Jaguar 970.

For lighter second and third cuts, as well as lucerne crops, we can bring the width down to 7.5m to form a continuous belt and throw one pass from each side into a 3m row, effectively raking 18m into one swath.

We also merge straw in front of balers at harvest and shutting it down to a 7.5m row seems to work well.

Does it take some getting used to?

The only time you have to be on your game is the short works as the merger moves grass sideways rather than just out the back.

I’m the main driver and I sometimes have to think about how the land work will meet with the headland to avoid having odd strips. It doesn’t take long for it to become second nature, though.

We contract nearly 300ha of marshland on the Norfolk Broads which is very undulating. We mow and merge through dry ditches and the suspension system on the merger seems to cope with it fine.

It is a little heavier than the rake, but is mounted on the lower link arms and we’ve yet to find the extra bulk an issue.

See also: How rolling road test can help keep trailer brakes shipshape

We still have a rake for times when we need the merger in two places, such as straw baling and later silage cuts.

How does output compare to a rake?

Tractors burn a bit more fuel running the merger, as they have to power the belts and pickup reels. That said, our John Deere 6155 is more than adequate and we could probably get away with 120hp.

The extra fuel use is offset by the increased output. We can happily glide along at up to 8ha/hour with the merger, whereas the 9.5m rake would be flat out at 4ha/hour.

It's most noticeable in lurcerne – the merger will fly along at 12kph and doesn’t miss a leaf as the reels act just like a forager, while the rake would have to plod along at 6kph to pick it all up.

We’ve noticed that drying times of the swaths are a little more uniform. The windrow is slightly fluffier due to the grass being laid down from above, rather than forced together from either side.

And, because the rows aren’t as tight, the air can pass through them better.

Have forager repairs reduced?

In the first cut of grass we saved a set and a half of blades, which equates to nearly £7,000 in parts. Throw in labour and downtime and the merger is already saving us money. Running one chopper, we can’t afford downtime when the weather is good.

Being able to keep the forager fully fed by making bigger rows has also meant the merger can comfortably stay in front of the chopping team.

What are maintenance and wearing parts like?

Maintenance is similar to a rake, with skids and pick up tines the main items. We had it in the workshop this winter and after 1,500ha we only needed a couple of skid covers and 9 pickup tines.

One gripe is that there are a few awkward grease points on the belts, but luckily these are only 50-hour intervals.

Kuhn added a few modifications this year to stop grass build-up between the belts and tines. The crop had a tendency to drag on the tines and not make it onto the belts, particularly in damper crops, but they fitted a plate in the gap so hopefully this won’t be an issue this year.

LIkes and gripes

Likes

E Multiple merging widths depending on crop

E Vastly reduced forager repairs and downtime

E Cleaner crops and increased output

Gripes

E Awkward greasing points on belts

E Modification needed to stop wet crop bridging

E High purchase price

Specifications

Make

Kuhn

Model

Mergemaxx 950

Width

9.5m centre swath or 7.5m side discharge

Average speed

12-15kph

Crops merged

Grass, wheat and barley straw, lucerne

Output

8ha/hr

List price

£72,619

JOURNAL : Farmers Weekly

Abstraction licence holders who are experiencing cashflow problems because of coronavirus are being offered the opportunity to set up a payment plan with the Environment Agency (EA).

Farmers with water abstraction licences typically expect to receive their annual bill, or the first-part charge if they have a two-part tariff billing agreement, in April.

However, the agency is writing to customers offering changes to payment terms if they are experiencing problems paying their bills on time because of the lockdown.

See also: How irrigation is changing on an AHDB potato demo farm

Other amendments to normal rules include a delay on the winter or all-year abstraction returns, which are usually requested at the end of March.

Growers still need to make sure they are complying with the terms of their abstraction licences, but will not be asked to supply details of their abstractions during the period 1 April 2019 to 31 March 2020 until later in the year.

The EA will write to them to formally notify them of the new arrangements, although growers who already are registered to submit details of their abstractions online can continue to do so.

Paul Hammett, NFU water specialist, said farmers who were able to submit their returns online were likely to carry on as normal and use the digital service to get the job done while it was fresh in their minds.

“But I think the important thing is that for those who are struggling, it is an important signal from the Environment Agency that it is trying to be helpful where it can.”

Irrigation prospects

Meanwhile, the EA has revised its irrigation prospects forecasts to take account of the lack of rainfall in April throughout England.

Prospects in many areas remain “good”, but in the North West and North East of England they are now ”moderate”.

Yorkshire, East Anglia and the South East are classified as “moderate to good”.

Good status means that water levels are average or above average and supplies are expected to be safe.

Moderate prospects mean that water levels are low and so some controls on surface water abstraction are possible by midsummer if the weather is hot and dry. Controls on abstraction from groundwater are also possible in small, sensitive groundwater areas.

Mr Hammett said the irrigation season had started early for some after a dry April.

According to Met Office ***data***, this April was the sunniest on record for the UK.

Rain in the last week of the month increased the rainfall totals in many places, but overall the UK still received only 40% of average April rainfall.

It was the third driest April on record for Scotland.

“Fortunately, as a result of widespread heavy winter rainfall which was a problem for many farms, reservoirs are full and there is generally good water availability from both groundwater and surface water sources,” Mr Hammett said.

“Farmers are closely following predictions of possible hot, dry spells in the weeks ahead and what they could mean for water availability as the irrigation season builds.”

Advice on annual returns

Completing an annual abstraction returns is about more than just filling in a form, according to water resource specialist Envireau Water.

The company, which has experience of working with businesses across the ***agricultural*** and horticultural sectors, says the process should also involve forward planning.

It offers the following advice:

Quality-check all returns ***data*** to ensure consistency with licence conditions.

Know the history of your abstraction and think strategically about your future requirements.

If you have over-abstracted, then you will need to prepare a clear justification of why and create a plan for bringing abstraction back within your licensed limits. In some cases, it may be necessary to apply for additional volumes.

If there has been under-abstraction for many years, then the “use it or lose it” approach may be an issue, so anyone with a time-related licence needs to be prepared to justify retaining existing volumes at licence renewal.

JOURNAL : Farmers Weekly

The EU could set a target of one-quarter of ***agricultural*** land in Europe to be farmed organically by 2030, with an additional goal of reducing the use of chemical pesticides by 50%.

The plan to increase the amount of organic farming in Europe is understood to be included in the latest draft of the EU’s Biodiversity Strategy to 2030, scheduled to be published later this month.

The proposal to reduce the use of pesticides and nitrogen, while increasing the use of integrated pest management methods, has been included in a draft of a Farm to Fork (F2F) strategy, which will sit alongside the biodiversity strategy.

See also: Switch to organic farming would increase greenhouse gas

According to Brussels insiders, the latest draft text of the plans suggests that transformative change is “urgently required” to reverse the trend of biodiversity losses.

It says organic farming is the “best-known and best-regulated agro-ecological practice”, but acknowledges there would also be a need for measures to increase demand for organic produce through a commission action plan.

The document also suggests that at least 10% of the ***agricultural*** area in use should be restored as high-diversity landscapes.

Organic progress

 Although there has been strong growth in organic farming in Europe over the past decade, the extent of the sector varies considerably across EU regions, so such a target would be a significant change.

Across the whole of the EU-28 in 2018, organic farming accounted for just 7.5% of the total used ***agricultural*** area, or 13.4m hectares.

According to ***Eurostat***, the total organic area in the EU rose by 25% between 2012 and 2017.

The highest share of organic farming was reported in the Salzburg region of Austria, where about half (52%) of the total  ***agricultural*** area was used for organic farming in 2016 (the latest year for which regional ***data*** are available).

There were a further seven regions where organic farming accounted for upwards of one-quarter of total used ***agricultural*** area: Severozápad in the Czech Republic (30%), Norra Mellansverige in Sweden (29%), Calabria in Italy (29%), Mellersta Norrland in Sweden (28%), Burgenland in Austria (27%), Sicilia in Italy (26%), and Moravskoslezsko in the Czech Republic (25%).

Latest UK figures show that organic farming represents less than 3% of the total farmed area on ***agricultural*** holdings.

Next steps

Publication of the F2F and Biodiversity Strategy has already been pushed back because of the Covid-19 pandemic.

The most likely dates for publication at present are 20 or 29 May.

JOURNAL : Farmers Weekly

Growers are set to focus more on profit when managing their wheat variety choices, as they adapt to the post-Brexit landscape, according to the results from an exclusive Farmers Weekly survey.

As farmers respond to reductions in direct subsidy payments through the Basic Payment Scheme and make changes to their businesses, margin performance is expected to drive the demand for easy-to-manage varieties that require fewer inputs.

Some 48% of survey respondents expect that future variety choices will reflect their financial contribution to the farm’s bottom line, with 39% saying they will increasingly be looking for varieties that need minimal intervention .

About the survey

The Farmers Weekly wheat variety survey had 587 respondents. Of these, 41% were owner occupiers, 38% were tenanted farms, 9% were farm managers and 12% were farm workers.

The average farm size was 346ha and the average area of wheat grown was 210 ha.

Representing all regions of the UK, the survey explored growers’ attitudes to choosing wheat varieties, both now and in the future.

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See also: Tips on getting the most from clubroot-resistant OSR varieties

Main survey findings

Agronomist advice and the AHDB Recommended List are the two most important sources of information

Greater focus on profit/margin post Brexit

Final decisions on variety choice typically take place in July

Two-thirds of respondents plan to start winter wheat drilling in October 2020

Seed from 2019 remains on two out of three farms

Opinion is evenly split on considering varieties not on the Recommended List

Given this finding, it is not surprising that two-thirds of participants expect varietal disease resistance to become even more important to them over the next few years.

Loss of chemistry and highly dynamic pathogen populations are also behind the move to more-resistant varieties; a trend that started a few years ago and is now expected to accelerate.

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However, for one-third of respondents, growing less wheat is on the cards in the post-Brexit period, while another 17% intend to target specialist/niche markets and look for new contract opportunities.

Variety characteristics

Growers give greatest prominence to yield and disease resistance when choosing their wheat varieties – reflecting that recent variety introductions can offer both.

More than three-quarters of our survey participants ranked them as very important, with local markets, harvest date and grain quality also considered important. Factors such as plant height and speed of development were less prominent.

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Septoria resistance was very important to 76% of the respondents – with a closer look at the responses show that a variety’s Septoria rating was more important to larger farms and to those situated in the south of the country.

In the north, a variety’s regional performance was a more important consideration than in other areas, while sowing date suitability was given greater focus in the Midlands.

In the last three years, there has been a significant change in the way that varieties are considered. Disease resistance has come to the fore, with the loss of chlorothalonil prompting greater interest in septoria scores.

Information sources

Agronomist advice and the AHDB Recommended List are the two most important sources of information on varieties, according to the survey results.

Some 82% of respondents mentioned their agronomist’s advice as a key source, putting it just ahead of the Recommended List. Previous experience with the variety, local trials and asking other farmers were also highly rated.

Local trials results were mentioned more by growers in East Anglia and the Midlands, while industry events such as technical events and shows were given greater importance by growers in the South East and South West.

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Farming publications are doing their bit too; some 56% of the survey respondents saw them as an important source of information for choosing their varieties.

In contrast, websites and social media were held in lower regard, due to uncertainty about the integrity of the posts. Other sources of information mentioned by farmers included end users and independent agronomy organisations.

The future

Plant breeding is expected to continue to deliver the progress that growers have got used to.

Asked about the traits that will be important to them in the future, 59% of our survey respondents would like to be able to select varieties on the basis of growth habit.

Other important future selection criteria were waterlogging/drought-tolerance, nitrogen-fixation and root-development characteristics.

In contrast, hybrid wheat was only mentioned by 9%. Despite its success in other crop species, it seems as though hybridisation will be a much harder sell in wheat.

The role of the Recommended List

While growers value the AHDB Recommended List as a trusted source of independent information on varieties and how they can be expected to perform, the survey suggests it is not held in such high regard as it used to be.

No longer the most important source of information on winter wheat varieties – coming behind agronomist’s advice - there is also far greater reliance being put on local trials results and other farmers' experience.

Expansion of the Recommended List in recent years means there are currently 35 recommended winter wheat varieties – a number considered to be far too many.

Likened to a brochure by one participant, there was a feeling that it had lost its focus and was not as useful as before.

Our survey also revealed a willingness to grow varieties that aren’t on the Recommended List. By that, respondents meant both older varieties that have come off the list, as well as those that hadn’t made the grade.

It was a fairly even split: some 54% of our survey respondents said they would consider growing a variety that wasn’t recommended, compared with 46% that said they wouldn’t (see graph).

Within that, younger farmers were more likely to go "against the grain" and opt for varieties they felt had something different to offer than their older counterparts.

The reasons given for that were matching varieties to local growing conditions, the narrow criteria for recommendation and constraints imposed by a national testing system.

For information on these varieties, growers said they were reliant on neighbouring farmers, local merchants and the ***agricultural*** press.

However, of the 46% who wouldn’t consider varieties that weren’t on the Recommended List, there was a familiar feel to their reasons.

Independent information, proven performance and confidence in a variety were important, as was a reluctance to take on any more risk.

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Autumn 2020

Two-thirds of our survey respondents plan to start drilling their winter wheat in October this year – which, for a significant proportion (42%), is earlier than usual.

After such a wet autumn and winter in 2109, it is not surprising to see that the weather is one of the most cited reasons for this (see graphs 4a and 4b).

Pest and disease pressure is also up there as a key reason for the choice of October as a start date – with greater use of cultural control measures being made to help manage the threat of barley yellow dwarf virus, septoria and other issues.

Not surprisingly, blackgrass control remains a reason for delaying drilling into October, with a greater proportion of larger farms mentioning it as a key factor.

Overall, some 67% of our participants will start drilling in October, compared with 27% planning a September start and only 2% willing to delay until November.

The desire to start a bit earlier this autumn is understandable, as growers look to get their rotations back on track and restore farm profitability.

It is also interesting to note that two in three of our survey respondents still have seed of winter wheat varieties remaining on their farm following the disruption to drilling plans caused by autumn/winter 2019.

Where they intend to buy new seed, growers are most likely to make their final decision in July.

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Sponsor's message

KWS UK has been providing growers with innovative new varieties to meet varied end-market needs for over 25 years. We use a range of technologies to ensure improved consistency in crop performance to benefit all; merchant, farmer, processor and ultimately end-user customer. Higher yields, superior disease and pest resistance and improved performance in adverse conditions are all key criteria we seek to establish in our product portfolio.”

Thanks to KWS whose sponsorship made it possible to conduct the wheat variety survey. Farmers Weekly had full editorial control of this feature.

JOURNAL : Farmers Weekly

Apprenticeships are mutually beneficial arrangements between an employer and an employee that allow practical skills to be built up alongside an educational programme.

Employers enjoy being able to mould young workers to best fit their business and passing on their knowledge, while ensuring key assets stay in the ***agriculture*** sector.

Apprentices can measure their progress in a real life environment and combine a paid job with a qualification.

See also: Coronavirus: How employers can get help with statutory sick pay

What is an apprenticeship?

An apprenticeship is a practical training programme alongside a full-time job, which allows participants aged 16 or over to earn as they learn.

It combines day-to-day work in the sector of the apprentice’s choosing with evidence-based assessment and leads to different levels of qualification.

In ***agriculture***, this covers an increasingly wide area of skills and levels, which could range from stockperson or a management course to a science and surveying degree.

The individual programme is employer-led and should result in a fully-competent apprentice who also has good people and employability skills, such as accurate timekeeping and a strong work ethic.

What apprenticeships are available?

Different courses and levels are available from training departments, educational facilities and organisations such as the AHDB, which offers Level 2 and Level 3 apprenticeships in ***agriculture***.

Bridgwater & Taunton College runs Level 2, 3 and 4 apprenticeships, as Mark Nash, trainer and assessor explains.

The Level 2 stockperson is a 12- to 18-month programme for a general farmworker role in a beef, sheep, dairy or pig enterprise.

Pros and cons of apprenticeships

Benefits

E Provide skilled workers for the future

E Increase staff loyalty and retention

E Free-up existing employees' time

E Can revitalise a company

E Apprentice is learning in real-life situations while earning a wage and seeing the highs and lows of ***agriculture***

Pitfalls

E Takes a committed, tenacious person to be able to learn on the job while studying, to stick to a long-term plan and stay motivated when their peers may be having the university experience

E Remember you are dealing with young people so expect bumps along the way

Source: Clare Keegan and Mark Nash

Requirements include English and maths at GCSE grade 2 or above, or functional skills at level 1.

The Level 3 advanced apprenticeship is geared towards students with a little more responsibility on the farm, such as rearing calves or setting up the drill and drilling crops, in addition to a level of basic record keeping.

English and maths requirements here are GCSE grade 4 or above, or functional skills at level 2.

The Level 4 is run over 30 months and is aimed at students coming into ***agricultural*** management who have more responsibility on farm.

This could include interacting with the vet, nutritionist, agronomist or bank manager, to make some managerial decisions.

At Bridgwater & Taunton, students also get to compete in groups to tender for a farm and present their projects to a team of bank managers for scrutiny.

Harper Adams University delivers degree apprenticeships up to Level 7, which is a five-year course.

Course options include: food and drink advanced engineer degree apprenticeship; chartered surveyor (rural) degree apprenticeship; and food industry technical professional degree apprenticeship.

How does it work?

At all apprenticeship levels, the students come in to college once a week on a day-release basis, says Mr Nash.

This theory learning also covers part of the mandatory 20% off-the-job training.

Employers commit to providing or organising about 10% of this, which can be in the form of training new skills, regular staff meetings, vet talks or farm walks.

“We try to support the employers with the ongoing process of keeping apprentices on track,” says Mr Nash.

“We also want to ensure the apprentices are being involved in the full aspect of business and not just being left with menial jobs.”

The college’s apprenticeships are generally assessment-based rather than exam-based.

Students are observed by their employers and college trainer assessors throughout their course and gather evidence to store on an electronic portfolio.

The final examiner has access to this portfolio, and when the apprentice is ready, they are put forward for an assessment through Lantra, which includes three practical tasks, an online test and a professional discussion.

At Harper Adams, the degree apprenticeships run for multiple years with blocks on and off campus.

These are assessed through exams, assignments and work-based projects.

What are the employer and apprentice’s obligations?

Clare Keegan, business development manager at Harper Adams, says obligations include: a contract for the life of the apprenticeship; commitment statements; regular reviews; and the employer must be committed to developing the right person for a specific job.

Apprentices should be treated like any other employee and are subject to the same regulations such as working time, health and safety, equality laws, and they should be given at least 20 days’ annual paid holiday a year, as well as bank holidays.

How much do apprentices get paid?

Apprentices must be paid at least the minimum wage by the employer.

This starts at £4.15/hour for apprentices and increases depending on age and progress through course.

Are there any funding opportunities?

Employers with a pay bill of more than £3m/year must pay the apprenticeship levy, and will receive funds to spend on training and assessing apprentices.

Those who do not pay the levy, pay 5% towards the cost of training and assessing the apprentice.

The government will pay the remainder, up to the funding band maximum, directly to the training organisation.

Incentive payments are available in certain circumstances, such as employing a 16-18 year old, employing fewer than 50 staff, or working in specific sectors.

How can I get involved?

Employers can contact their nearest ***agricultural*** college if they are interested in taking on an apprentice.

Potential apprentices can look on the National Apprenticeship Service website for jobs in their area or they can apply to do an apprenticeship and the facility will then assist them to find a job.

Apprenticeships can also be completed on family farms, if appropriate.

Case study: Michael and Tony Ball

Brothers Michael and Tony Ball are AHDB Strategic Dairy Farmers in Derbyshire and have worked with apprentice George Ball (no relation) since 2013.

Farm facts

Coton Wood Farm

304ha

500 cows

All year round system

Eight robot milkers

Supplying Freshways

49ha of winter wheat

20ha of miscanthus

George, whose family are also in farming, was studying a GCSE in ***agriculture*** locally, which involved one day a week spent on farm.

This was run by Dart Training, an organisation that also offered apprenticeships.

When George left school, he was keen to start working on a farm, so Michael and Tony offered him a full-time job and he moved on to an apprenticeship.

While working at Coton Wood Farm, George has completed Level 2 and Level 3 diplomas in work-based ***agriculture***, and a Level 4 Higher Level apprenticeship in ***agricultural*** business management.

George, who also built up a flock of about 100 ewes on rented land, said: “The best part for me was the hands-on approach.

“I really enjoyed being able to follow the progress of things you have done throughout the days, weeks, seasons and years, and I think being able to see and do what you’re being taught is a good way of learning.

“The worst bit is it can be quite challenging to do a full-time job and keep up with coursework and have a social life away from the farm, which is probably the main thing you miss out on by not going to college or university.”

Tony, who also employs another Level 3 apprentice, said: “For us, the main benefit is that you are employing someone at the start of their career, who – hopefully – comes with no preconceived ideas of how things should be done, so we can mould them into our way of working and it makes it easier for them to work to our standards.

“The one drawback is the time and supervisory input required at the outset with someone who has little experience.”

The team have worked so well together that they are planning to continue doing so by way of a joint venture.

Tony and Michael are in the process of buying another farm with the intention of milking a new autumn block calving herd this summer, and George will be running this unit under a contract farming agreement.

George said: “I am looking forward to getting to realise my dream of milking my own cows and putting my own ideas into practice.

“Coton Wood Farm has undergone a lot of changes over the past seven years, going from a 200-cow dairy unit with a parlour to a 500-cow unit with eight robots milking the cows, which was great for me while doing the apprenticeships, as it gave me the chance to see the latest technology in the industry.”

George would recommend apprenticeships to anyone who wants to get stuck in, earn as they learn, achieve qualifications and gain hands-on experience.

JOURNAL : Farmers Weekly

Farm leaders have urged people exercising in the countryside to follow the rules to protect themselves and farmers who are helping to feed the nation during the coronavirus pandemic.

With farmers turning livestock out and using machinery in fields and farmyards, there are reminders that many of the rural areas people are visiting during the lockdown are working environments.

The Country Land and Business Association (CLA) has asked people to stay on the footpaths near farms to reduce the risk of accidents.

See also: Coronavirus: Game shooting season faces uncertainty

CLA president Mark Bridgeman said: “We urge members of the public to be vigilant and aware in the vicinity of livestock and large machinery, when taking their daily exercise.

“For those walking with young children, please ensure they are kept close to you.”

The CLA has asked people to keep dogs under control near livestock and to close gates and not block farm entrances, many of which are used regularly.

Dog attacks

The Farmers’ Union of Wales (FUW) has also urged walkers to keep dogs on a lead after reports of attacks on livestock, something the union said is “avoidable and unnecessary”.

Ian Lloyd, the FUW’s animal health and welfare committee chairman, said livestock worrying was yet another stress for farmers already working flat out in difficult circumstances.

“We are reminding those taking respite in the countryside to also remember our farmers, who are key workers producing our food at this very difficult time.

“Many family farms in Wales have been hit hard by the closure of restaurants, cafes and other service outlets during the current pandemic.”

The FUW said it will continue to push for tougher legislation around dog attacks on livestock, to help reduce the welfare and financial consequences for farmers.

Police fines

Meanwhile, North Yorkshire Police has revealed it issued 61 fines last week to people who were not following government guidance by making unnecessary journeys.

On Saturday 25 April, 17 fines were issued in the rural village Malham. In total, the force issued 31 fines on Saturday to people visiting from West Yorkshire, Lancashire, Cumbria and Kent.

A further 30 fines were issued on Sunday (26 April), with officers fining six people in Brotherton who had travelled to the small village to go off-road biking.

Advice for land managers

Keeping paths clear and waymarks and signs in good order and up to date will help people stick to the right routes and access points. Contact your local authority or National Park Authority to find out what help is available.

Where there is public access through a boundary feature, such as a fence or hedge, create a gap if you can – or use an accessible gate or, if absolutely necessary, a stile. When installing completely new gates and stiles, make sure you have the permission of the local authority.

Encourage people to respect your wishes by giving clear, polite guidance where it is needed. For example, telling visitors about your land management work helps them to avoid getting in your way.

Source: The Countryside Code

JOURNAL : Farmers Weekly

Farmers tend to gradually wind down their work as they reach old age, but no one told Devonshire farmer Alec Burrough.

Despite being classed as very high risk to coronavirus, the 86-year-old is working every day to keep Britain farming and help #FeedTheNation.

He is still using the same 54-year-old red Nuffield 10/60 tractor to carry out a range of daily tasks on the organic family dairy farm he moved to as a young boy in Cullompton, Devon.

He has been farming full-time for the past 71 years.

See also: Coronavirus: Prince praises farmers who #FeedTheNation

As one of the 1.5 million classed as “extremely vulnerable” by the UK government, this has not deterred him from carrying out the essential role he plays as a key worker during the crisis that has gripped Britain.

At a time when there is a shortage of farmworkers in the UK, Mr Burrough, an avid Farmers Weekly reader, is a true inspiration.

His list of daily jobs includes work in the yard, on the tractor in the fields and calf rearing.

Mr Burrough, who has suffered from chronic obstructive pulmonary disorder (COPD) for many years, said: “I’m just doing what I’ve always done and making sure people stay fed.

“People with a serious lung condition like mine are told to try to stay active, and I’m definitely doing that.

“If someone had told me I’d still be using the same Nuffield tractor to do my job 54 years on, I’d say that was a good investment.”

Hard work and frugality

Mr Burrough said his childhood spent farming during the Second World War instilled in him an appreciation of hard work, frugality and working together for the common good.

“During the war, we had to work together and make the most of everything we had,” he explained.

“We didn’t take anything for granted.

“I don’t understand how people throw things away so easily now, whereas I was always brought up to make the most of what I had – like my tractor.”

The older generations are capable of great things, as shown by NHS fundraising hero Captain Thomas Moore.

The 99-year-old war veteran has raised more than £27m by completing 100 laps of his garden before his 100th birthday

Mr Burrough will celebrate his 87th birthday in July.

He farms with his son Jonathan and daughter-in-law Louise, and has three grandchildren aged 7, 9 and 11.

JOURNAL : Farmers Weekly

A Welsh cattle farmer has died after being trapped against the wall by the bucket of a JCB machine, an inquest has heard.

Dewi Jones, 68, suffered crush injuries and died following the incident at Ty Celyn Farm, in Llanfwrog, Denbighshire, on Tuesday 21 April.

An inquest was opened and adjourned into Mr Jones’ death at Ruthin coroner’s court on Monday (27 April).

See also: Advice on first aid when there’s a farm accident

John Gittins, coroner for North Wales East and Central, was told Mr Jones had been moving hay with his brother into a heifer pen when he was trapped by the shovel of a JCB Bobcat.

Although he managed to wriggle free, he collapsed and an air ambulance was called to the scene.

A post-mortem examination gave the provisional cause of death as an abdominal bleed and liver laceration after blunt-force trauma.

HSE investigation

The Health and Safety Executive (HSE) is also investigating the circumstances surrounding Mr Jones’ death.

Farming continues to be the UK’s deadliest occupation. In 2018-19, 39 people suffered fatal injuries while working in ***agriculture***.

Fourteen of these deaths involved being struck by a moving vehicle, including tractors, trailers, telescopic handlers, farm vehicles, ATVs, and nearly half of the workers killed were aged 60 or over.

JOURNAL : Farmers Weekly

A farmer has died and his son was badly injured after they were attacked by a water buffalo in Monmouthshire.

Father-of-three Ralph Jump, 57, was pronounced dead at the farm in Gwehelog on Tuesday afternoon (5 May).

His 19-year-old son, who has not been named, was critically injured and his 22-year-old daughter, Isabel, suffered a serious leg injury.

See also: Coronavirus: Yellow Wellies issues mental health support for farmers

Mr Ralph’s son was flown by air ambulance to the University Hospital of Wales, in Cardiff, and his daughter was taken by land ambulance to the Royal Gwent Hospital for treatment. Her injuries are not thought to be critical.

We were called to a commercial address near Usk, after reports of a water buffalo attacking two men and a woman.

A 57-year-old man was sadly pronounced dead at the scene.

A 19-year-old man and a 22-year-old woman are receiving hospital treatment.

"-- [*https://t.co/dChRL3DZUe*](https://t.co/dChRL3DZUe) pic.twitter.com/2kNICJJvoj

Gwent Police (@gwentpolice) May 5, 2020

Paramedics received assistance from the National Police Air Service at the scene following the attack, which happened shortly before 3pm.

The water buffalo was humanely destroyed.

The attack took place at the premises of the Bufalina Soap Company, in Usk, a family business that manufactures handmade luxury soap from the milk of their herd of Mediterranean water buffalo in the Welsh Marshes.

Water buffalo are native to Asia, but a number of farms across the UK keep herds.

JOURNAL : Farmers Weekly

A Yorkshire arable farmer was left shocked after discovering fly-tipped waste on his land containing sensitive childcare details.

Tim Braithwaite, who farms in Sprotbrough, near Doncaster, found bags of toys strewn across the entrance to a field of winter barley over the weekend.

The bags contained folders that revealed sensitive records written by a childminder about children headed “Little Puffins Childcare”.

See also: What to do if you’re a victim of fly-tipping

Mr Braithwaite contacted South Yorkshire Police and Doncaster Council, which came and removed the rubbish within 24 hours without charge.

A former owner of the childcare company has since come forward and apologised over the incident.

The woman, who did not want to be named, said she contacted Doncaster-based firm L&C Rubbish Removals on Facebook and paid £40 for the rubbish to be ***collected***.

She told Sheffield newspaper The Star: “Their Facebook page says that these people are fully licensed, so I stupidly went ahead with this.

“I paid the £40 via bank transfer and the guys came to take away my rubbish.

“I had absolutely no idea of the fly-tipping incident until a friend sent me the link via Facebook.

“I closed my business in 2017 due to my daughter’s Illness, which sadly left her disabled.”

She added: “When I closed, I organised and cleared away any paperwork and I honestly did not know that there could be anything left in these files.

“I will pay any price for my mistake and I fully take any responsibility if there was actually any personal ***data*** within these files, which I think is unlikely due to previous organisations.”

'Major problem'

Mr Braithwaite told Farmers Weekly: “Fly-tipping is a major problem and it has been getting worse in this area since coronavirus has forced the closure of all the local tips.

“People should dispose of their rubbish only through legitimate sources. Fly-tipping wastes the valuable time of police, council officers and causes huge costs and inconvenience for farmers.”

An investigation involving police and the council is under way.

Farmers Weekly has contacted L&C Rubbish Removals for a comment. The company says on Facebook it is “fully insured, fully licensed, open seven days a week and cheaper than a skip”.

JOURNAL : Farmers Weekly

The dry weather in Aberdeenshire has continued throughout April, with the annual total to date amounting to only 33% of average. This allowed spring barley drilling to start early on 20 March – early for us – and with a great effort by the whole team we were able to drill 808ha in 23 days.

Now that the crop is established, we desperately need some decent rainfall. We had 6mm last night, and a few showers are forecast later in the week, but really we could do with an inch or so over a few days.

See also: Herts grower puts hoe to the test in narrow-row cereals

While the spring barley still has some moisture at seed depth and has not yet been impacted by the dry conditions, the wheat is certainly suffering. When a plant is pulled up, the soil just falls off the roots and any damper parts of the field show how pale and thin the majority of the crop is.

With the 2018 drought still fresh in my mind, I have held back some nitrogen for now on both the wheat and spring barley. The rainfall over the next 10 days will determine how much, if any, of this will be applied.

It has been a strange spell with lockdown for coronavirus.  During drilling, we were lucky to be relatively unaffected, being able to get on with our jobs with only minor changes to working practices.

One of these was that I often took my bike when moving the loader and seed trailer. Cycling back really showed up how bad many of our road surfaces are and also, despite the reduced amount of traffic, how many bottles and other rubbish is being thrown into the verges. If only some of the many extra walkers out and about would pick some of it up!

During this time it is also frustrating to see some supermarkets importing beef, particularly steaks, when local processors need to find new markets for these cuts. Is this a failure of the supply chain, or an excuse to drive the price down? Either way it is not helping the UK beef sector and drives farmer mistrust of retailers.

JOURNAL : Farmers Weekly

It has been a surreal month since I last wrote an article. Apart from the odd conference call, the diary is a complete whiteout which at least means I have knuckled down to farm work and kept busy.

Social distancing comes naturally to those of us spending long days in tractor cabs.

Forage maize has been planted in good time and is up in rows. We are trying to establish more maize using minimum tillage which definitely gives a more stable, resilient seed-bed.

Pewsey Vale scored big in the catchy game of "rain roulette" with two bouts of 40mm helping to evenly establish spring cropping, which now looks promising.

See also: Tips on getting the most from clubroot-resistant OSR varieties

On a personal level, to immense relief, all members of my family who had coronavirus symptoms have fully recovered and the farm team remain in good health.

For me the only lasting souvenir has been not recovering my sense of smell. This came in handy when we were clearing out the slurry pit!

Mistakes will always happen and unfortunately we had an incident recently when AdBlue was put in the wrong fuel tank causing significant engine damage to a tractor.

Please remind your teams to never top up this additive while the engine is running, and that even a tiny misplaced quantity in the fuel line will cause problems. Thanks to TH Whites for sorting us out.

The decimation of the wider economy by lockdown measures is truly horrifying and will have repercussions for a generation.

I can understand why some have asked whether the cure is worse than the disease. A primary concern for agribusiness is how on earth will this be paid for?

Beyond income and VAT taxation adjustments I would suggest this is a good time for families to have frank discussions about farm succession; changes to ***Agricultural*** Property Relief seem likely when the government weighs up radical land and property taxation options.

Time is running out for a post-Brexit trade deal with the EU. Simultaneously discussions continue for a free trade deal with the US for which the main danger is that ongoing food supply disruption is used as an excuse to flood markets with cheap imports, leaving our own production standards undermined.

With one voice the industry must apply maximum pressure to ensure this never happens.

JOURNAL : Farmers Weekly

Sleeping is cheating. There’s been little chance to nap here of late.

What a difference eight weeks makes. We have gone from “gripping” (draining) water off with a 14 tonne hoe, to maximum moisture retention.

Spring barley drilling started off like ‘riding on the skin of a rice pudding’, and has gone to rock hard dry conditions. The better land has emerged and rocketed away, the “strong” has emerged, but is struggling and is in need of a drink.

See also: Call to back British beef as retailers buy Polish mince

Maize drilling is well under way and to conserve moisture we are running the Watkins tri-till through the mucked stubble, followed by the power harrow, with the maize drill following in convoy.

All of us operate in the same block of land and then move onto the next. The key is not to get too far ahead, otherwise the moisture disappears in front of your eyes.

Half the acreage is down to grain maize and the other half down to our old favourite LG Ambition which I regard as a dual-purpose grain or forage crop.

Now I have to get my head around the beef monitor program. If we do a diet tweak, we can now see the implications in real time.

I liken it to looking in the bulk milk tank and seeing a response to the diet nearly immediately.

Now we know the baseline growth rate we can monitor the effects of the diet change. Obviously, you have to ignore the first couple of days because the cattle have to acclimatise to the different taste and texture of the feed, but we then need to be back on the rising curve of growth matching the previous ***data***.

The fat cattle job at the moment is hard work. We have had a 5-10p/kg reduction in the deadweight price due to the knock-on effects of Covid-19.

Saying that, the liveweight price has not dropped proportionally to the deadweight price, and I would suggest the local butchers are doing a right trade.

I hope the consumer doesn’t revert back to supermarket shopping and shows the local shops some loyalty when the current crisis is over.

Doug Dear is a Farmer Focus writer from Yorkshire. Read his biography.

JOURNAL : Farmers Weekly

I am feeling in a much better place than I have been for a number of months, finally being caught up. After a marathon effort we got a vastly increased spring cereal area into the ground in some surprisingly good conditions. I now look forward to what seems likely to be a later-than-normal harvest workload.

As luck would have it, youngest son managed to get back from New Zealand just as the coronavirus restrictions started to take hold and we were really getting going. Thinking it unwise for him to mix with others for a while, he got landed with the night shift. After all, his body clock was still on New Zealand time, which suited us all fine.

See also: Top tips on managing late disease in potatoes after diquat

Potato planting has proceeded apace, again into good conditions. Despite it appearing dry we are finding enough moisture at depth which has resulted in prompt and timely emergence.

Our pre-emergence herbicide programme remains largely unchanged although we are getting used to managing without diquat. I feel the greater learning opportunity will be when we come to haulm management later in the season.

I have access to an impressive haulm topping outfit through a local contractor, but I feel the cost will be considerably more than simply spraying a desiccant.

We have just added an additional tractor to the fleet, but in a different way. We have tended to buy in a fairly traditional way, but this is our first contract hire. I am keen to see how this compares with our usual route, given that we now have a relatively fixed cost per hour for maintenance, repairs and depreciation.

Having done the sums I felt that there is no right or wrong, cheaper or dearer way. It is more about what you want to achieve.

Depreciation costs are significant for our business and they are hard to calculate with any degree of certainty. The contract hire route does at least give some cost clarity right from the start, which will aid budgeting.

I am also pleased to see the fall in the price of fuel. Normally when we get to a busy period it seems to increase. We are unable to stockpile as we only have our regular tanks, but it is a small positive benefit.

JOURNAL : Farmers Weekly

Spring drilling was all wrapped up by early April – this year has already provided most of the drilling conditions possible going from very difficult to very easy in a relatively short time.

Crops have established well and on the whole are now benefiting from the minimal disturbance drilling method and the moisture it helped retain. Sugar beet is presently an unfortunate reminder on how spring cultivations in a year like this can be a bad move, with varying germination.

See also: How ethylene can help control sprouting in potato stores

While coronavirus is hindering progress with my mid-tier capital works, and making other jobs more complicated we have been very lucky that the impact has been minimal so far.

I cannot imagine being stuck at home for weeks without the usual freedom we all take for granted, and while the extra people out walking does bring some issues, it is also a huge opportunity for engagement and to show off what, why and how we do things.

Some simple signs explaining what crops are grown for, and what field margins, wild bird mixes and beetle banks are planted for, and the wildlife they are there to encourage and support will go a lot further in keeping people to footpaths and produce a positive result for farming all round in future; than ones that say only "Keep out".

There are always exceptions, but a lot of lost walkers are innocently ignorant. Footpath signs aren’t always visible, clear, or even present, and to untrained eyes a wide strip of grass around a field for a footpath looks the same as a field margin, especially if half has recently been cut as part of its management.

We need to give people a positive experience on the land we manage while everything else is upside down and not so great. As customers we support businesses that give us good service and a positive experience – the people walking the footpath are our customers and we keep asking for their support – maybe we need to earn it a bit more?

I found some small signs produced by CFE when it was the Campaign for the Farmed Environment that were designed to educate walkers about field margins and ground nesting birds.

Maybe industry organisations, such as the "new" Championing the Farmed Environment could help with some simple infographic style signs to help show people what different parts of the farmed landscape are for.

Matt Redman farms 370ha just north of Cambridge and operates a contracting business specialising in spraying and direct drilling. He also grows cereals on a small area of tenancy land and was Farm Sprayer Operator of the Year in 2014. Read more from Matt Redman.

JOURNAL : Farmers Weekly

We have been in a nationwide lockdown for four weeks, with only “essential services” allowed to operate.

We are fortunate in that we have been able to go about the normal farm programme while being supported by our associated service industries and processors.

It could be argued that had we closed the borders earlier, we may have preserved the operation of the domestic economy.

That said, it appears that a drastic lockdown is, thus far, seeing our case numbers fall quickly with our government now pursuing an “elimination” strategy. Covid19 is such a nasty bug, it would be very unwise to think we have beaten it yet.

See also: How to make sure you hit protein target for milling wheat

Tourism has been wiped off the map for the foreseeable future with an effect on the economy comparable to a complete collapse of the dairy industry.

Added to that, our hospitality sector is taking a hiding from the lockdown and will suffer both from an ongoing lack of tourists, but also from the reduction in domestic discretionary spending going forward.

There is no doubt grim times are ahead for many in New Zealand. Our economy has been shattered in the past six weeks.

Primary production is now, more than ever, the key source of foreign earnings for our wee country. The last few years it has been politically expedient to cast farmers and growers as public enemy number one.

Now it seems our politicians, business leaders and economists are giving us a smile and a wink, and a bit of a pat on the back.

Our own economic future is fragile as we are selling into world markets that themselves have taken a pummelling, so caution is needed.

But in the meantime, we are needed more than ever, both to produce safe, nutritious food to export, but also to support our friends in other sectors who are hurting.

Our builders, contractors, trucking firms, local retailers, everyone downstream that we deal with desperately need our help.

Now is our time to bring forward maintenance or development projects, or anything else we can find to get those guys and girls back to work and help them back onto their feet. Take care.

David Clark runs a 463ha fully irrigated mixed farm with his wife Jayne at Valetta, on New Zealand’s South Island. He grows 400ha of cereals, pulses, forage and vegetable seed crops, runs 1,000 Romney ewes and finishes 8,000 lambs annually.

JOURNAL : Farmers Weekly

It’s business as normal in very abnormal times. I could easily write this piece 10 times over full of sentiments of gratitude, despair and condolence and likely resonate with the majority of people in one way or another.

However, social media is awash with Covid-19 stories good and bad, so I’ll try to stick with ‘normal’ and hope you are all keeping safe.

We are well into our second grazing round on the farm, with pre-grazing covers of 2,500kg DM/ha to 2,700kg DM/ha. Grass growth last week was a shade under 50kg DM a day and above our demand for the farm.

See also: How to maintain butterfats during spring/summer grazing

As a result, concentrates have been eased back with a view to feeding 3kg a head a day and grass intakes of circa 15kg DM a day. The cows are loving the dry weather and high dry matter content of the grass and are exceptionally content, even when working to hit residuals and clean up fields.

Bulling activity is excellent. Large bulling groups are clear to be seen every day and production is running at about 2.1kg milk solids a day.

Most of our field work has been completed in good time, with some fodder beet going in for next winter.

Last year’s wintering ground has been worked down and reseeded and the dirty water has been spread on some of the grazing. Having soil tested the farm, the benefit of the dirty water is evident in the P and K levels, so we are trying to spread it on some different fields.

This meant running the umbilical across the yard. It was working fine until a lost articulated lorry arrived in a blind panic having been stuck on narrow lanes for an hour. The lorry dragged the five-inch pipe across the yard and out of the ramp ready for the next car to arrive to try and cross it and put a gash right through it.

Serving is less than two weeks away as I write. Preparation work is complete with metri-checking done.

Prostaglandin has been given to 30 cows to help them clean naturally and no antibiotics (Cefapirin) have been given. We are trying to limit antibiotics use generally and particularly that one, as it is a first-generation cephalosporin antibiotic.

Johnjo Roberts is a Farmer Focus writer on Anglesey. Read his biography.

JOURNAL : Farmers Weekly

We really are very lucky to work in the industry we do – producing food.

I know we all moan about the weather and the prices we get for our barley or beef or milk, but unlike many other industries the world can’t function without us, the food producers.

Life hasn’t even changed that much for most of us in the current crisis.

I know I am very fortunate to still be out and about delivering to shops and houses and as I pass so many businesses shut down with the coronavirus pandemic you can’t help but wonder about the poor people behind these businesses, who are either furloughed or who have already lost their jobs.

See also: OFC 2020: Expert to rebuff red meat claims and EAT-Lancet report

Many of these businesses may never open again.

Our little business is still very busy with home deliveries and we’ve seen a huge increase in footfall. We’ve been shipping orders all over the country, but we have hit a major snag this week as our insulated box supplier is struggling to get us more supplies.

We all know the world is going to be a very different place after this, but maybe there will be some good to come out of it.

Maybe people will realise they need to spend less time in their cars or on planes and more time at home with their families. Maybe they will realise it was the cars and planes destroying the planet and not the cows. Maybe people will continue to shop locally and maybe people will realise that they need to value our great British food producers.

Lambing has now finished and been successful. All sheep lambed outdoors in perfect weather conditions with most of the lambs still to experience what rain feels like.

I only assisted four ewes and had very few lamb losses. There have been a lot of cattle arriving over the last month. We’ve dropped from 300 ewes to 110 and increased cattle to more than 300 head.

Nearly all the cattle have been bought directly off-farm, mostly through our local co-op.

As usual, I think stores are too expensive relative to the fat price. Let’s hope we have a good BBQ season and prime prices rise.

Michael Shannon finishes 300 head of mostly Angus beef stores each year and runs 110 Scotch Mules on a 100ha forage-only enterprise near Biggar, Lanarkshire, as well as free-range turkeys for Christmas. Meat is sold through his online business and farm shop Damn Delicious, with surpluses sold deadweight.

JOURNAL : Farmers Weekly

“Hey, if you charged an entrance fee to the farm you could make a fortune. There are people everywhere!” This quip was from Georgina, one of our horse livery clients, as she returned from a hack round the farm. I think she was joking, but she is a financial adviser, so who knows?

I will not be setting up a turnstile, but we have started to engage more with the extra visitors by putting up some “lockdown learning logs”. These are laminated A4 information sheets which are tacked on to logs we have placed around the farm beside footpaths. They explain what we have just sown, what it is for, when it is harvested, what happens to the lambs.

See also: All you need to know about controlling wireworm in potatoes

Quite simple stuff, but judging by the feedback, it has gone down particularly well with parents who have young children to amuse and educate.

The Exlana ewes have all lambed now in perfect warm and sunny weather. Very few needed obstetric assistance and the lambs are growing on well in the diverse mix which includes Timothy, fescue, cocksfoot, red clover, sainfoin, plantain, chicory and yarrow.

I have given four surplus triplet lambs to a neighbour, Bertie, age 7, to kickstart his sheep enterprise. I am impressed to hear he is getting up at 5am to give them their first bottle of the day.

Hew has covered a lot of ground with the new Sly Boss drill, getting spring beans, barley, rye and linseed sown. We have been pleased at how the angled disc coulter got beans into hard ground at 3in deep. It is always an anxious time for the drill operator in the weeks following sowing to see how crops emerge, and in truth Hew probably didn’t need the extra pressure of me putting information sheets round the farm saying what crop was (hopefully) going to be in the field.

With six weeks without rain, emergence and growth has been slower than we would like, but fortunately, Hew seems to have inherited my broad shoulders and thick skin and, as I type, we have some welcome rain. Phew.

JOURNAL : Farmers Weekly

This past month has flown by. The weather has been amazing for lambing and first cut of silage.

As I write this, we are due to cut on 5 May. It looks to be a big crop and quality looks high, which will be the mainstay of our forage for the milking herd through winter.

We are onto the last handful of ewes to lamb, which has been brilliant. After the first cycle, there were only 36 multiples left to lamb out of 428, which is great going and should give us a consistent bunch of lambs in the autumn.

See also: 8 ways to prepare for a busy lambing season

The ewes have lambed very much unassisted, with very few issues and plenty of grass in front of them.

The milking herd are really performing now. We got back to predominantly 2019 first-cut silage and milk jumped up four litres in five days to 36.7 litres.

Milk quality took a slight nosedive, going from 4.1% fat down to 3.8%, but the total mixed ration has been adjusted and the quality seems to be rising again.

All landscaping is now complete around both the new sheds and the new slurry lagoon. We are just waiting for the grass seeds to grow.

We have been checking for a few weeks to see when the seeds will germinate, but because it has been so dry, the lack of moisture in the soil has delayed germination - they look to be coming now.

I hope everyone is staying safe in these uncertain times. I have the deepest sympathy for farmers supplying some processors severely affected by the milk crisis.

It must be heartbreaking to see their hard work literally going down the drain or being paid well below the cost of production.

Hopefully, some time soon, things will slowly start to open again, and everyone can get back to a slight bit of normality.

Farmers in general are lucky. We can carry on nearly as normal, whereas inner-city folk are stuck in a house or apartment with little or no garden or space.

I cannot imagine how that would feel.

Patrick Morris-Eyton is a Farmer Focus writer from Cumbria. Read his biography.

JOURNAL : Farmers Weekly

Bizarre is the only way I can describe Kansas ***agriculture*** at the moment.

Covid-19 has reached the meat packing industry and severe slaughter disruptions are starting to back animals up.

Simply put, there are no buyers at any price for finished animals.

See also: Coronavirus: Trump orders US abattoirs to stay open

The chief executive of Tyson Foods bought a full-page spread in The New York Times on 26 April.

In it he said: “In addition to meat shortages, this is a serious food waste issue. Farmers across the nation simply will not have anywhere to sell their livestock to be processed, when they could have fed the nation.

“Millions of animals – chickens, pigs, and cattle – will be depopulated because of the closure of our facilities. The food supply chain is breaking.”

There are many complicated issues regarding our supply chain and marketing, but I truly hope that our industry of 2021 looks different to the one of 2019.

It isn’t realistic that the next generation of producers (which I think I am part of) has any future in anything that looks like this.

We are doing what we can to weather the storm. Thank God for the rumen.

Summer grass growth is starting, so with some changes to stocking rates we don’t have to feed or sell a single animal until October. This gives us an advantage over chicken and pork producers.

Any other options we can take to cut costs, we are implementing. We usually AI every cow but will skip 150 older cows this year.

It isn’t so much about the cost of AI (which counts) but getting them to their summer pasture that doesn’t have facilities.

Our mineral programme isn’t as “high end” as last year and I also tried a new worming protocol where you don’t automatically treat every cow but leave the heavier conditioned and older cows. It will be repeated this year.

Our cows work hard for us in normal circumstances; this year we will have to ask them to work a little harder.

Meanwhile, there has been only one case of Covid-19 reported in our county. It was a healthy young man who has only lost his sense of smell – I’d like to find him and shake his hand.

Daniel Mushrush is a Farmer Focus writer from Kansas. Read his biography.

JOURNAL : Farmers Weekly

The past two weeks have been full on. In fact, I have been somewhat grateful for lockdown as it has meant there have been no distractions.

We have been able to take advantage of the brilliant weather conditions – which again seems hard to believe, given the winter we have had.

The slurry lagoon has been emptied and the sand dredged in record time. We then devised a plan to deal with our flooded maize ground that resembled a scene from the Second World War.

See also: Combines roll for severely delayed maize harvest

Two passes with a Sumo cultivator, followed by the roller and then straight in with a combination maize drill has worked nicely, and the last of that maize was sown on 27 April.

In my wisdom, I also decided that following the results of our grass samples and with a wet 10-day period forecast, it would be a good idea to take 40ha of first cut.

At the last minute the forecast changed, and we did first cut and maize over the same weekend.

The gamble paid off and, although the yields were on the low side, quality looks good and hopefully the aftermath will green over nicely. I am not a big tractor man, but I have to say, although I had limited sleep, I really enjoyed myself.

I would like to take this opportunity to thank our contracting teams – The Adams, Stevie Edwards and Pip Edwards – as well as our agronomist Ian Evans, for their hard work.

It is a rewarding time of year. Unfortunately, the news from Muller has been less rewarding.

In the space of three weeks we have been given a 1p/litre price rise (brilliant), followed three days later by a request to cut production by 3%, followed two weeks later by the 1p/litre price rise being rescinded.

It’s tough mentally to have to keep readjusting budgets and cutting costs with no indication of if, or when, the market may pick up.

I appreciate we are better off than some other producers, but I think the whole situation could have been handled better.

Let’s just hope this works in mitigating any long-term pain and that the rest of the year will not be as tough.

Read more about Shropshire farmer Henry Wilson.

JOURNAL : Farmers Weekly

I will ty to refrain from mentioning the dry weather, but we could certainly do with some rain very soon if the spring crops are going to come to anything.

Lambing has started with a bang. We have tried to group the ewes into a north and south district and split them between James our shepherd and myself.

James is looking after 800ish and I have 1,200ish about 25 minutes away.

See also: 13 tips for lambing outdoors

We have had one group of 160 ewes hit with a bad case of Campylobacter. The vet has advised to just ride it out and after lambing, disperse those ewes across the whole flock to get an immune response going before next year’s lambing.

Other steps we have taken have been to space out those ewes to try to avoid too much contact between them (more electric fencing) and pick up all afterbirth.

We are now into day 10 of lambing as I write and are certainly picking up fewer aborted lambs so we hope we are over the worst of it.

The Covid-19 situation hasn’t really affected us too much. Roads are empty and fuel is cheap which suits our style of lambing – but people are everywhere.

I appreciate everyone is trying to help, but when you see a picture of your sheep on a local resident’s Facebook page with the comment that it is “coughing, can’t find the farmer so should I call the RSPCA or a vet? Has it got corona?” it does make for stressful/comical reading.

It’s fortunate I can rely on Jo to log on and gently explain that it is probably going to be all right and to just leave it alone.

Grass is as good as we have ever had it. A pre-lambing rotation gave us a lot of early growth and Jo has planted a couple of herbal leys for the sheep in the arable rotation so we will be having Ben from Hyde Hall come in and throw up a few thousand metres of fencing for us there.

The hope is to try and get a few hundred lambs away early to stop so much pressure in finding food for ewes and lambs over winter if it rains.

See Rob and Jo Hodgkins’ biography

JOURNAL : Farmers Weekly

We’ve had no rain to speak of for six weeks. My default reaction was to moan incessantly, but that didn’t seem to do any good, either with the weather or my locked down family, so I’m now trying to think of how to react in the future.

More winter crops might be one way to go, but is the opposite of what we have been doing to combat grassweeds and we have been getting on well with cover crops for soil improvement, sheep grazing and stewardship payments.

See also: Why biopesticides will play a bigger role on arable farms

I also have solid fertiliser still on the surface a month after application and scorching from liquids, so another tactic might be to use some kind of delayed release fertiliser and apply the whole lot at the start of the season, but that might not be beneficial to plant or soil microbe health.

I was surprised when completing my annual Facts scheme exam to see urea fertiliser singled out as bad. The concern is volatilisation of ammonia and, while we do have to to minimise this, ammonium nitrate was touted as a better alternative. I don’t sell either, but maybe we should recognise that both have their pros and cons.

It is said that urea may lose 20% of its nitrogen via volatilisation, but if you look at the source of this information it appears this may only happen at 32C so perhaps is not too relevant in the UK?

Also, NIAB trials over many years find the same yields from both forms of fertiliser, so ammonium nitrate must be losing an equivalent amount, and scientific work estimates that N lost by leaching ranges from 40kg to 115kg of N/ha.

Added to this, ammonium nitrate can increase crops’ susceptibility to fungal attack and reduce their ability to uptake ***nutrients*** such as magnesium, manganese and zinc, especially on my chalky soils. As ever, a balance, rather than extremes may be the answer?

Andy Barr farms 700ha in a family partnership in Kent. See his biography.

JOURNAL : Farmers Weekly

With spring drilling done and dusted we have started inter-row hoeing our winter crops.

We focused on our winter beans first as they were particularly weedy. Most of the "weeds" are volunteer spring oats from harvest 2019 and so any that have escaped in the row will be harvested with the beans and then separated out on a gravity table after harvest. It’s this year’s unintended bi-cropping trial!

See also: Tips on getting the most from clubroot-resistant OSR varieties

We’ve also hoed all the winter wheat we managed to get in and started phase one of our living mulch trial which is my second attempt to develop an organic low till system. Our trial will run as follows:

In-between our 120mm crop bands we have 200mm of space where we have sown white clover at 7.5kg/ha comprising 80% AberAce wild white clover and 20% AberHerald which will remain in the ground for the rest of the rotation and possibly beyond.

The plan is then to strip-till the 120mm cropping rows and plant spring oats in early 2021 and so on. Lambs will be fattened on the clover to keep it in check before winter.

Organically I believe that we still need to be able to clean the crop rows as well as mineralise some of the ***nutrients*** we build up during the rotation to get our crops going, hence opting for strip-till rather than no-till.

I’m also concerned that having a living mulch across 100% of the field will compete for moisture and ***nutrients*** with my cash crop which I have seen in the past in thick under-sown leys.

I’ve got 10 months to find or make the machine to achieve that narrow 120mm strip.

We have the will so there must be a way.

JOURNAL : Farmers Weekly

As I write this the children have started lambing their Blue Texels again.

Unfortunately, a sub-fertile new ram left half their flock empty at scanning. Rather than running empty some later lambs will be a bonus.

Sadly, we have lost too many lambs with pneumonia and ewes with mastitis.

See also: Tips on tackling mastitis in sheep

The fantastic weather has had its drawbacks – largely the temperature difference between hot sun and frost. A high of 28C was recorded in one field while dosing lambs for nematodirus and that night the temperature dropped to -2C.

With all the sheep out at the beginning of April, all the sheds have been cleaned and manure spread on some maize ground – a first for us.

All the pens, buckets, bowls etc have been washed and dried. We were ready for a couple of farm visits that are now not going to happen.

The bulls have prepped up really well and are all behaving on the halter. All the work with the females over the years has rewarded us with cattle with lovely temperaments.

We don’t overfeed them, which means their feet and legs are good. On my foot-trimming round, I see a lot of young bulls that have been overdone, which is wrecking their feet.

No feet, no bull – it really is that simple.

All the lambs have had their second clostridial vaccine, so hopefully this will help to build their immunity going forward.

We put a preventative fly spray on all the ewes and rams. I haven't got time to deal with flystrike and it's not acceptable for our image.

The last hoggets and first January lambs sold well after a few weeks of market disruption. We didn't sell any last week due to another blip in prices, with more poor excuses from the processors.

British meat is selling on shop shelves. It might not all be fillet steak, but to ensure British farmers are still producing in five years a fair distribution of revenue is still essential.

We have had lots of walkers at the farm. Hopefully, they will really start appreciating what a beautiful place we live in and that it’s mostly created by farmers.

James and Belinda Kimber farm 850 commercial and pedigree sheep and 30 pedigree Simmental and Charolais cattle in Wiltshire across 95ha (45ha owned) with the help of their children, Josh, Izzy and Richard. James also runs a foot-trimming business and Belinda has a B&B.

JOURNAL : Farmers Weekly

The past few months have been pretty scary to say the least and really quite grounding for most of us, and I would like to thank all the frontline staff, especially those in the NHS, who take risks every day for the good and wellbeing of others. In times like these the real heroes come to the fore.

Being confined to the office or tractor cab is no real hardship so I’m going to keep my complaining to a minimum.

See also: Tips on getting the most from clubroot-resistant OSR varieties

The weather has almost been predictable – going from far too wet to far too dry in about three weeks.

We didn’t manage to get drilled up as one of our heaviest blocks of land had completely lost its structure and was basically three inches of concrete on top of six inches of cold wet clay and with no possibility of creating a decent seed-bed.

And as I’ve alluded to in the past, spring crops on heavy land are very unforgiving of poor seed-beds.

We did, however, manage to get 400ha of both spring barley and beans drilled, and on the whole I’m happy – although the beans are, ironically, desperate for rain.

I have to say lockdown has been a hugely productive time in the Challen household, all windows facing south have now been occupied by various plant pots and trays as veg and flower production is in full swing.

One of the stables has been converted to a gym, although I consider this a rumour as I still haven’t ventured in yet in fear that I may get challenged by young Master Challen to pump iron or cycle 50km.

The kitchen has been converted to a “For Farmers” office as Harriet is working from home and although additional quality time with the kids is great, without doubt the best bit has been the huge increase in home baking, with fresh cake nearly every day.

Every cloud has a silver lining. Finally I'd like to say I'm glad to see Boris back at the helm and wish him and his family well.

JOURNAL : Farmers Weekly

What a rollercoaster the past five weeks have been.

Having my three-year-old come to work with me every day has got to be one of the most fun and the most exasperating experiences.

I’m sure many of you can relate. Although it’s a juggling act, I am grateful to be spending this time with him and appreciate how lucky we are to have the farm during these crazy times.

It’s certainly become clear that we are all weathering the same storm, but in very different boats.

Thankfully, the pig business has not been adversely affected so far. In fact, we have seen an increase in demand from local outlets and the Standard Pig Price (SPP) reached 164p/kg for the first time since 2017.

See also: Coronavirus: Farms advised to use face masks

Retail has seen a big uplift in sausage and bacon sales (up 48% and 18%, respectively, for the week ending 12 April), to the detriment of fresh pork (total roasting joints down 63%).

AHDB has just launched another campaign to promote pulled pork; hopefully driving some more fresh sales and taking some of the burden from cold stores.

Unfortunately, our European counterparts aren’t doing so well, with Germany seeing a 9% in their pig price, which is at an equivalent 153p/kg.

This has had an effect on UK cull sow values and leaves open the possibility of cheaper continental imports sneaking their way back in.

On the flip side, the poultry business is seeing some pressures. We have three broiler breeder farms, supplying fertile hatching eggs.

Although retail of fresh chicken is up 10-15%, this is not enough to offset the decline in foodservice. This means that some flocks are being culled early and others brought into lay late, at huge cost to all in the supply chain.

With a new flock coming in next week, I am pretty nervous, to say the least.

In some more positive news, the National Pig Association’s farrowing crate survey unearthed that 43% of respondents would leave the industry if there was a ban, so they have been lobbying tirelessly on our behalf.

Defra ministers now want to work with us to phase out farrowing crates, rather than a complete ban, which is a welcome shift in mindset.

Sophie Hope is a Farmer Focus writer from near Cheltenham. Read her biography

JOURNAL : Farmers Weekly

Farmers have been advised to apply now for an ***agricultural*** dispensation for wide-vehicle movements, well before the harvest period begins.

The call was made by NFU Scotland (NFUS), which warned that the application process could face delays due to the effect of the Covid-19 pandemic on staffing levels.

The union said farmers should apply to Police Scotland’s Abnormal Loads team for dispensation or a renewal at least six weeks before the paperwork was needed.

See also: Farm vehicle use – are you insured?

Abnormal load dispensations are required if a vehicle or implement are more than 3m wide and/or any part projects more than 4m.

Any equipment that exceeds these dimensions or may exceed them with an implement attached should be included on the dispensation.

NFUS transport adviser Jamie Smart said: “There have been no derogations during the pandemic for moving ***agricultural*** wide vehicles on the roads, so it is important to obtain a dispensation from Police Scotland.

“Like all businesses, the abnormal loads office at Police Scotland are having to practise social distancing, which may slow down applications.”

Mr Smart advised farmers that they must carry a copy of the dispensation document in the relevant vehicle in case they are stopped by Police Scotland.

In England, farmers are also advised to contact police well in advance of needing to transport wide vehicles.

Vehicles affected include those more than 3m wide, travelling on roads with a speed limit of 40mph or less, or those travelling distances of five miles.

Alternatively, annual dispensation can be granted by most police forces, particularly at harvest time. The document must be kept in the vehicle at all times.

Farmers should contact their local force and notify them of the vehicle details and areas it will travel within.

Further information

Scotland

Dispensation forms are available via:

E The NFUS website

E Phone 0131 472 4000

E Email: [*info@nfus.org.uk*](mailto:info@nfus.org.uk)

Completed forms should be emailed to:

[*OSDAbormalLoadsScotland@scotland.pnn.police.uk*](mailto:OSDAbormalLoadsScotland@scotland.pnn.police.uk)

England

Advice on moving abnormal vehicles is available on the government’s website

JOURNAL : Farmers Weekly

Farmers should be reworking cashflow projections for the next 18 months in the run-up to Basic Payment Scheme (BPS) payment reductions, say advisers.

Volatility on the back of the coronavirus pandemic and lack of clarity on the UK’s EU exit terms also mean business planning needs more attention to identify cash crunch points, said Bradley Hurn, of consultant Brown & Co.

For many arable businesses, this will come in spring 2021, he said.

Those tendering for annual grazing or cropping ground or for longer-term lettings need to factor this into cashflow plans and tenders that BPS is going to start to fall from the 2021 payment.

“Some combinable cropping FBT [farm business tenancy] tenders have been at the £200/acre mark and that doesn’t stack up,” said Mr Hurn. “The tendency to spread that cost across the whole cropped acreage is not the way to justify it – that additional land has to contribute to profit.

“A lot of 2019 grain was sold before Christmas at £130-£140/t – not an exciting price, but the big yields mitigated the relatively low price to some extent.

“However, the big yields have not created a large enough cash surplus to help with the potentially poor harvest of this year.”

New crop budgets

Turning to new crop budgets, the large expected carryover of barley into the new crop year on 1 June, combined with a big rise in the spring barley area for 2020, mean growers should be budgeting on the basis of there being no malting premium, says Mr Hurn.

“Our gross margins for average Grade 3 land are worked on a flat price of £115/t for harvest movement of feed and malting barley.”

Harvest 2020 gross margins

Spring barley (malting and feed)

Spring wheat (feed)

Winter wheat (feed)

Yield (t/ha)

6.2

6.5

8

Price (£/t)

115

155

155

Output (£/ha)

713

1,007.5

1,240

Seed (£/ha)

75

75

75

Fertiliser (£/ha)

140

180

210

Spray (£/ha)

125

140

180

Sundry (£/ha)

10

10

10

Total variable costs (£/ha)

350

405

475

Gross margin (£/ha)

363

602.5

765

Source: Brown & Co

The new Environmental Land Management (ELM) scheme will take years to fully deploy, so lower BPS sums should also prompt a review of structures.

On many farms, such a review could lead to a joint venture. “We’re definitely doing more arable labour and machinery joint ventures than we were five years ago, and there is a lot of scope for more,” says Mr Hurn.

“It’s not for everyone, but there are still big savings to be made, reducing investment in kit, releasing management time and using labour more effectively.” Such a change can also give a business the skill, ambition and/or the confidence to try new crops or markets, he said.

Livestock plans

Livestock producers often rely on putting a large number of stock through an individual autumn sale, but they might want to be wary of doing so this year, said James Brown of the same firm.

“Trade has been very volatile and splitting between two or three sales might be advisable to mitigate the effect of a bad day and even out the cashflow,” he suggested.

Equally, depending on what progress the UK has made on its coronavirus journey, the autumn sales calendar may be disrupted.

Autumn sales calendar may change

“There is a risk that a lot of 12- to 18-month old cattle may be for sale at the same time in the autumn, partly through disrupted sales and partly because low prices may have encouraged producers to hold on to stock they would usually have sold.

“Buyers, in turn, may feel constrained if beef and sheep prices have not improved over the summer,” said Mr Brown.

Markets are also being affected by smaller abattoirs reducing or changing their killing days, which is affecting buyer numbers at auction.

“As with the store and breeding stock, perhaps consider taking smaller batches of finished lambs or cattle in more often to reduce risk and smooth cashflow, where possible.

“Some might want to plan a split lambing next year to catch the early market with part of the flock – it brings higher creep costs, but higher market prices.”

Work out payment plans

Smoothing cash outflow can also be addressed. Contractor’s charges are often one of stock farmers’ biggest single bills and their timing is often out of kilter with income from sheep or beef sales.

“We have found many contractors are willing to work out a payment plan,” says Mr Brown.

“You agree the likely bill for the year and split it into 12 equal instalments, or as many as you agree suits both parties’ cashflow, with any difference being made up in a balancing charge at the end of the year.”

With a big drop in the wheat area for 2020, feed wheat prices could rise and new-crop barley prices are under pressure. The gap between the two could make barley worth considering in rations as long as the nutrition is right.

The smaller wheat area may lead to higher straw values for harvest 2020. Some producers with cash flexibility have bought stocks now to carry over into the winter, said Mr Brown, who suggested budgeting for a rise of 25% in straw costs compared with 2019 levels.

Business review pointers

Is business structure correct? An arable or livestock joint venture could reduce risk, improve profitability, bring in new skills, release management time anA can start small.

Family labour Are time and costs being realistically accounted for? Is that labour being used to the best purpose - someone currently working on the farm may want to work elsewhere.

Are borrowings correctly structured? Review this and get advice.

Does the overdraft include a hardcore element that is always there? The business risk of interest rate changes and the "repayable on demand" aspect of overdraft borrowing can be reduced by putting that hardcore element onto a loan footing. This also imposes an element of repayment discipline.

Many of the banks are agreeing capital repayment holidays, but plans need to be in place straightaway for how these payments will be made in future, in addition to what will become due in the meantime. There will also be extra interest on the deferred amounts.

With banks heavily involved in administering government-backed coronavirus loans, lending decisions may well take longer than borrowers want them to.

How is the livestock market changing? Are breeds those most suited to the farm? A change to more traditional breeds can mean easier management and lower labour costs.

JOURNAL : Farmers Weekly

Lambing can be a challenging time, but it’s also one containing magical moments – especially when the younger generation get involved.

Thanks to all the Farmers Weekly readers who have found time to share their snaps in our Lambing 2020 gallery.

See also: More pics in our Lambing 2020 gallery

You’ve uploaded fantastic photos of your children, grandchildren and other relatives lending a hand and, in some instances, getting their first insight into this busy time of year.

Here’s our final round-up of your shots from this year, showing some of the joy and awe that kids feel when encountering – and working with – lambs.

Definitely some fantastic budding shepherds here, we reckon.

To share your photos, go to Lambing 2020 gallery

Feeding time

Bale break

Hang on tight

Lambing in style

Happy helpers

Siblings smiling

Passing on the wisdom

King of the castle

Super stockman

Homework

Twin triumph

Hold on tight

JOURNAL : Farmers Weekly

Vending machines selling milk, cheese, meat and other staples are helping to #feedthenation and keep people safe during the coronavirus lockdown.

At a time when person-to-person contact must be kept to a minimum, vending machines selling produce directly from farms are coming into their own, offering 24-hour service and card-only payments.

Dairy farmers Matthew and Coral Senior are working hard to supply organic milk directly to the local community in south Somerset via three 24-hour vending machines located at North Perrott Farm Shop, John Bright Country Store near Salwayash, Bridport, Dorset, and Odcombe Village Hall near Yeovil, Somerset.

See also: Map: Where to buy milk direct from farm

The service also has an environmental benefit, as customers are filling reusable glass bottles, creating less plastic waste.

Their Holy Cow Organic milk is simply pasteurised, cooled and ready to drink, so there is no heavy processing and no food miles. It costs £1.30 per litre and is never more than 48 hours old.

Social distancing

The machines are cleaned at least four times a day and customers are also offered hand sanitisers. Strict social distancing measures are in place, on a one-in, one-out basis.

“A lot of local shops have closed in our area, so we started the vending machines over 12 months ago to bring a little bit more to the community,” said Mr Senior.

“They have fallen on their feet since the coronavirus. People who have been self-isolating can just pop out and buy a few staples without having to travel very far.”

Fen Farm Dairy, in Bungay, Suffolk, has been operating vending machines at the farmgate since 2011.

Dairy farmer Jonny Crickmore said the machines have been a huge success and sales had trebled since the start of the coronavirus pandemic. He is now having to restock the machines often twice daily and also operates a one-in, one-out policy.

Raw milk coffee

Their raw milk coffee machine is brewing 24/7. “It’s completely self-service and there’s hand sanitiser for you to use. Plus our cups are totally compostable,” said Mr Crickmore.

The farm also sells raw milk and butter, its own Brie-style Baron Bigod cheese, produced from raw milk from the farm’s Montbeliarde cows, bread and meat.

Panic buying led to supermarket shortages of eggs, especially at the beginning of the coronavirus crisis. But farmers have been able to meet demand by selling eggs from the farm gate.

Gate Farm Eggs, based in Flowton, Ipswich, Suffolk, says their vending machines selling free range eggs are now in constant use.

Being open “from dusk until dawn” allows key workers to purchase eggs after shifts from a safe environment, which also poses no threat to staff.

“Demand for locally-produced, good quality free range eggs is on the increase and although our gate sales have always been high, the popularity of home-baking during lockdown has meant a soar in sales recently,” said Joe Watkins, from Gate Farm Eggs.

British Lion donates eggs to NHS workers

British Lion is donating eggs to the HelpNHSHeroes initiative which provides food boxes for health service workers.

HelpNHSHeroes has been trialled in pop-up shops at two NHS hospital sites, the Lister in Stevenage and the Royal Berkshire in Reading, selling boxes to workers.

Following the successful trial, there are plans to scale up to national distribution to more than 40 hospitals across the UK.

The boxes provide meals for a family of four for two days, and cover all nutritional needs, such as protein, carbohydrates and fruit and vegetables. They will be sold on a non-profit basis for £30.

NHS staff can place a food box order for ***collection*** at the end of their shift using a phone app. Meanwhile, shift workers completing back-to-back shifts are being offered free breakfasts as part of the scheme.

JOURNAL : Farmers Weekly

An Essex farming couple are keeping elderly and vulnerable people fed during the coronavirus lockdown – by using a tractor-trailer to deliver food to their doorsteps.

G & J Barron Farms, based at Pattocks Farm, Chappel, was asked by residents if it would open its farm shop – normally operating only at Christmas to sell turkeys – as the supermarkets were running short on supplies.

Arable and turkey farmers Ross and Sarah Barron considered the request but decided reopening the shop would risk spreading the virus to staff and locals, as it sits in the middle of the yard.

See also: Farmer, 86, working every day to #FeedTheNation

Instead, they decided to dust off their 1963 red vintage Massey tractor and trailer and start home deliveries of staple local foods, including meat, fruit and veg, eggs and honey.

Mrs Barron told Farmers Weekly: “We rear free range turkeys for Christmas and open a farm shop for three days selling everything you need for a Christmas dinner, including other meats, vegetables, etc.

“I said to my husband, why don’t we just put everything in a trailer and deliver it to locals round the villages? It has gone from there.

“We sell a range of foods from our farming neighbours, including free-range eggs, pork and strawberries.”

Mrs Barron takes the produce around the nearby villages of Great Tey, Little Tey and Aldham, just outside Colchester. Many of these villages no longer have local shops and they are home to a number of elderly residents.

Social distancing

Payment is by card, and orders are linked Mrs Barron's phone so that she can observe government guidelines on social distancing. Locals also have to use the hand sanitiser provided before they select their produce.

As well as providing a vital food delivery service, for some residents Mrs Barron may be the only person they see all week. She is able to box up produce and deliver to the doorstep for those who are isolating.

Street names where deliveries will be made are posted in advance on the farm’s Facebook site. Residents are asked to leave a shopping bag on the fence or gate to request the tractor to stop.

Mrs Barron said: “I am working 12- to 13-hour days, basically until the sun sets. It’s a lot of work, but it’s very rewarding. People are so happy to see you.

“They have asked me to continue after coronavirus. I may do something. I haven’t decided yet.”

Great Tey resident Charlie Saville told BBC Look East: “It’s a brilliant system. Really good. And hopefully, very supported by the village.”

JOURNAL : Farmers Weekly

Morrisons has launched a food box packed with British produce to help farmers struggling with the loss of the food service market.

The 10kg box includes meat, vegetables, milk and cheeses produced in the UK, and £1 from every sale will be donated to the Prince’s Countryside Fund (PCF), which is co-ordinating donations on behalf of Farming Help charities.

It follows other supermarket promotions to help farmers deal with the drop in demand for more premium produce, which would typically be destined for restaurants.

Claire Saunders, PCF director, thanked Morrisons for backing British farmers and providing much-needed support.

See also: Supermarkets step up steak promotions to help farmers

“This contribution will allow us to support farming groups across the UK - including the five Farming Help charities.

“It will also ensure that British farmers have the support they need through this difficult time to keep producing healthy, nutritious food for our tables.”

The box costs £45 and includes rib eye steaks and pork loin steaks.

David Potts, chief executive of Morrisons, said: “Being the biggest customer of British farming, we want to help farmers while also playing our full part in feeding the nation.

“Our farmers produce some of the world’s finest meats, vegetables and cheeses, which we want to offer to our customers.”

Steak promotions

Marks and Spencer launched a 100% British meat food box, which includes Aberdeen Angus casserole steak and rump steak.

Waitrose, Lidl and Aldi have all stepped up promotions on steak products to help beef farmers. Waitrose has offers on selected pre-packed and meat counter steaks in May and June.

The AHDB has launched a campaign which aims to inspire consumers to create restaurant-style meals at home, using high-quality cuts from British beef.

The levy board has been sharing easy recipes to try in the kitchen.

A kick of " from quick chilli butter and a whole lot of flavour from the steak. This delicious 20-minute steak with chilli butter is just one of the recipes we are sharing with our fans on Simply Beef and Lamb #MakeItSteak #SteakNight

Check it out ' [*https://t.co/8QZWh5yQqI*](https://t.co/8QZWh5yQqI) pic.twitter.com/NJrDCLs9t3

AHDB (@TheAHDB) May 9, 2020

JOURNAL : Farmers Weekly

Morrisons has announced a series of measures to say thank you to British farmers helping to #FeedTheNation during the coronavirus pandemic.

The Bradford-based supermarket chain is offering a 5% discount to its 2,700 farmer suppliers when they buy their own groceries.

The initiative aims to support its hardworking farmers and their families and will run until at least mid-July, when it will be reviewed.

See also: Coronavirus: Prince praises farmers who #FeedTheNation

Those eligible for the discount include livestock farmers supplying lamb, beef and pork, fruit and veg growers and egg farmers supplying Morrisons direct, and dairy farmers with a Morrisons contract.

The retailer will also open a summer “BBQ and Steak Bar” in its stores from Thursday 30 April – providing another fillip to struggling British farmers and promoting a wider selection of steaks, joints and seafood.

Morrisons chief executive David Potts said: “This is a difficult time for the nation and it’s a very difficult time for farmers.

“We’re the biggest supermarket customer for British farmers and they continue to provide very good quality British food in the face of very real challenges.

“We want to show our thanks for all their work in feeding the nation and encourage our customers to buy British food.”

Trade affected

Customer demand and industry prices for certain foods have fallen dramatically since the lockdown started – as one-third was destined for the restaurant and catering trade, which has temporarily closed.

Meat producers have been unable to sell certain products, including high quality steaks and joints that would have been destined for the restaurant trade.

Morrisons has 494 stores serving 12 million customers each week. It is British farming’s biggest supermarket customer and its own-brand fresh meat is 100% British.

Will Jackson, AHDB Beef & Lamb strategy director, said: “The summer BBQ and steak bar approach supports and neatly sits alongside other industry promotional activities including a social media campaign to encourage shoppers to enjoy #steaknight.

“As we move from spring into this summer, in particular shoppers may well be looking for a treat and what better than fantastic beef and lamb.”

JOURNAL : Farmers Weekly

Dairy processor First Milk has announced its member milk price will be held at the current level for June 2020.

It means the price for a liquid standard litre will remain at 26.75p/litre and its manufacturing standard litre will be 27.63p/litre.

Despite the price hold, the farmer-owned co-op’s vice-chairman, Jim Baird, warned of continuing uncertainty in dairy markets.

See also: Dairy farms to get up to £10,000 to offset coronavirus cost

Mr Baird said food service sector demand had fallen sharply since the coronavirus lockdown began.

“It remains hard to determine what the total impact of Covid-19 will be on dairy markets in the UK or globally in the months ahead,” he added.

First Milk’s price hold comes after Meadow Foods announced a price cut last week.

Meadow Foods told its suppliers on 30 April that the weakened market had forced it to cut prices for a standard litre by 1p/litre to 25p/litre in May for its Cheshire and surrounding milk fields, and by 2p/litre in Cumbria, Lancashire and south Wales to 22p/litre.

Chief executive Mark Chantler added that the June price would not be announced until later this month due to an uncertain market outlook.

“We will be leaving any price announcements until later in the month, to give us as much visibility of the market ahead as possible,” Mr Chantler said.

Gloomy dairy outlook

Looking ahead, AHDB Dairy suggested the EU milk price equivalent was expected to decline in the coming months in line with the downward trends in butter and skimmed milk powder pricing.

The sector board's senior analyst, Patty Clayton, said: "With stocks expected to build for these products, and global demand to remain subdued, these trends are likely to continue over a longer period."

Ms Clayton added that the coronavirus pandemic had caused a downturn in forecast production.

Suggested milk production across the EU-27 was likely to be lower than earlier predictions due to the pandemic, she said.

Milk production is projected to expand by a modest 0.4% in 2020, similar to 2019 increases.

This is less than previously forecast, as growth in yields could be limited by compound feed shortages, processor-driven milk reduction schemes and the potential drop in the size of the dairy herd, Ms Clayton explained.

JOURNAL : Farmers Weekly

When it’s a hot May day, too windy for spraying or that last dose of liquid fertiliser, there’s only one place to be: on the very top of the combine, wielding a weedy pressure washer.

It’s the perfect place for some solemn contemplation and reflection on the state of the farm.

In many ways, it’s like being the cartoon guru dispensing wisdom on the sharp peak of the mountain – not least because of the effort involved to get there: up the side steps, over the engine (still giving off a delicate aroma of toast after last year’s close-thing fire), and carefully on to the grain tank.

See also: Read more from Charlie Flindt

And then, giving thanks that you remembered to turn on the power before setting off on your Snowdonesque ascent, you get to work, making sure the low-pressure blast scythes through the black dust but leaves the paint untouched.

Enjoy this bit – once you start on the mechanicals, most of it comes back in your face.

Peer pressure

Pressure washing combines was thoroughly disapproved of in my youth – “you’ll get rust in the seams!” was the cry.

It was done with a hosepipe and a hand brush. Mind you, we had men back then, and three weeks to spare.

When the shoulders need a rest, it’s a great chance to survey much of the farm from an unusually lofty viewpoint.

To the south-east is the one field of oilseed rape to have survived – and I’m getting a bit fed up with it.

One week it’s a write-off, and I’m on the point of ploughing it in. Then, suddenly, it’s off again, flowering and getting off the floor.

On goes the last bit of fertiliser, and it promptly goes all goth teenager.

Tod the Cropdoctor agrees that it only justifies a cheap ’n’ cheerful mix of insecticide and fungicide – and it promptly explodes into life again.

To the east is my fertiliser tank, sitting empty, waiting for the last lorry load. It should, of course, be topped up and ready to use, but in the glorious chaos of the past six weeks, my sophisticated ordering system (don’t laugh) has gone to pieces.

Look to the west and you’ll see why; there’s good wheat, bad wheat, late wheat, early wheat – and often in the same field.

Trying to work out a detailed fertiliser policy for that lot – while trying to sow and spray the rest of the farm – has been a bit of a challenge.

As usual, I’ve been doing WICWIC farming – what I can, when I can. So far, the weather had been really kind, with regular bursts of hot rain letting the nitrogen get to work quickly – but then you blink, and it’s time for more.

To the north is the old Conder Bin storage barn, unused for decades.

Ten 50t capacity boxes, bolted together, with an intake pit, cleaner, and a Cyclone fan with heater banks, designed to dry the crop (and empty the bins) through the ventilated floor.

1970s style

I’m not sure I’d dare press the star-delta button now though. Dad put it up in the 1970s, after a bumper grass seed crop, but now it sits rather sadly waiting for something – anything – to be done with it.

A few months ago, I put out feelers for demolition and replacement. Ouch. “It’s the asbestos, you see.” Not this year.

With shoulders rested, it’s back to pressure washing.

It’s quite comforting to see the farm in its usual state: not brilliant, hardly spic-and- span, and certainly not good enough to drive visitors to ascend my New Holland-shaped mountain in search of farming wisdom and knowledge.

But it’ll do.

JOURNAL : Farmers Weekly

Sometimes the most significant stuff pops up in the most unlikely of places.

For instance, you’d hardly think that a Defra publication from December last year called Farming ***Statistics***: Final crop areas, yields, livestock populations and ***agricultural*** workforce at June 2019 – United Kingdom would cause a frenzy of excitement.

It’s hardly the latest Harry Potter, Harold Robbins or yet another of the Fifty Shades series – although I suppose it does detail the results of a damn good thrashing.

See also: Read more from Charlie Flindt

But for those of us who are into that sort of thing (analysing harvest yields, not a damn good thrashing) it contained some very important ***statistics***, and all helpfully and neatly laid out in a graph – it’s on page five of the PDF. It shows yields of wheat, barley and oats over 20 harvests.

The message is simple. Over two decades, yields have been creeping up nicely, then dipping for two harvests before surging back up to a new high last harvest.

It backs up exactly what I, and many other farmers, saw from the combine cab, and explains the initial and inevitable drop in prices just after harvest.

Harvest hoo-ha

What’s the significance – why is it so exciting? Well, it is me to me, anyway. You see, when I’m not arguing with vegans online, I’m arguing with “soil catastrophists”.

They are a very vocal brand of eco-warriors, and they spend their time bashing modern farming on the rather dubious claim that we spend our time destroying the very thing that makes our farming possible: our soil.

You’ll recognise their arguments: the soil is being washed away at an alarming rate, the soil has been rendered toxic or sterile by years of industrial farming, to the extent that only pouring on more chemicals will give a crop, and as a result, we only have five (or is it 10, or is it 15?) harvests left.

Making a positive counter-argument for modern chemical farming is easy, but it falls on deaf ears.

Somehow, having 36 years of hands-on farming experience and a respectable ***Agricultural*** Engineering degree (which included some proper technical soil science taught by proper, if barking mad, soil scientists) is trumped by reading The Guardian, watching Countryfile, and harvesting echo-chamber opinions at SW1 twatterati dinner parties.

Back to earth

I invite them out to my farm – all the soil is where it was when we arrived 60 years ago.

I try and tell them about Liebig’s Law – you don’t get good yields from poor soil, no matter what extra chemicals you “pour” on.

And I try telling them that we do indeed test, nurture, protect and cherish our soils, and they are actually in very good health.

And the “5/10/15 harvests left” prediction will be as accurate as the others eco-scares that get ceremonially ridiculed every “Earth Day”.

But the catastrophists will never take the word of a “chemical junkie farmer”.

Well, thank goodness for Defra (and there’s a phrase I never thought I’d use), and its factual and unemotional analysis of the state of UK arable farming, written and illustrated in the clearest and simplest terms.

Yields are on the up, and have been for two decades. We are looking after our soils.

Having said all that, there is a fourth line on the Defra graph: it shows the oilseed rape yield, and it bucked the trend quite dramatically last year.

There’s a wonderful irony there; a crop’s yield has plunged after farmers were forced to stop using a key chemical following active and vociferous green campaigning.

Good thing Defra is too diplomatic to point that out.

JOURNAL : Farmers Weekly

It’s slightly embarrassing to have to ask – and let’s keep this between ourselves, shall we? – but does anyone know where I can get hold of new steering wheel for my 2018 Massey 5713S? I need a new round one to replace one that, unfortunately, isn’t.

I would go to my dealer, but they’d probably produce the “Blimey, we don’t sell many of those!” line – and then ask how it happened. I could try bluffing and say it was a mysterious spontaneous breakage, and try yet another just-out-of-warranty claim.

The first problem with that plan is that I’m a terrible liar, and the second is that I have already drawn heavily from the deep well of just-out-of-warranty goodwill claims – it might be running dry.

See also: Read more Flindt on Friday

Insurance assessment

Even going to NFU Insurance for a claim could be rather humiliating. They’ll take one look at the details of the “incident” and write a nice formal letter consisting of two words, the second one being “off”. You wouldn’t blame them, and here’s why.

I bet this isn’t the only farm where odd jobs are being done that would normally get procrastinated into eternity. A couple of Saturdays ago, arable work was nicely up together – a genuine opportunity to lock the tractor barn and and what, exactly?

In my case, it’s eat. While other unfortunate folk are using their lockdowns for intensive yoga, interior decorating or buffing up their Swedish (as in the language, not the au pair), I’m scoffing. All that weight lost after the hip op, back on again.

The only solution is to unlock the barn and get back in the tractor. “I know”, I thought. “I’ll take the loader and grab, and push some of this winter’s fallen trees back off the tracks.”

I had a very jolly afternoon doing some “public good”, and making mental notes of the next supply of firewood. All that lovely ash – although the fact that so many of them are coming down is worrying.

I got the last one done, and headed home via the track next to Clump, closing up the grab as I went. The sky was blue, the birds were singing, the bluebells were out, the wheat looked lovely, spring had most definitely sprung most stunningly – and at that very moment, the tractor stopped dead.

I wasn’t closing the grab; I was pressing the wrong button on the joystick, and lowering an open and slightly downward-tilted grab to the dirt. Result: 10kph to 0kph in a scary millisecond.

Seventeen stone of finest Hampshire beef (that’s me, by the way) failed to stop. I don’t remember much about it – just a strange bewilderment.

Hobnob airbag

My left thumb hurt like heck, as did my teeth, and my lower ribs felt like they’d been hit by an iron bar. I gave them a good poke (as props do after losing a scrum), thinking, “no, not hospital, not now, please!” All seemed sore, but intact.

Once I’d gathered my senses, I realised that the “iron bar” was the steering wheel, and it had acted as a mini-crumple zone. It was now a very odd shape.

Thank goodness, too, for all the cheese, ginger beer and Hobnobs; the perfect inbuilt “airbag”, protecting my ribs. And the next thing I did? Check, of course, that no one had seen me do it.

It’s not the sort of tale to tell the dealer or the insurance company – a tale of complacency and idiocy at the tractor wheel, which once was round, but now isn’t. So, if you’ve got a spare one, pop it in the post.

JOURNAL : Farmers Weekly

Wheat consumption for flour production could drop by about 152,000t between April and June despite a surge in home baking brought on by the coronavirus lockdown, the AHDB has said.

The estimated figure would put consumption about 13% down on five-year averages for the market, according to AHDB senior analyst James Webster.

With uncertainty remaining about how long the lockdown will remain, he used a range of consumption reductions between 5% and 15%, and varied the lockdown end date between May and June.

See also: How to make sure you hit protein target for milling wheat

"Overall wheat consumption for milling is likely to be down between 36,000t and 171,000t, with a best estimate of being nearer the higher figure," Mr Webster calculated.

Mr Webster added that this could be added back into the balance sheet as carry-over stocks and add “a modicum of pressure to late-season prices”.

He explained that the fall in demand was due to coronavirus lockdown measures, which were having differing effects on the main markets for flour – pre-packed for household use and retail bread and foodservice consumption.

Pre-pack/household use

According to figures from Nabim, the UK flour trade body, total annual demand requires about 4.2m tonnes of British wheat and 800,000t of imports.

Normally, about 4% of that is sold in 1.5kg packs for household consumption and about 2m of these are packed each week.

Since the lockdown measures were introduced, demand for packeted flour has more than doubled.

However, even with mills and packaging sites running 24 hours a day to produce 4m packets, there is insufficient capacity to meet household demand, Nabim said.

Mr Webster calculated an additional 14,500t of flour had been produced for retail sale, equivalent to an additional 18,200t of wheat consumed.

“Assuming this trend continues to the end of the season, an additional 37,900t of flour would, in theory, be produced for retail sale, equivalent to about 47,300t of wheat,” he reckoned.

Retail bread and foodservice consumption

While the household consumption is relatively simple to work out, the retail and foodservice sectors are more difficult to analyse.

Nabim say there is considerable overlap in output from bakeries that can supply both food service and retail outlets.

Collectively, they make up the remaining 95%, with roughly 70% of that going into food service and 25% into retail.

Further confusion surrounds closures as not all businesses, such as takeaways and other retail outlets, have shut down, Mr Webster said.

JOURNAL : Farmers Weekly

Better food security could be one important outcome of the coronavirus pandemic – which has highlighted the determination of British farmers to feed the nation.

MPs investigating the impact of the pandemic on the UK's food supply chain are expected to recommend steps to make sure people have better access to sufficient healthy food.

See also: Coronavirus: MPs probe threat to food supplies

Members of the House of Commons environment, food and rural affairs select committee held their first public evidence session as part of its inquiry on Tuesday (5 May).

Speaking afterwards, Keighley MP Robbie Moore told Farmers Weekly he believed the government must ensure UK food security and supply chain resilience.

Under scrutiny

He said: “We need, as a scrutiny committee, to make sure Defra does have those plans in place to ensure that food resilience is there now but also going on into the future.”

Mr Moore said the inquiry was an ideal opportunity for MPs to ensure food security and resilience was at the heart of Defra's thinking and policymaking.

Jack Ward, chief executive of the British Growers Association, said demand for food was “like the Christmas rush without any warning” ahead of the coronavirus lockdown.

“If this crisis has done one thing, I think it has partly restored the pride that farmers and growers have in producing food,” Mr Ward told the inquiry.

Wake-up call

“Suddenly, the nation has woken up to the fact that when all is said and done, food is absolutely critical and [producing] it is dependent on lots and lots of people.”

NFU president Minette Batters told MPs it was vital to keep food supply chains functioning so they could continue to feed the nation when the pandemic was finally over.

“We are only just starting this journey – it is not all going to be sorted. Lockdown is obviously going to be a very phased approach and who knows what that looks like.

“The new normal is going to be quite long lasting, so we are going to have to keep working at how we keep these living supply chains focused so we don't lose sight of British sourcing.”

JOURNAL : Farmers Weekly

The start of post-Brexit trade talks between the UK and US has prompted renewed warnings that British farm standards must not be undermined.

Talks between UK international trade secretary Liz Truss and US trade representative Robert Lighthizer are due to begin on Tuesday (5 May) via video conference because of the coronavirus pandemic.

See also: NFU20: British farm standards must not be undermined

The government has pledged that any agreement will not compromise the UK's high environmental protection, animal welfare and food standards.

But farm leaders want a clear statement that any food imports will not be produced using methods that would be illegal in the UK.

This would mean a ban on imports of chlorine-washed chicken and hormone-treated beef – both practices are allowed in the US, but banned in Britain.

Threats and opportunities

The Country Land and Business Association (CLA) said a potential trade deal offered both opportunities and threats to UK growers and livestock producers.

The US is a huge market and a free-trade agreement would give American consumers the ability to enjoy world-class British food produced to very high standards.

CLA president Mark Bridgeman said: “Our farmers grow some of the best produce in the world.

“Food and drink businesses are well placed to capitalise on growing demand and new markets abroad. They should be at the heart of our future trade talks.”

Conform to standards

Like other farm leaders, Mr Bridgeman said the US must conform to UK standards if it wanted greater access to the UK market for its own produce.

He added: “Allowing food produced to low animal welfare and environmental standards to undercut UK farmers is unacceptable.

“The UK government has repeatedly issued warm words in this regard – but it must go further and legislate to protect UK farmers in all future trade deals.

“Maintaining food standards needs to be part of the ***Agriculture*** Bill.”

According to the UK government, eliminating tariffs and reducing other trade barriers with the US could boost the economy by between 0.07% and 0.16% over the next 15 years, depending on the terms of the agreement.

JOURNAL : Farmers Weekly

An increase in environmental awareness has strengthened investors’ interest in an expanding forestry market.

Savills’ latest report on the UK forestry market shows that last year more buyers became interested in the asset, due to both its performance and environmental benefits.

A shift in public attitude towards climate change encouraged businesses to invest in forestry in order to offset their carbon emissions.

See also: Why we’re selling the family farm during coronavirus

Meanwhile, other trends continued, including low supply, strong competition and decent timber prices.

Values on the up

The value of the UK forestry investment market was just over £121m during the 2019 forest year (1 October 2018 to 30 September 2019) – a 2% reduction in overall sales value compared to the previous year.

The area of forestry traded also fell, down 4% from 36,819 acres to 35,583 acres, while the average value increased by 17% to £4,108/acre.

Forestry prices depend on location, accessibility, tree species, average age and timber volume.

Conditions and values vary across Scotland, though each area remains more productive and active than England and Wales combined.

North Scotland is a lower value area, due to the poorer physical growing conditions and extended distance to timber markets.

In 2019, North Scotland saw the highest rise in average values from £2,282/acre to £3,394/acre (45%). It was the only region to sell more acres in 2019 than 2018, reporting an increase of 1,977 acres to 9,612 acres.

The average value of forest in central Scotland rose by 31% during the 2019 forest year to £5,164/acre. It experienced no real change in the number of acres sold (12,182) and had the largest market share across Scotland, England and Wales.

Average values in southern Scotland rose by 38% to £6,139/acre. Although the number of acres sold (10,724) was down by 17% on 2018, it had the second largest market share.

The south is the most competitive area for timber marketing, and its forests benefit from excellent physical conditions leading to fast, even growth.

England and Wales have a scarcity of productive woodland for sale, which increases values. The average price of commercial forestry traded in England and Wales is higher than any Scottish region. In 2019, average values reached £6,637/acre, with 2,990 acres sold.

Tree-planting target

Investors now see forestry as a viable income stream, the report says, which has been supported by the introduction of the Woodland Carbon Guarantee in England, a scheme aiming to establish a public marketplace for carbon offsetting through woodland creation.

The UK government has committed to achieving net zero emissions by 2050. To achieve this,  it is estimated that 74,132 acres of trees need to be planted each year, nearly triple the current annual planting rate.

However, there are multiple barriers to achieving this, such as the UK nursery stock of tree saplings being limited to orders the nurseries know will be fulfilled, and a multi-year lag time to produce new stock to meet new demand.

Changing land use from ***agricultural*** production to woodland creation requires prior approval, which can be time consuming. And once approved, the land cannot be returned to farmland.

In addition, there is a relatively limited area within the UK that is suitable for tree planting. It is important not to compromise other economic land uses, biodiverse habitats and protected ecosystems, and planting must be appropriate – in the right place and for the right objectives, which must include production of sustainable, quality timber.

Woodland planting schemes

 £46.4m Forestry Grant Scheme, Scotland 2019-2020

£8m Glastir Woodland Schemes, Wales 2021-2023

£6,800/ha Woodland Creation Grant: Countryside Stewardship, England 2019

£50m Woodland Carbon Guarantee scheme, England

Source: Savills

What sold well?

Llanbrynmair Forest in the Montgomeryshire area of Powys, a region well-known for its timber production, sold in excess of its £27.5m guide price after being on the market with Savills for about six months.

The first commercial planting took place in 1960, and the most recent replanting of the 5,342-acre forest took place in 2019.

What’s on the market?

Northumberland forest

John Clegg & Co has launched 1,200-acre Whiteburn Forest in Northumberland for offers over £4.8m.

It includes mixed age, high yielding Sitka spruce timber ready to harvest, and a stone house that has previously been let as an activity centre.

Somerset woods

In the Quantock Hills near the West Somerset coastline, Westwood and Stileage Woods is available with Carter Jonas, guided at £295,000.

The 23 acres of amenity woodland has a mixture of tree types, is home to an abundance of wildlife, such as wild birds and deer, and includes a lake.

JOURNAL : Farmers Weekly

Research, expert advice and attention to detail have helped one first-time broiler grower achieve some of the highest performance figures in the wholesale sector.

David Hewitson's journey into broiler production started when he returned to his family's Hauxley Farm near Stockton-on-Tees in 2017 after serving in the Navy.

At the time, the farm already produced arable, pigs and sheep. But Mr Hewitson was interested in broiler production, which was enjoying a 10% year-on-year growth in demand.

See also: How to spot and treat infectious bronchitis in broilers

The positivity surrounding the sector, and low environmental impact, added to the attraction of broiler production, he says.

Farm facts: Hauxley Farm

Indoor broiler production

98,000 birds

Cockerels reared to 52 days

Pullets to 36 days

Red Tractor Assured

Research phase

Mr Hewitson began an extensive search for information on set-ups, production, industry targets and health and welfare issues.

"I set out to get as much information as possible online then began to contact growers to get a solid idea of how to set up a successful unit," Mr Hewitson says.

These were some of the most important people he spoke to during this phase. The practical advice and warts-and-all reviews helped build a realistic picture of the sector.

Farmer contacts also recommended who to talk to in the wider industry. Based on their advice Mr Hewitson began a round of discussions with broiler feed and processing companies to ensure there was sufficient capacity in the market.

As well as companies linked to broiler production, he quizzed advisers and consultants and secured assurances from potential buyers over demand for the stock produced.

Planning and construction

Following advice that suggested a minimum of 100,000 birds in two sheds was needed to achieve a decent return on investment, the Hewitsons submitted plans for a four-shed, 220,000-bird unit to allow for future expansion.

The planning permission process went smoothly and cost about £28,000. But it still took 12 months to complete and the additional environmental reports required, pushed up costs to £65,000.

Good weather during the winter of 2018 meant the Morspan building was constructed, Collinsons equipment and a Fancom environmental system installed, within four months.

Connecting the electricity supply proved to be the biggest headache. "Instead of hooking us up and allowing us to use the planned, energy-efficient, ground-source, heat pumps, the installer struggled and eventually quit."

"With hindsight, I should have looked harder at the company's credentials, and I would advise anyone thinking of entering the sector to carry out a thorough check," Mr Hewitson says.

The unit had to turn to emergency generators for power as the first flock was due to be placed. Gas heating was later installed as an interim solution while the work to connect up the ground-source heat pump continued.

Stocking phase

As the time approached for the arrival of the first crop, the amount of new information, checks and details were almost overwhelming, says Mr Hewitson.

One mistake during this initial phase could have caused a problem that held back the entire crop's performance. For help, Mr Hewitson turned to feed and nutrition specialist ABN.

The firm's Total Farm Performance service provides structured support to guide growers through production, and poultry adviser Kieron Daniels was assigned to Hauxley Farm.

"As David says, the amount of new information can be overwhelming. It would be easy to miss or skip a vital point, so my role was to guide the start-up," Mr Daniels says.

With the incoming crop approaching, one of the first tasks was to ensure that everything in the two new sheds was fully functioning and any potential glitches identified.

The two sheds were heated to 32C for two days before shavings were laid, and this temperature was maintained until after the chicks arrived.

This practice is needed because the newly laid concrete floor is cold and can chill the day-old birds. Performance would be hit from day one and never recovered.

Another key to getting performance from the outset was to prepare the water system at Hauxley Farm immediately before the birds arrived.

"Water intake governs food intake, which underpins performance. If birds don't drink, growth rates will not hit targets," says Mr Daniels.

To ensure water intakes are adequate, birds need cold, fresh water available to them continuously from the very first minute of arrival.

However, water can lie in the system pipework while the shed is pre-heated and also warm-up, allowing microbial populations to develop.

The water system was flushed through until it ran cold before the birds came in. Checks were also carried out on water pressure regulators.

There must be sufficient pressure for a drop of water to hang on the drinker nipple. The glistening drop catches the light, and the day-old bird is instinctively attracted to it.

However, if pressure is too high the system will drip, and shavings beneath can get wet and harbour disease.

Immediately before stocking, additional feed was provided at floor level to encourage the birds to feed from the start.

The crop

Once the birds were in, it was a case of careful monitoring and frequent, subtle adjustments to the system to optimise performance.

During the first crop, Mr Daniels walked the sheds alongside Mr Hewitson several times a week to help him get used to the process and to identify any irregularities.

The Hewitsons were advised to walk each shed three times a day for about 40 minutes and focus on the birds' behaviour, both individually and as a flock.

It's important to note how birds are feeding, drinking and their behaviour. For example, the flock can appear flighty, which can indicate the lighting regime needs adjusting.

From days one to 10, light levels need to be high to stimulate food and water intakes.

Early feeding helps birds' gut microflora develop faster, ultimately leading to better gut health, better digestion and increased feed intakes.

But levels need to be adjusted downwards as the birds grow, to keep them calm and improve growth rates.

Feed and drinker equipment was regularly checked during the shed walks.

The height of drinker nipples was fine-tuned when necessary, sometimes by as little as half an inch, to keep the line just above the birds' eyelines.

This maintains water intakes as the bird lifts its head to peck at the hanging droplet and the water then flows naturally back into its beak.

Set too low, and the water will drop away from the bird to the floor. If birds are unable to drink efficiently, feed intake is lower and ultimately weights drop.

Likewise, minute adjustments to the feeder heights are needed to allow the birds optimum access to the feed without wastage or competition.

As well as the visual checks, feed and water intake levels were ***collected*** and monitored through the system equipment. These were analysed at least once a day to spot any irregular upward or downward trends in intakes that might suggest disease or a system problem.

The task is made easier with ABN's InFocus app, which has been used to ***collect*** and collate ***data***.

The ***data*** can be sent straight from a phone to the cloud allowing both Mr Hewitson and Mr Daniels to access and analyse the results using graphs which highlight any discrepancies in performance or fluctuations in feed, water or the environment.

Mr Hewitson then made adjustments where needed to maintain optimum bird performance in both sheds.

It is important not to treat individual sheds as one unit. Each one will have a number of slight differences that can be overlooked but collectively add up.

The environments can vary considerably, so need managing differently to keep growth rates up.

Performance ***data*** analysis

At the end of the first crop, ***data*** was reviewed under the Total Farm Performance package.

The wholesale market requires a larger bird than retail outlets, and crops tend to be split-sexed. In Mr Hewitson's first crop, pullets started being taken at 33 days weighing an average of 1.91kg, and cockerels first went out on day 46 weighing an average of 3.65kg.

The shed was totally cleared on day 49. Mortality in the first flock was 5%.

Feed conversion ratios for the first crop were just 1.68:1 placing the Hewitson's flock at the top of ABN's performance chart across its monitored wholesale producers that year.

The first crop also saw growth rates peak close to 120% of the breed guide between 20-25 days.

The first crop's European Production Efficiency Factor (EPEF) was above 400, ranking Mr Hewitson's performance in the top four of ABN's flocks.

After monitoring the first crop results Mr Daniels and Mr Hewitson tweaked the system slightly.

"Despite the high peak in growth compared to the breed standard, we lost some performance in the early days," Mr Daniels notes.

From day one, growth rates were 79% of the breed standard and did not achieve a 100% figure until day six.

"For the second flock, we decided to put more feed on the ground as the new chicks came in. The move was successful and saw the flock hit 100% of the breed standard by day three.

"We also made a number of changes to the lighting intensity at different times/around week three of the growing period to encourage water consumption, and hence feed intakes, in the first few weeks.

"After which, further lighting changes were made to slow bird growth down later on – the aim was to reduce mortality by another 1%," Mr Daniels says.

The plan worked, and the growth curve peaked more gradually to 110% between 25 and 30 days.

A knock-on benefit of the more uniform growth was a 1% reduction in mortality over the lifetime of the flock.

The combined better growth and lower mortality saw the EPEF rise to 417.

With only his second crop, Mr Hewitson's broilers reached the second-highest performance figure of ABN's monitored flocks.

How the European Production Efficiency Factor is calculated

The efficiency factor allows broiler results from different flocks and different regions to be compared.

This factor standardises technical results, taking into account feed conversion, mortality and daily liveweight gain.

The formula is: (average grams gained per day x % survival rate )/feed conversion x 10

Crop 1: (ADG: 71.95 x SR: 94.96%) / (FCR 1.68 x 10) = 407

Crop 2: (70.48 x 95.92) / (1.62 x 10) = 417

JOURNAL : Farmers Weekly

Wheat growers are being urged not to cut back on fungicides on some of their thin, poor-looking crops, as showery weather could soon bring wet-loving septoria disease back with a bang.

Many late-drilled wheat crops have struggled out of the winter, prompting growers to think about cutting back on expensive fungicides as their yield potential is clearly lower.

But some experts argue that even potentially lower-yielding crops can be laid low by disease, and the current dry weather should not lull growers into complacency.

Bill Clark, technical director of crop consultant Niab, says there is plenty of septoria in winter wheat crops and all it needs is showery weather to make the foliar disease rise up from the lower leaves.

“Don’t talk yourself into lower inputs yet, as potentially lower-yielding crops can still see a big response to fungicides,” he says.

See also: How to counter the raised yellow rust risk in winter wheat

See what the situation is in regions across the country:

Kent

East Anglia

North Yorkshire/Durham

Northern Scotland

Herefordshire

Dorset

Dry weather approach

The current dry weather may help fuel a laid-back approach, as the multisite fungicide chlorothalonil will protect emerging leaves, but a change in the weather may herald the need for the eradicant properties of systemic fungicides, which travel into the leaves of plants, such as azoles and SDHIs.

Much attention has been focused on widespread yellow rust, but while it is fairly easy to control with relatively inexpensive azoles such as tebuconazole and epoxiconazole, the wet-liking septoria is often difficult to eradicate.

“Yellow rust is everywhere, but septoria is out there and if we get showery weather, it will jump,” Mr Clark warns.

An azole-multisite approach might work at T1, but there are risks attached, and he advises a SDHI-azole-multisite at T1 and a higher dose of a similar mix at T2.

The T1 stage is when leaf three on the wheat plant is nearly fully emerged, and often occurs in late April into early May, while T2 is when the final – or flag – leaf is emerged and usually occurs in late May into early June.

With yellow rust around, Mr Clark advises not reducing the SDHI-azole mix below half dose, as the rust active element will be too reduced.

He suggests trying new chemistry, such as Revystar, at T2, but to cut the dose of this more expensive mix to match that of previously used products.

Popular SDHI-azole fungicide mix products

Adexar – SDHI fluxapyroxad (Xemium) plus azole epoxiconazole

Ascra - SDHIs bixafen and fluopyram + azole prothioconazole

Aviator – SDHI bixafen plus azole prothioconazole

Elatus Era – SDHI benzovindiflupyr (Solatenol) plus azole prothioconazole

Keystone - SDHI isopyrazam plus azole epoxiconazole

Revystar - SDHI fluxapyroxad + azole mefentrifluconazole (Revysol)

Scottish septoria

In Scotland, where there are a lot more early-drilled wheat, Fiona Burnett, professor of applied plant pathology at Scotland’s Rural College (SRUC), says the dry and sunny weather is reducing the disease threat, with septoria only found on the lower leaves.

She suggests only using an SDHI, which are at a high risk of resistance developing, where there is a lot of disease present (and especially eyespot). In a low-risk situation, an azole-chlorothalonil approach may be adequate.

“If there are any savings to be made, then T1 could be the time,” says Prof Burnett.

For the T2 flag leaf spray, where the most responsive yield effect can be seen, she suggests following the SDHI-azole approach, and as these sprays in Scotland are likely to come after the ban on chlorothalonil on 20 May, the multisite component is likely to be folpet.

She does suggest that at T2, chlorothalonil may have been “propping” up some of the older SDHI-azole mixes, and suggests growers keep doses high and use the most effective new chemistry.

Kent

In the milling wheat heartland of Kent, there is quite a lot of septoria on crops and despite the dry spring, some showers and wind - causing leaf rubbing - will aid the disease’s spread.

Chris Bean, technical director at agronomy group Zantra, is looking to manage the risk sensibly, carefully checking the danger from yellow and brown rust. Growers will struggle with brown rust if not controlled at T0 and T1, he says.

His T1 approach for his area of Kent and south Essex will be an SDHI-azole-chlorothalonil mix, varying the rate according to risk, with strobilurins added to help with rust control and nitrogen update.

“There are a lot of milling wheats down here and strobilurins have been shown to improve the uptake of nitrogen, which translates into protein,” he says.

His T2 strategy will follow a similar approach, focusing on rusts, as all milling varieties saw brown rust in trials last year, with Zyatt and Firefly showing high levels as well as the very susceptible Crusoe.

East Anglia

Yellow rust is the main disease concern in these eastern arable lands, although there is plenty of old septoria in wheat crops after a very wet winter.

Dick Neale, technical manager at agronomy group Hutchinsons, advises growers to look carefully at their crops and make sure they have a rust-active element in their T1 fungicide sprays.

He suggests an SDHI-azole or SDHI-strobilurin route, both with chlorothalonil added, and believes not using an SDHI can be a bit too risky at T1.

“If you do a sensible T1, when you come to T2, you do not have to spend all that much money,” he says.

His approach at T2 would be similar to T1, but growers could drop rates depending on the weather and might omit the chlorothalonil in very dry weather.

North Yorkshire/Durham

Septoria is always the key focus for Nigel Scott, with early-drilled wheat crops of more susceptible varieties, such as Barrel and Kerrin, at risk from the disease.

He says there is a place for SDHIs at T1, especially for their greening effect, helping with rooting and their nitrogen scavenging properties, as well as their fungicidal effect. However, more backward crops may just get an azole-chlorothalonil treatment.

Septoria pressure is lower this year, especially with late-drilled wheat crops in his area of North Yorkshire and Durham, but after such a mild winter and with unknown weather ahead, the risk of this disease is there.

“It will be a decision made on a field-by-field basis. With no rain for more than six weeks, we have to look at spending,” says Mr Scott, who works for agronomy group ProCam.

For T2, the advantages of using an SDHI are clearer, and last year's experience proved the point, as a dry spring prompted thoughts of cutting back before the heavens open in mid-May.

Northern Scotland

Long-term disease control is key in northern Scotland, where the wheat harvest stretches well into September and even October, so coping with septoria is vitally important.

Agronomist Alistair Gordon, who covers Morayshire through to the Black Isle and into Easter Ross, is  seeing septoria in the base of wheat crops. There is more disease on the variety Barrel compared with Skyscraper, which is generally clean.

Mr Gordon, who also works for advisory group ProCam, says his approach is based on using two SDHIs, as he says they help reduce plant stress on the region’s dry, light soils.

He plans to use the older SDHI isopyrazam, along with either of the azoles epoxiconazole or prothioconazole at T1, and then a SDHI-azole-strobilurin mix at T2. He hopes this three-way mix will help counter the absence of chlorothalonil at T2.

“The T3 spray is the important spray for us, as there can still be two to three months to harvest, so we need to protect the crop,” he says.

Herefordshire

Andrew Goodinson is seeing septoria on the lower leaves of wheat crops that were sown early in his area. Yellow rust is visible on later-drilled crops that went in just before Christmas, while those sown after Christmas are generally clean of disease.

For T1, the agronomist’s approach for "cleaner" varieties in terms of septoria, such as Firefly, will be a low-dose azole plus strobilurin and chlorothalonil approach. He will only look at an older SDHI mix product on the more disease-prone crops.

Strobilurins will help crops due to their physiological greening effect and give extra protection against yellow rust, which has been more prevalent this season, especially on Gleam and Skyscraper.

For T2, it will be an SDHI-azole-multisite approach, with chlorothalonil used before 20 May and folpet afterwards, says Mr Goodinson, who covers Herefordshire and the surrounding areas for agronomy group Hutchinsons.

“It’s all about managing the disease threat in often thin and open late-drilled wheat crops this season,” he says.

Dorset

In  the wetter climes of south-western England, agronomist Russell Dean sees the use of SDHIs at T1 and T2 as commonplace to counter the threat of septoria.

He is surprised about the large amount of the disease he is seeing, as growers in his area have switched to more resistant wheat varieties such as Siskin, Costello and Graham in recent years.

Mr Dean, who covers Dorset and Somerset for agronomy group Frontier, is following an SDHI policy at T1, while making sure there is a good rust active included, as he has seen yellow rust as far west as Bridgwater, near the Somerset coast.

For T2, SDHI use will be commonplace across all his crops, and he will be looking to use the new chemistry such as Revystar at this fungicide timing, which traditionally gives the biggest yield boost.

“With high grain prices, growers will see a higher rate of return for only a modest few pounds more for the new chemistry,” he says.

Winter wheat variety disease resistance scores in the AHDB Recommended List

Variety

Septoria

Yellow rust

Brown rust

Zyatt

6.4

7

6

Crusoe

6.2

9

3

Siskin

6.6

9

5

Firefly

7

9

6

Barrel

4.3

9

5

Kerrin

4.9

7

7

Costello

6.1

9

5

Graham

6.8

8

6

Gleam

6.3

7

6

Wheat varieties are assessed on a 1-9 scale for disease resistance in the AHDB Recommended List, where 1 is very susceptible and 9 shows good resistance

JOURNAL : Farmers Weekly

George Eustice is probably still wondering what hit him.

He barely had time to settle himself into the big corner office in Smith Square before the coronavirus crisis was upon him.

Thrust into the full media limelight as shops began to run low on food, any initial roadmap of how he wanted to spend his first months in the top job has been hastily scrapped.

See also: Find all our coronavirus content in one place

The long-awaited consultation on dairy contract reform, for example, was meant to have been published last month, having first been expected in 2018, but has again been kicked into the long grass.

Instead, he has been taking his turn at the Downing Street podium as part of the revolving cast of ministers at the daily coronavirus press conference.

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Back at the office, there has been policy making on the hoof that has helped supermarkets continue to keep shelves full and public concern abated.

The actions that he has taken, and not taken, are giving us an insight into what the current government approach may mean for farmers.

The bedrock of this is a classic Tory belief in the ability of the free market to balance supply and demand and solve problems, with government only intervening to keep the playing field level, rather than supporting the players.

This can be seen with the recent oversupply of milk caused by closure of most of the foodservice sector.

Competition law

The policy lever reached for first was a relaxation of competition law that, in theory, could help rebalance markets, but not to rush back to intervention buying where the state becomes the customer.

And, even though intervention purchasing and private storage aid for some commodities are now available, those are EU measures, not UK government ones.

Defra was also for some time insistent that farmers should use the Coronavirus Business Interruption Loan Scheme (CBILS), rather than receive bespoke support.

The problem there is that many would not pass the viability checks – even though the scheme requires these to be based on the pre-crisis fundamentals of a business.

This is the crux of the issue. Why, a free marketeer might ask, is it the job of government to prop up businesses that didn’t even have the faith of their banks before coronavirus happened?

Furthermore, it can be argued that CBILS, with a maximum loan duration of six years, is very costly for farmers who normally borrow over much longer periods.

Unions have also been quick to point out that coronavirus has pushed food security up the political agenda, and farms need to be helped now in order to maintain UK production after this is over.

Milk promotion campaign

In response, and after much foot dragging, Defra have announced that farmers in England who have seen income drop by 25% or more will be eligible for grants of up to £10,000 to compensate them for up to 70% of lost income.

The department, along with the AHDB and Dairy UK have also this week announced a jointly-funded £1m milk promotion campaign.

Farming unions have been quick to welcome the concession that the Secretary of State and his team won from the Treasury amid the many competing demands from other beleagured sectors of the economy, but it is concerning for affected farmers outside of England that it was not possible to achieve a UK-wide plan of action.

However, despite this sticking plaster the direction of travel remains clear. Direct payments are being phased out. Environmental payments will not fully compensate for the Basic Payments Scheme income forgone.

The era of EU-levels of interventionism is over.

While paying tribute to farmers as essential workers, the government is prepared to allow more of them to fail.

And farmers who may expect Mr Eustice, a former farmer himself, to deliver more on their behalf need to remember which way power flows in cabinet – from the top down.

JOURNAL : Farmers Weekly

Good things, it is said, come in threes and, in terms of government measures to help farmers weather the coronavirus storm, this week has been no exception.

For starters, Defra has finally agreed to give English farmers an extra month to complete their Basic Payment Scheme (BPS) applications without penalty, recognising the disruption the pandemic has caused to many farm businesses.

See also: Defra extends BPS deadline to 15 June

In this endeavour, Defra is joining the Welsh government – though administrations in Belfast and Edinburgh have not followed suit.

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Another positive is the Defra announcement that 75% bridging loans will be made available this month to those still waiting for their 2019 Countryside Stewardship money.

It is estimated that about half of 2019 claimants are yet to be paid, so the loans will provide some essential cashflow to a significant number of farmers and landowners.

The third piece of good news is the government’s announcement of a Bounce Back Loan scheme.

This will offer small and medium-sized businesses affected by coronavirus loans of up to £50,000, guaranteed by the government, with no fees or interest payable for the first 12 months.

It is expected that this scheme will be considerably more useful than the Coronavirus Business Interruption Loan scheme, promising as it does easier access and faster payment.

These three measures are certainly helpful. But, as ever, there is more the government can and should be doing to underpin domestic food production – not least in the dairy sector.

Yes, it recently relaxed some competition rules, enabling processors to co-operate more and so ease product flow to different market outlets.

But that is far short of what is needed at producer level. Many hundreds, indeed thousands, are facing reduced payments, delayed payments and, in some cases, no payment at all for milk they have been forced to discard.

Coronavirus is hitting the whole economy hard, farming included. And while farmers are finally winning some recognition for their role as “essential workers”, to continue producing food for the nation, they need certainty

An NFU-organised letter writing campaign has seen more than 2,200 letters sent to 400 MPs calling for urgent help.

In particular, the NFU is demanding targeted grants for affected farmers, market support measures such as private storage aid, and a government-run milk reduction scheme to better balance supply and demand.

All these ideas make good sense and are fully justified by the extraordinary circumstances the dairy sector now faces, though, as Farmers Weekly went to press on Wednesday (29 April), Defra secretary George Eustice seemed to be playing down the prospects.

But, as well as such short-term measures, the government needs to offer some medium-term reassurance, too.

The EU Commission has already said it will allow 70% advances of BPS payments in October rather than December, and 85% advances for agri-environment schemes. The UK authorities should make the same commitment.

And looking further ahead, Defra should delay its plans to start phasing out direct payments to farmers in 2021 by at least a year, to give the sector more time to prepare for the radical shake-up this will then trigger.

Delaying would also give the government more time to consider its priorities when it comes to food security and supply chain relationships in a world order that is now so fundamentally changed.

Coronavirus is hitting the whole economy hard, farming included. And while farmers are finally winning some recognition for their role as “essential workers”, to continue producing food for the nation, they need certainty.

Starting to slash BPS payments next year – which for many farmers is the entire profit for their business – can only serve to undermine their viability.

JOURNAL : Farmers Weekly

So, the ***Agriculture*** Bill has cleared its third and final reading in the House of Commons and now heads to the House of Lords for the next stage of its parliamentary passage.

The bill paves the way for the new-look ***agricultural*** support system for English farmers, based on a winding down of direct payments and a winding up of a “public money for public goods” approach.

See also: What the new ***Agriculture*** Bill contains for farmers

During the Commons debate on Wednesday (13 May), MPs taking part remotely considered several amendments, including those tabled by opposition MPs and those sympathetic to rural voters.

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The most high-profile of these were the ones surrounding trade in ***agricultural*** goods and the terms to be agreed in any future free-trade agreement (FTA) with the likes of the US.

These amendments – including one from Neil Parish MP and another from Labour leader Keir Starmer – sought to ensure that any future food imports only come from systems that meet our UK standards of animal welfare, plant health and environmental protection.

The ***Agriculture*** Bill is silent on this point, as the government view is that trade matters should be dealt with in the separate Trade Bill.

But pretty much the whole food and farming industry disagrees, and it has been a recurring theme that it is not acceptable for our farmers to have to compete with food imports produced using methods that would be illegal in this country.

Some encouragement was provided by international trade secretary Liz Truss. Writing exclusively for Farmers Weekly, she insisted that “as we leave the EU, we will maintain the same import standards – no UK import standards will be diminished as part of an FTA.

“We will never undermine our high standards on domestic environmental protection, animal welfare and food safety – ensuring that in any agreement, British farmers are always able to compete.”

This is undoubtedly helpful. But it does not provide protection from substandard imports outside of any FTA, and it counts for little until it is enshrined in legislation.

During the debate in the House of Commons on Wednesday, the government whips secured enough support to ensure that the Neil Parish and Keir Starmer amendments were heavily defeated.

Fortunately, this is far from the end game. The Lords still have to give the bill full scrutiny and are expected to be much more sympathetic to the various demands of the food and farming industry - including those not related to trade.

Yes, the new ***Agriculture*** Bill, relaunched in January, contained some improvements to the original – notably requiring a review of food security every five years, introducing a multi-annual budget and providing for emergency market intervention.

But much more needs to be done. The planned cuts to the Basic Payments Scheme should be delayed, food production should be included as a “public good” worthy of taxpayer support, and any aid should be targeted at active farmers.

More power should be given to the groceries code adjudicator to ensure a fairer supply chain, food security should be subject to specific targets and reviewed more frequently.

Above all, protection from below-standard food imports must be enshrined in legislation.

The current ***Agriculture*** Bill is too weak on all these points. It is therefore imperative that industry lobbying is sustained as the Lords debate it in the coming weeks and months.

JOURNAL : Farmers Weekly

In the previous Global Grain Insight, published in the middle of February, we concluded: "If coronavirus continues to spread, it could have a negative impact on the whole global economy."

While that sentiment has proved correct, none of us could have imagined the extent to which the virus has affected our everyday lives, as well as the markets and wider economy.

Markets at this time of year usually have their eye on the weather, with any hint of unfavourable conditions giving support to prices, but while the world is not without these, the crushing destruction of demand from coronavirus is all-pervasive.

See also: Rust control advice to achieve high-protein milling wheats

With a world in lockdown, little travel taking place, hospitality mothballed and minimal global trade, markets are at a standstill.

Without coronavirus, grain markets would be looking very different.

Much of western and central Europe has gone from being too wet to too dry, and although recent rains have helped to stabilise conditions, estimates still put EU wheat production down 12.5m tonnes from last year to 134m tonnes for 2020-21.

Influence of main price factors

Red: Factors putting downward pressure on prices – 45%

Accounts for 45% of current market influence. Demand destruction due to coronavirus is outweighing any current supply hitches in wheat, with availability of low-cost maize aggravating matters.

Amber: Watch this space – 40%

Short-term weather changes could inject volatility into markets. Continuing dry weather in key markets such as the EU, Brazil, Russia and the Ukraine might still unsettle things. But for any long-term effect, they’ll have to be sizeable.

Green: Factors exerting upward pressure on prices – 15%

Current weather issues are enough to keep prices from falling too much, but so far, they are not sufficient to outweigh coronavirus and initiate a sustained rally.

Drier-than-normal weather in the main corn-producing states of Brazil has affected yield potential, and this could drop further if these conditions persist. It is a similar picture for wheat in southern Russia and the Ukraine, where rain is also needed.

That said, Russia is expected to produce 77m tonnes of wheat this year, compared with 73.5m tonnes in 2019-20.

Australian production is expected to rebound from last season’s drought-hit wheat crop of just 15m tonnes to more like 24m tonnes, and US maize plantings are well ahead of average.

Demand for maize, particularly for ethanol, has fallen dramatically, however, and the abundance of cheap maize is adding pressure to all grain markets.

Further weather problems could inject additional volatility into markets, resulting in short-term selling opportunities. There is also encouragement to be taken from some countries seemingly getting a grip on the virus and lifting restrictions.

But for the foreseeable future, nothing short of a major weather event will lift the weight of coronavirus sitting on global markets. Until demand returns, upside potential for markets is limited.

UK prices dictated by global events

UK price prospects have for some time now been driven by global events, with the reduction in domestic wheat production already well known in the market.

Current estimates put UK wheat production for the coming harvest at about 10m tonnes – a substantial drop from the 16.2m tonnes last year. The effect of this, at least in part, is likely to be offset by record carry-over stocks approaching 3.5m tonnes from the current season.

It’s a different scenario for barley, with a record crop predicted. That, in turn, brings with it the need to find export markets and that could be more challenging than normal in these difficult times.

Spain, usually a sizeable destination for UK barley exports, has experienced considerably better weather than many other parts of Europe recently and looks set to produce bumper crops this year.

This could mean a large proportion of UK barley exports must find their way into third country markets, which could prove challenging due to the lower moisture contents required.

With the UK set to leave the EU at the end of December, we could also see a repeat of last season, with growing pressure to export barley ahead of this deadline.

This heavy domestic barley supply, plus the prospect of sizeable maize and wheat imports, mean it is difficult to see how UK wheat prices can rise without global prices going up too.

JOURNAL : Farmers Weekly

Farmers are taking an increasingly measured approach to their grassland and manure management, helping to cut costs and improve efficiencies.

A new survey carried out by the organisers of the Grassland & Muck Event – the third such survey since 2011 – has revealed that more farmers are analysing inputs and outputs, enabling them to better target management decisions.

See also: Why farmers will pay heavily for not reseeding grassland

***Nutrient*** testing

Based on 224 responses from around the UK, it seems more people are testing their soil, and doing so more regularly, with 68% testing it every five years or even more frequently, versus 62% in 2017 and 57% in 2011.

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More than a third of grassland farmers now dig soil pits to analyse soil structure, compared with a quarter in 2017, and they are applying lime more regularly, too, with 56% doing so at least every five years, compared with 49% in the last survey.

“When you look at individual responses, there is good understanding driving these decisions,” says Yara agronomist Philip Cosgrave.

“People may be aware of the acidifying effect that last winter’s high rainfall will have on pH and are basing applications on soil tests.”

More than three-quarters of respondents are also routinely spreading manure or slurry on grassland, and there has been a continued shift to more accurate testing of manure ***nutrient*** content: 18% used laboratory analysis against 14% in 2017 and just 9% in 2011. “That is good to see – there is huge variation in organic manures,” says Mr Cosgrave.

But there is still room for improvement. For example, 27% of those surveyed do not produce a manure or ***nutrient*** management plan – very similar to the figure found in the previous survey.

That said, farmers are increasingly turning to professionals to calculate crop ***nutrient*** requirements, with 54% now using agronomists to do this versus 43% in 2017 and 39% in 2011.

Fertiliser use

As a result of this more technical approach, farmers have further reduced fertiliser use; 32% of survey respondents said they were using less nitrogen fertiliser, while about a quarter had reduced phosphate and potash applications.

However, the percentage of farmers altering applications across the three ***nutrients*** was higher than in 2017, suggesting more targeted, reactive use over that period, perhaps in response to manure applications and crop needs.

In contrast, 40% of respondents increased sulphur uses. “Farmers are much more aware of sulphur requirements – it’s up there with NP&K now,” says Mr Cosgrave.

But there is still scope for greater efficiency, with 37% of farmers saying they do not check their sprayer calibration for each product used.

“Carrying out a tray test is a good way of double checking your spreader is working properly,” Mr Cosgrave advises. “There is a lot of wear and tear in spreaders, so you need to ensure the setting you’ve selected is working correctly, otherwise you will get an uneven application.”

Grass growth

But it is an improving picture when it comes to grass management, with 54% saying they measure their grass – mostly using a plate meter – up from just 30% in 2017.

And about 44% use a consultant or software to make grass management decisions, compared with 31% who don’t use any such tools.

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Reseeding levels have remained fairly steady over the past three years, with 79% reseeding leys every one to six years, usually in response to poor yield and weeds.

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Most respondents are tackling grass weeds in-house – only 35% are using contractors – and 45% use a selective herbicide, while 23% are opting for spot treatment.

And when it comes to silage, an increasing number either always use (22%) or have started using (9%) an inocculant to improve forage quality and consistency – both up on the 2017 survey results.

“It is clear to see that farmers are focusing on producing better quality silage and grazing to produce more milk or meat from grass,” says Mr Cosgrave.

“If you start measuring ***nutrients*** and how much grass you’re growing you can start making changes and see whether you’re making progress. It all feeds back to better environmental impacts and lower costs of production.”

Grassland & Muck survey

This survey was carried out by the organisers of Grassland & Muck, which was cancelled this year due to the coronavirus outbreak.

Event organiser Alice Bell speaking about the survey said: “It’s wonderful to have been able to gather this information over several years, giving a really strong snapshot of the direction in which the industry is moving.

“Although we sadly had to cancel this year’s event due to the Covid-19 outbreak, we thought it important to publish the results so farmers and their advisers can identify trends and opportunities for greater efficiencies.”

JOURNAL : Farmers Weekly

There is a whole host of very good winter oilseed rape varieties on the current AHDB Recommended List, with 13 new additions to consider for all areas and growing situations, as well as some interesting candidates coming through.

Picking them apart is more difficult this year, believes Colin Peters, Niab’s breakcrop specialist, who points out that all varieties in trials performed better where there was less flea beetle pressure.

“There were issues with both flea beetle and lack of moisture last autumn,” he says.

“As a result, we’ve seen geographical variability, as success with crop establishment depended on the timing of the flea beetle migration in the local area and whether that coincided with some rain.”

See also: How to use active fallows to repair soils on undrilled land

Looking ahead to 2020 plantings without new drilling date guidance – other than the need to use available moisture – Mr Peters recognises that growers have some big decisions to make in a particularly challenging time for producing oilseed rape.

Top variety picks from the proven performers

East and West

North

Conventional

Aspire

Ballad

Elevation

Barbados

Hybrid

Windozz

PT275

DK Exsteel

“There are different trains of thought on whether to go for cheaper seed and higher seed rates or expensive seed and lower seed rates,” he says.

“There are also the tried-and-tested varieties versus the new-kids-on-the-block decisions to wrestle with.”

Proven performers

Starting with the tried-and-tested varieties, he notes that some popular choices are no longer listed.

“A good example of that is Campus. There’s no doubt that some of these will still be widely grown, as everyone knows what to expect from them.”

Looking at proven conventionals that are still on the Recommended List, he highlights Aspire and Ballad for the East/West region and Elevation and Barbados for the North.

Likewise, proven hybrids and Windozz and PT275 for the East/West and DK Exsteel for the North get flagged up.

“These are all good solid varieties that have produced the goods on farm.”

Newcomers

However, there’s no avoiding that the main variety talking point for 2020 is newcomer Acacia.

A conventional variety from Limagrain, it has been given a UK-wide recommendation and tops the list with a gross output of 109%.

In the East/West region, it has a gross output of 110%, while in the North it is 108%.

“It’s a versatile variety that has done very well in trials,” notes Mr Peters.

Acacia is very stiff, a characteristic liked by growers, but its disease resistance scores of a 6 for light leaf spot and a 5 for stem canker aren’t the highest of the current variety selection on the list.

“Acacia does not have turnip yellows virus resistance, which sets it apart from last year’s top conventional Aspire, which is also from Limagrain.

“Whether that will make a difference or not remains to be seen.”

Mr Peters says that virus resistance is another weapon for growers.

“The issue this year is whether or not you can get it and the yield performance you are after at a price that you want to pay.”

Welcome additions

Just behind Acacia comes a strong selection of new UK-wide varieties all from Limagrain and all beginning with the letter A – Ambassador, Aurelia, Artemis and Aardvark.

“They’re all hybrids with turnip yellows virus resistance, except for Aardvark,” he continues.

“Ambassador and Artemis are taller types, but stiff, with good stem canker scores.

“Aurelia has the best disease profile on the list, with 8s for both light leaf spot and stem canker. It’s certainly caught the eye.”

Both Aurelia and Artemis also perform well in the North, where height and maturity can be more of an issue.

“All of these new varieties are interesting and have good oil contents.

“Getting another year under their belts will be helpful in terms of differentiating them,” says Mr Peters.

In the North, new conventional variety Blazen from KWS offers a gross output of 105%, putting it slightly ahead of the rest.

Other types

The best of the Clearfield types is PT279CL, with suitability for all regions, he believes, but NizzaCL has now been recommended for the East/West region.

Otherwise, clubroot-resistant Crocodile offers a gross output of 105% in the East/West, which is a progression.

“Crome is a better choice for the North on clubroot-infested soils, with a gross output of 103%, which is up there with the best.”

13 new additions to the AHDB Recommended List

Variety

Type

Recommendation

Acacia

Conventional

UK

Ambassador

Hybrid

UK

Aurelia

Hybrid

UK

Artemis

Hybrid

UK

Aardvark

Conventional

UK

Dazzler

Hybrid

East and West only

Darling

Hybrid

East and West only

Nizza CL

Hybrid

East and West only

Blazen

Conventional

North only

Specialist varieties

Crocodile

Hybrid

Clubroot resistant

Croozer

Hybrid

Clubroot resistant

PX131

Hybrid

Semi dwarf

Resort

Hybrid

High erucic acid

Winter OSR candidates

It is early days for the 12 candidate winter oilseed rape varieties that are in the Recommended List system, but there are a few that Colin Peters picks out as showing promise where the ***data*** is available.

DSV’s hybrid Voltage is looking strong this spring and has a gross output of 108% in the East/West.

With good standing ability, it also has turnip yelows virus resistance and is up for a UK-wide recommendation.

So is another hybrid, Hermione, from KWS. Although it doesn’t have the highest yields in East/West, it performs very well in the North.

Hermione is a very stiff variety with excellent stem canker resistance.

Two others that are in contention for the East/West region are Antigua from Limagrain and DK Expectation from Bayer CropScience.

“These are both looking very well. They’re hybrids with turnip yellows virus resistance and strong disease resistance packages.”

Cabbage stem flea beetle: Lessons from autumn 2019

Cabbage stem flea beetle is ruining what is an exciting time for oilseed rape breeding with no new regulated chemical control measures available for this year, confirms Colin Peters.

Screening work with biopesticides and beneficials is being carried out by many organisations, he reports, while monitoring of flea beetle movement into crops by Niab will start earlier this year.

This work is being co-ordinated by Aoife O’Driscoll, who is taking the lead in Niab work on the pest.

To date, the work has shown a clear role for white mustard as a companion crop, and future work will involve looking at seed rates and a further understanding of the ecology and lifecycle of the pest.

“What we do know for certain is that pyrethroids aren’t the answer – they won’t do the beneficials any favours.”

JOURNAL : Farmers Weekly

Harper Adams students took the trophy in this year’s Farmplanner competition, with a plan to secure the long-term term viability of Exton Park in Rutland.

The plan included a trial of soya as an alternative break crop to reduce the risk of growing oilseed rape. The team also suggested taking 150ha out of the combinable rotation by planting miscanthus.

Staff would be reduced to one working farm foreman, a general farm worker, a herdsman/general estate worker, and one seasonal harvest worker.

See also: Managing contract farming agreements in difficult seasons

However this would be phased in, with a trainee farm foreman being recruited a year before the current foreman is due to retire, allowing knowledge exchange and training.

The host farm – Exton Park, Oakham, Rutland

1,286ha in hand, managed by Harry Campden, whose family owns the estate

900ha of mainly grade 3 arable land

130ha pasture

85 suckler cows, calves sold at 10-11 months

260ha woodland

Five full-time staff

Grain marketing strategy was targeted for improvement, chiefly by making the best use of a new grain store under construction to time grain sales to better advantage, but also by potentially using futures and options. A move from feed to milling wheat was also recommended.

The plan included replacing the suckler herd with 200 red deer hinds for venison production – a growing market compared with the pressured beef market.

Harper’s recommendations for diversification included a burial barrow within the farm’s woodland, a café in redundant farm buildings to benefit from high use of footpaths on the estate, and a woodland adventure trail for children aged 5 to 12.

Exton challenges for student teams

Labour All the current staff are due to retire in the next five years. Their knowledge of the farm, its land and associated services will be lost, so what new labour system should be put in place?

Farming system With the coming change in labour and associated skills, what arable and livestock systems should be considered?

Redundant buildings A new grain store is being built, making the current store and yard within the village redundant. What development should be considered for the redundant yard and buildings?

Woodland This hosts a shoot but is not used for any other activity – what other diversification opportunities could be considered?

The overall plan was projected to generate a pre-tax profit of £380,000 before subsidy, allowing continued investment and a sustainable business for future generations.

Farm manager Harry Campden, whose family owns the estate, said: “There are good ideas in all of the reports, particularly on the diversification aspects.

“The teams had a real challenge in presenting these remotely from the judges and from each other, and they rose to that very well.

“It was a close call but the Harper entry stood out as the better one of the four. It was professionally presented and the barrow, café and woodland adventure trail are interesting complementary alternative enterprises.”

The other finalists were from Newcastle University, Riseholme College and Bishop Burton.

Mr Campden’s interest was also drawn by Bishop Burton’s plan for a special educational needs enterprise in collaboration with local schools.

The judging panel comprised Mr Campden; Emma Watson of consultant Gasson Associates; Tim Brigstocke of IAgrM; Ben Hatton and Victoria Giles of Farmplan; and Suzie Horne of Farmers Weekly.

Could you host the 2021 Farmplanner competition?

Farmplanner challenges teams from UK ***agricultural*** universities and colleges, usually attracting about 10 entries from which a shortlist of three or four is selected.

The Institute of ***Agricultural*** Management is looking for a family farm business for the 2021 competition, ideally with at least two significant enterprises, preferably arable and livestock.

This should be an enterprise that needs to make decisions about its future and which is willing to host teams of students to walk the farm and draw up competing business plans.

The host must be prepared to set some challenging questions, for example on business structure, enterprise mix, staff, family involvement and/or assessing potential for new ventures.

Student teams make an initial visit to the farm, all on the same day, and then have a couple of months in which to make a report, including recommendations to the farm owner in the same way that an independent consultant would.

The final judging usually takes place at the farm with each team presenting and being questioned on its recommendations.

JOURNAL : Farmers Weekly

Precision-guided hoeing is being put through its paces on a Hertfordshire farm in an effort to improve blackgrass control in winter wheat and minimise the need for a spring-applied herbicide.

A spend of up to £60/ha on post-emergence grassweed chemistry across 620ha of combinable cropping prompted Jo Franklin to look at alternative weed control methods, with the aim of reducing the use of herbicides that have little efficacy on resistant blackgrass.

See also: Why biopesticides will play a bigger role on arable farms

One of the first to use the Garford Robocrop Guided Hoe on narrow 12.5cm rows in a conventional farm setting, she admits that getting the 6m hoe set up right as it moves around the farm is proving to be a challenge in such a busy spring.

“Some of our autumn-drilled wheat is already as forward as it can be for the technique to work,” she told Farmers Weekly in late March.

“You have to be able to still see the row – once the crop is at canopy close, it’s too late.”

For this reason, winter wheat drilled by Baldock-based Kaiapoi Farming towards the end of January proved to be an easier test site, with the hoe working well.

“The crop was still small and weed numbers were low. In those fields, one pass with the hoe will take us right through to harvest.”

Soil moisture

Her plan is to use the implement where conditions are right, as soil moisture is critical to its success.

If it’s too wet, the hoe tends to pull up a clod with the weed still attached, rather than pulling the blackgrass plant out cleanly.

Spring barley

Having a seeder fitted to the guided hoe will allow Jo Franklin to try putting clover into her spring barley crop as she goes through it for weed control purposes.

Her intention is to travel as late as is possible with the hoe – up to growth stage 31-32 in the spring barley crop – as there is a narrow window for getting clover to establish successfully.

If it works, a clover understorey will then develop in the barley, so that the farm’s sheep can graze it after harvest.

“It was never my intention to hoe the whole farm and we will be sticking with our pre-emergence herbicide programme for the foreseeable future,” she reveals.

“Although it’s theoretically possible to use the hoe in the autumn, our plan is to go through October-drilled wheat in early March.”

A concerted, integrated effort for the past few years has seen blackgrass numbers fall across most of the farm, but in the worst patches there can still be 500 heads/sq m.

“We haven’t got post-emergence chemistry that works in the spring.

“Any blackgrass that gets left behind by the autumn programme is an issue.”

Early lessons

Early learnings with the hoe are that it needs patience and a real desire to get it right, she adds.

“Getting it set up correctly is really important. It has to be accurately aligned with the drill coulters and, once in operation, you must follow the exact direction of drilling.”

Operator attitude is essential, as is training, believes Ms Franklin.

“It hasn’t been all plain sailing, and the coronavirus lockdown restrictions have made it more painful. Next year will be different.”

As one of the Agri-EPI satellite farms, she received help with the initial purchase cost of the machine of about £50,000.

Each unit has to be made according to the farm’s row spacings, which is why they have been more widely used in crops planted with precision drills to date.

Her 6m hoe is using 4cm feet on 12.5cm rows.

Accuracy critical

Getting it to work in narrow row cereals is more challenging.

Cameras mounted to the hoe capture images of the crop ahead of the tool bar, with the position of the rows guiding the hoeing tools so that weeds can be removed.

For such accuracy, however, the tractor needs to be almost following the exact path of the drill, to enable the cameras to take out the final few millimetres.

“To get this accuracy, we teamed up with Trimble using a centre point RTK [real-time kinematic] signal and self-steering GFX 750 system to ensure pass to pass repeatability,” she says.

“We were able to record the drill passes and then, several months later, follow the exact same pass with the hoe with less than 2cm difference.”

Agri-EPI satellite farms

Agri-EPI was established by the government as part of its Agri-Tech strategy, to focus on precision ***agriculture*** and engineering.

The satellite farms are a network of commercial farming operations that act as a test bed for research and development, helping scientists and engineers with new ideas.

JOURNAL : Farmers Weekly

A Lancashire veg grower and machinery maker has managed to rack up an impressive 600,000 miles in his mid-noughties Toyota Land Cruiser, without it suffering any serious mechanical maladies.

Peter Gresty, from St Michaels on Wyre, Preston, specialises in growing early crop carrots and has a business producing and selling veg processing equipment.

This work takes him all over the UK, Ireland and Europe, meaning he quickly clocks up miles on a vehicle.

See also: High-hour Horsepower: Land Rover Discovery hits 540,000 miles

But rather than going to the expense of running new cars and changing them regularly, he’s opted to pile the miles on a vehicle with a proven track record for reliability.

His 2004 Toyota LC5 is one of three such 4x4s featured in Farmers Weekly’s machinery pages, all of which have breezed past the 400,000-mile mark without any significant spannering required.

However, with almost 600,000 miles on the clock, Mr Gresty’s truck is the farthest travelled by some margin. The current clock readout is 596,000 and if it weren’t for the coronavirus lockdown it would have been well over 600,000 miles by now.

Peter Gresty’s Land Cruiser LC5

E Year 2004

E Engine 3-litre, four-cylinder Toyota D4D

E Power 161hp

E Towing capacity 2.9t

E Transmission Five-speed automatic

E Suspension Front coils and rear air bags

E Price paid £21,000 in 2007

E Mileage when bought 28,000

E Mileage now 595,000

The truck was purchased from a Toyota dealer in Nottinghamshire in 2007 – when it was on just 28,000 miles – and it cost him £21,000. “At the time I thought that was a lot of money to spend on a 4x4, but clearly it was a pretty good investment,” says Mr Gresty.

Running costs have been minimal and for a 2t vehicle it is pretty light on fuel use, returning about 35mpg when driven considerately and 22mpg when towing.

It’s only rated to pull a 2.9t trailer, meaning it can’t compete with modern pickup trucks for out-and-out capacity. But the 3-litre four-cylinder diesel has ample power and it could easily pull more if it was rated to do so, he says.

Agritec International

Mr Gresty has worked in the veg business for more than 30 years and grows 40ha of his own early crop carrots, as well as sowing and managing 120ha for other farmers.

Ten years ago, he completed a Nuffield Scholarship that looked at veg production and processing around the world. He saw a market for farm-scale veg processing equipment that would allow farmers to add value to their crops.

This led him to set up a business building and selling machinery for peeling and packing potatoes and carrots. He trades under the name Agritec International and he sells machinery across the UK and Ireland, as well as some exports further afield.

Rear air suspension – standard fitment on the LC5 model – also makes the ride particularly smooth and stable when towing, and it pumps up to help keep the vehicle level.

The generous internal space is handy for carrying large numbers of passengers and cargo too. With all three rows of seats in place, it can accommodate eight people, but with the rear set removed and the central row folded flat, there’s a cavernous void for loading equipment.

“It’s amazing what we’ve been able to carry in there and we can even slot a pallet in with the forklift if we need to,” he says. “This is where the newer Land Cruisers (apart from the commercial-spec model) fall short, as the third row of fold-down seats ruins the carrying space.”

Keeping it running

For the first 60,000 miles, the Land Cruiser was under warranty and during that time it was serviced by Toyota. Just before this ran out, the injectors began playing up – a known fault – and these were replaced free of charge.

Since then, servicing has been carried out at Mr Gresty’s local garage every 10,000 miles. This is always a full service with a complete set of filters and a timing belt on every sixth visit – there are currently 60 stamps in the book.

Considering the car’s mileage, it has required amazingly few replacement parts.

Apart from the injectors, the only other unexpected repairs have been to the rear air suspension system. The first was one of the air bags which went pop when he was towing a loaded trailer, and the second was a new compressor after the original broke down.

“It’s in a pretty poor location on the underside and gets plastered in crud, so it’s no wonder it gave up the ghost,” says Mr Gresty.

Other replacement parts have been limited to the usual batteries, wheel bearings, and brake parts, plus a few alternators. However, the original unit must have been particularly good quality as it held out for 320,000 miles.

It’s still on its original starter motor, but this does work loose and requires a tighten every 80,000 to 100,000 miles.

Interior finishes have stood up well too, with the seats showing remarkably little sign of wear. The only casualty has been the leather on the steering wheel.

Rather than shell out a fortune for a new wheel from Toyota, Mr Gresty purchased a cover from eBay, which he stitched on by hand. “It was a bit of a fiddle and took me about three hours, but it was actually quite satisfying.”

He also saved a small fortune when the satnav/entertainment unit packed up. Toyota quoted £2,000 for a new one, but Mr Gresty took it to a local TV repairer who fixed it for just £150.

The only continual niggle is the air conditioning system, which he has now given up trying to mend. “We’ve tried all sorts over the years, but I’ve had to resort to using the windows and the sunroof.”

Having run several brands of tyre over the years, Mr Gresty has settled on Dunlop Grand Trek, which cost £500 for a set and consistently cover 90,000 miles. The truck’s full-time four-wheel drive system also means wear is fairly consistent between the front and rear.

Building up a fleet

The Land Cruiser’s reputation for reliability means prices for the LC3, LC4 and LC5 models built in the 2000s are now starting to climb.

To make sure he’s got a good supply of vehicles, Mr Gresty has invested in two more to take the pressure off his original truck. These are 2004 and 2007 models that are on 290,000 and 206,000 miles respectively.

Similar Land Cruisers with fewer than 200,000 miles on the clock tend to cost more than £5,000, with lower mileage examples running to over £10,000.

Discovery still going the distance

The arrival of Peter Gresty’s Land Cruiser in our high-mileage vehicle club has nudged Martyn Rainbow’s impressive Land Rover Discovery into second place.

Farmers Weekly featured the 1996 300TDI model in May 2018 when it was on 540,000 miles and we’re pleased to report that it’s still going strong, sitting on a current tally of 569,000 miles.

Since our visit, the only mechanical letdown has been the solenoid on the original starter motor – we’ll forgive it for that. Click here to read the full story on Mr Rainbow’s Discovery

I can beat that

If you own an off-road vehicle that can beat Mr Gresty’s 600,000-mile Land Cruiser we’d like to hear from you – just email [*oliver.mark@proagrica.com*](mailto:oliver.mark@proagrica.com) with a few details.

JOURNAL : Farmers Weekly

Colleges and universities around the country closed their doors as the UK went into lockdown.

This presented big challenges for students, who had to adjust to new ways of studying, faced a premature end to the academic year and found themselves having to cancel holiday jobs.

Though the Covid-19 crisis has brought practical and financial problems for young people, ***agricultural*** students are facing the situation pragmatically.

We hear from two about how they are staying positive.

See also: Coronavirus: How two dairy farmers are staying positive

Charlotte Lawder, Harper Adams University

Charlotte is keeping her fingers firmly crossed her sandwich-year job will happen as planned. The 22-year-old, who’s in the second year of an ***agriculture*** with animal science degree, still expects to start her placement with a nutrition company in early June.

“As of now, it’s still going ahead, but what exactly I’ll be doing might change depending on the movement restrictions, as my role would have involved a lot of travel between farms.”

Charlotte is living with her family in Shropshire, where she’s been busy preparing for open-book exams and completing assignments using online learning material.

Working-from-home challenges

“Working at home has its challenges, but I set myself targets and am quite self-motivated – as long as I have regular tea breaks,” she says.

“Our lecturers have been great and they’re always at the other end of an email to answer any questions.”

Inevitably, the Covid-19 crisis meant a premature end to the academic year, she explains.

“I was living in a student house and we’ve ended up emptying that and moving out, which felt really bizarre.

"It wasn’t a task we were expecting to have to do until early June, but we’re all now working on the principle that we won’t be going back for the summer term.

“The legendary summer ball has also been cancelled, which I’m gutted about. It’s one of the highlights of the Harper year, with everyone’s traditionally in great spirits, having finished exams.

“That said, I’m conscious I’m incredibly lucky compared to a lot of people right now.

“As well as having my health, I’ve got a garden, a field and a horse, so can spend time outside, unlike so many of those who live in towns and cities.”

Charlotte says technology is really proving its worth and is taking advantage of online ways of staying in touch, such as the Zoom and Houseparty.

“Not seeing friends in-person is rubbish and doing it online isn’t quite the same, but the interaction is nice and really important to keep everyone’s spirits up.”

Cancelled travel plans

Another disappointment for many young people has been that they’ve had to cancel travel plans.

“I took a year out before I went to uni and, as well as working on a couple of dairy farms to gain experience and earn some money, I spent some time in the US.

“The sheer scale of the ranches over there was unlike anything I’d seen. It gave me a different perspective and I learned a lot.

“I’m someone who likes to have a long-term plan and the current turmoil won’t derail my plans to pursue a career in the nutrition sector.

“I love being around livestock and nutrition is such an important job – it’s crucial to get it right for the welfare and performance of the livestock and for the viability of the farm business.”

Thomas Gregory, Sparsholt College

Thomas says he’s so busy that it feels like “business as usual” for much of the time, although watching the news can still be shocking. The 19-year-old is helping at his family’s Hampshire-based farming and contracting business, in tandem with focusing on college work in the evenings.

Studying remotely requires extra self-discipline, but the college has been brilliant and the lecturers are amazing, says Thomas. He hopes to begin an ***agriculture*** degree at Sparsholt this autumn, after completing the second year of his Level 3 ***agriculture*** qualification.

“That was the plan, but nobody knows what the situation will be then. It’s not impossible that we’ll still be in lockdown.

Taking precautions

“Everyone has adapted their behaviour in the current crisis. We don’t mix with a lot of people anyway – we feed the stock and spend a lot of time on our own in a tractor – but we’re making sure we’re taking precautions such as handwashing and social distancing.

“Not being able to see mates hasn’t been too tough because most of them are from farming backgrounds and it’s such a busy time of year now and right through the summer that it’s rare we’d get much time to meet up anyway. I do miss the occasional evening in the pub, though.

“It’s also hard not seeing my girlfriend, who’s a Sparsholt student, too, but we’re keeping in touch by text and Snapchat in the day and we FaceTime in the evenings.

"I haven’t seen her since the day we left college and I don’t know when I will be able to again. We all have to respect the rules, though, and that means not doing any non-essential travel.”

Unnecessary trips out

Thomas is concerned, however, that many people are still not listening to the government advice and are leaving their houses unnecessarily.

“I see a lot of walkers on footpaths – sometimes the same people passing three times a day and the route they’re taking means they’ll have had to have been out for more than an hour.

“I also worry about my nan, who’s in her 80s. She lives on the farm and I used to visit her all the time, which I’m obviously not doing now. We take her food, though, and leave it outside her door.

“We’re all just taking it a day at a time at the moment. In some ways, the contracting side of the business hasn’t changed, but cattle prices have been badly hit.

"I don’t understand why they’ve fallen so much – people still need to eat, after all.

“I’m quite an upbeat and cheerful person by nature and, as there is nothing we can do about the current situation, I try not to get too down about it.

"I’m fortunate – no one I know has been affected by the virus and my work means I can be outside, still able to enjoy the fresh air and have the sun on my face.”

JOURNAL : Farmers Weekly

Sheep farmers on Anglesey have cut antibiotics use during lambing by almost 60% over a two-year period.

By improving nutrition, hygiene, colostrum quality and management, a group of seven farmers reduced the number of animals treated with antibiotics without affecting production or welfare.

In the lambing periods from 2017-19, the farms reduced antibiotics by 59.8%, on average.

With veterinary and nutritional advice funded by European Innovation Partnership (EIP) Wales, the farmers demonstrated that a proactive approach can significantly reduce reliance on antibiotics at lambing.

See also: 4-step guide to reviewing antibiotics use on your farm

Feeding space

One of the farmers, Gareth Thomas, of Tregynrig, Cemaes Bay, said one of the simplest, but most effective, measures he put in place was to allow sufficient feeding space for ewes.

His ewes are fed ad-lib silage and receive concentrates twice a day, at 8am and 4pm.

He increased space allowances to 15cm a head when feeding ad-lib forage, and 45cm a ewe when feeding restricted concentrates. He achieved this by reducing the numbers at each trough from 50 to 40.

Protocols at lambing on the project farms

Pre-lambing pens were cleaned out, disinfected and limed between batches.

Water troughs were cleaned out regularly.

Lame ewes were treated promptly and managed separately, to avoid spread of infection.

Castration and tailing of lambs in the first week of life was avoided to minimise stress and wounds where joint ill bacteria could enter.

Everyone involved in lambing and handling sick lambs wore rubber gloves.

Stomach tubes were washed in warm, soapy water and disinfected in baby bottle solution.

Lambing pens for sick ewes or lambs and for ewes that had aborted were set up in a separate area, away from the main lambing pens.

Where cow colostrum was used, the quality was assessed using a refractometer and only colostrum at 22 immunoglobulin G or higher was fed to lambs.

Hygiene

Mr Thomas runs a flock of 650 Suffolk cross North Country Mule ewes, which he breeds to Charollais or Texel rams.

He disinfected the sheds twice when ewes were housed for lambing in January, with a two-week gap between groups to reduce E coli levels - singles were grouped separately from twins and triplets.

To aid the reduction in antibiotics use, bedding was analysed for bacteria that can cause mastitis, joint ill, scours and watery mouth.

“Bedding tests in the pre- and post-lambing pens are vitally important for us to know if we need to do anything to reduce E coli," explains Mr Thomas.

“By testing the bedding, we could act on the results by disinfecting and liming."

Mr Thomas says the EIP project taught him he needs to lime more around wet areas, such as troughs and feeding areas.

Nutrition

Good pre-lambing nutrition is another reason fewer antibiotics were used. For the project, silage quality was analysed for dry matter, protein, digestibility, metabolisable energy, minerals and fermentation.

At Tregynrig, in addition to ad-lib silage, ewes were fed a compound feed at 12.8 megajoules (MJ)/kg DM. This was introduced five weeks before lambing, up to a maximum of 0.9kg for triplets a week before lambing, 0.7kg for twins, and 0.3kg for singles.

Each farmer worked closely with independent sheep consultant Kate Phillips and with Karen Wheeler of Adas to formulate the correct ration.

Mr Thomas, who supplies fat lambs to Woodhead Bros in April and May, says the project has allowed him to lower his costs.

“I've saved at least £2-£3 a head by using vaccinations more accurately and targeting treatment, rather than using a blanket treatment approach," he says.

All the farms involved had achieved savings too, he adds.

“We did this without compromising animal health and welfare, as our ewes were in the best possible condition before starting lambing.

“We are now concentrating our spending on the places where it needs it most."

Sheep vet Kate Hovers, who advised the farmers, says the project demonstrates what can be achieved with good hygiene and nutrition, and simple management changes.

“Wide adoption of these approaches could have a dramatic effect on antibiotics use across the sheep industry," she adds.

About EIP Wales

EIP Wales, which is delivered by Menter a Busnes and Farming Connect, has received funding through the Rural Development Programme 2014-2020, which is funded by the European ***Agricultural*** Fund for Rural Development and the Welsh government.

It aims to take the outcomes from research – whether it is a new technique or technology – and test them at farm scale. There are currently 34 projects across Wales that bring like-minded people from different backgrounds together to try to solve common ***agricultural*** problems.

Lynfa Davies, who is Farming Connect's knowledge exchange manager and heads the EIP Wales programme, said the programme is on course to deliver the target 45 projects, so it is closed to new applications.

However, a number of other Farming Connect services and projects are available to support innovation and the introduction of new technologies, as well as investigating more efficient ways of working.

For more information on EIP Wales, please visit the Farming Connect website or contact: [*eipwales@menterabusnes.co.uk*](mailto:eipwales@menterabusnes.co.uk)

JOURNAL : Farmers Weekly

The Bazeley family run well-established self-storage and bottled beer businesses at Offwell Farm, near Fareham, Hampshire.

A tenant of Southwick Estate, Martin Bazeley started the storage business in 2003 and launched Suthwyck Ales in 2000, teaming up with a local brewery to make beer using malt from the farm’s own barley.

See also: Coronavirus news and advice

The coronavirus lockdown caused the loss of 95% of the pub trade for the beer business and the closure of its Victorian Steam Brewery retail shop.

Home deliveries help compensate

However, a home delivery service has been swiftly developed and this, together with increasing orders from independent shops, has roughly made up for the loss of the pub custom, says Mr Bazeley, whose sister, Jane, runs the office for the businesses.

Storage and beer – preparing for end of lockdown

Marketing course with the Self-Storage Association

Google Ad words evaluation and improvement

Increased Facebook marketing

Thinking ahead, planning for possible loss of storage customers

Using time to make sure storage offer is spick and span

Review of shop hours and how to maintain new business of home deliveries

Developing online offerings at Barn Store and Southwick Brewhouse websites

“One or two pubs have been brilliant at innovating, selling take-away containers of beer alongside fruit and veg and much more,” says Mr Bazeley

“The shop already had an online order and payment facility, so it was simply an update to add free delivery within 15 mile radius and a minimum order of £30, and we were away.”

Online sales went from a trickle to a healthy flow, boosted by additional marketing efforts, including Facebook posts.

Brewhouse manager Matt Hallett’s latest e-newsletter included a video and just a couple of hours after it went out, he took £1,062 of orders.

Business review

The enforced turnaround has brought a swift reappraisal of the business.

“It has just made us revise the whole thing. Maybe this is going to be the new way we trade,” says Mr Bazeley.

“Perhaps we will open the shop just on Friday and Saturday for beer sales and take care of home deliveries from Monday to Thursday.”

The business qualifies for small business rates relief and received a £10,000 grant from Winchester council. “This has helped us gear up to the new way of operating, so it has been a brilliant help,” he says.

Three business customers of the Barn Store self-storage operation have been badly affected by the lockdown and have been offered a 50% rent reduction for three months, with a review at that point, says Mr Bazeley.

“It’s important to have an end point. We prefer to help a customer who has been genuinely adversely affected to get through the worst and remain a happy customer, rather than lose a customer who may be hard to replace.

“It costs five times as much to acquire a new customer than to retain an existing one.”

Just three new customers have moved into the storage units since lockdown.

“We have been able to remain open, albeit discouraging casual or unnecessary visits. It’s mostly the business customers, one of whom is a supplier to the NHS, that still access their units.

“The flip side is, we are expecting some ‘pent-up' move-outs post lockdown – people who would have moved out naturally had it not been for the restrictions.

“We are examining our marketing to do what we can to replace these customers when they go.

“We’ve got to keep positive and keep going,” says Mr Bazeley. “We are channelling time into making sure the storage premises are looking top-notch.

“We all have to remember that however bad this is, it is temporary. When people are able to, they will be spending.”

Uncertainty causes wedding woes

Michael and Jenny Churches had a record 38 weddings booked for this year and many more coming in for 2021 and 2022 at their Glastonbury Wedding and Events business.

The ceremonies and receptions are held in a deconsecrated church right next door to Godney Farm, near Wells, Somerset, where they have a dairy herd, sucklers and sheep.

Wedding challenges

Uncertainty over likely physical distancing rule changes makes communication with couples difficult and planning almost impossible

Cashflow drop from weddings mean delay to investment on farm

Summer 2021 will be more of a management challenge as some weddings have been moved from 2020 and the calendar will be more crowded

After a two-year planning saga and much restoration work, the first wedding was hosted in 2015.

Providing a wedding venue is hard work at any time, with tensions rising as the big day draws near, and very bespoke arrangements are needed to accommodate different couples’ requirements.

“Since the announcement of the lockdown on 27 March, it has been awful,” says Mr Churches. The uncertainty makes planning impossible and things have been frustrating and, at times, fractious, he says.

“It was very stressful getting in touch with couples and having to tell them they were going to be limited on numbers before the government stopped weddings and events altogether.

“We have since managed to move 15 weddings that would have been taking place in April, May and June, and lost three couples that cancelled.

“We have even had to move our daughter's wedding. When the invitations have already gone out it, it is even more frustrating for us and for other couples, because of the uncertainty and having to judge how long you leave it before you tell your guests it will not be happening.”

Six weddings are pending, with couples waiting to see if the government limits numbers or stops them altogether.

“The only small consolation is the farm is still operating as normal as can be possible,” says Mr Churches. “But the price of the milk and beef is not that good either. It is all looking a bit grim.

“We are grateful for the couples that still have their weddings with us and we are rolling all the deposits on for a year.”

The shutdown time is being used to extend the car park and do maintenance such as creosoting fencing and planning for five glamping pods, pending planning permission being granted.

“We could really do with having them here now so we can get the services into them,” says Mr Churches.

“It’s all moving forward, but we just need the cash coming in – we’re not alone, but it’s going to be challenging.”

The farm funded the £167,000 spent on updating and converting the church, and while this is preferable to owing the bank, the farm must be paid back, as improvements are needed there too, says Mr Churches, who has applied for the £10,000 small business rates relief grant.

The Churches’ son, Andrew, has converted two Rice horse trailers (pictured above) into mobile event bars. One generally stays at the farm for functions in the church, while he takes the other one to events off farm. Both are being kept in the barn until lockdown rules ease.

FW Awards finalists

Jenny and Michael Churches were finalists in the diversification category of the 2019 Farmers Weekly Awards and hosted a Farmers Weekly diversification event in October 2019.

Lakeland venture adapts to forced change of plan for first full summer

Isaac and Kerrie Benson only opened their Lakeland Farm Visitor Centre in July 2019.

Lockdown has meant the closure of the centre and the café, just as the business was looking ahead to its first full summer season.

However, like many others, the Bensons are adapting.

Before the closure, footfall at the centre and in the shop and café was about 90% local, but also heavily weighted to older customers, who in general will have to isolate for the longest, says Mr Benson.

This makes the outlook for the recovery a long one. It’s never going to be business as usual for the next 18 months, while the older generation will have to shield, he points out.

“But I’m not complaining; things could have been a lot worse.”

Lakeland Farm Visitor Centre

Farm experience venue, café and farm shop, near Ings, Cumbria

Demonstration area based on an auction-ring setting for safe livestock handling

Dry stone walling demos and classes, alongside wool spinning and craft classes

Adapted to supply takeaway ready meals to help make up for loss of café income

Meat sales from own livestock has doubled in shutdown

Meat sales rise

While the café and the centre are closed, the use of the farm’s own lamb and beef has doubled, benefiting from the closure of the local town’s two butcher shops, which were heavily dependent on the hotel and restaurant trade.

The business has adapted to provide reasonably priced takeaway ready meals all day, on which no VAT is payable. Staff costs are also lower, so the margin is higher. Orders and payment are generally taken over the phone, and customers can pick up their meals in the car park.

Family labour

The four full time café staff have been furloughed and the business is relying on family labour, alongside the full-time butcher in the shop.

“We’ll miss the whole summer season,” says Mr Benson. “But as long as the furlough system is in place, the jobs will be there for the staff to come back to. But if that goes, they’ll be looking for a new job, and that’s the brutal reality of it.”

“We can’t expect to go into the winter with a full team unless there is some sort of help package and until our older customers have the security of a vaccine.”

The Bensons also have a holiday cottage, for which they received some local authority grant aid, but as the farm visitor centre is still in the process of being rated, they are unsure how much help will be available for this.

JOURNAL : Farmers Weekly

Feeding a 50:50 ration of grass and maize silages to pregnant ewes three weeks before lambing is improving their ability to produce milk.

Home-grown maize silage is fed to the 500 Mule ewes at Bryn Farm, near Cowbridge, when they are housed before lambing.

“The maize makes the ewes very milky,” says Owen Rees, who oversees the sheep enterprise and farms with his father, Ed, his uncle, Robert, and cousins, David and Tom.

Farm facts

384ha farmed, of which 243ha are owned

Lambs sold to Dunbia at a liveweight target of 40kg

Most lambs sold by the end of September

100 lambs retained as replacements

Aberdeen Angus cross Friesian and Hereford cross Friesian suckler herd, calving from April to June

Offspring sold at 26-28 months old at a target of 280-330kg deadweight. Angus cattle are sold to Scotbeef and the Herefords to Celtic Pride

Why did they switch to feeding maize?

The business is largely self-sufficient in feed, growing 10ha of maize and up to 16ha of spring and winter barley.

The maize had been grown as feed for the 120-cow suckler herd, and was introduced into the ewe diet two years ago when the family were seeking an alternative to energy blocks.

“We were using the energy blocks to balance the grass silage and hay the ewes were getting, but they were costing us about £25 each and we were getting through two pallets of them," Owen calculates.

See also: All you need to know about feeding sheep a total mixed ration

With limited feed space, the blocks were positioned in ring feeders in a yard adjoining the housing.

“The blocks were expensive. We never knew which ewes were taking them and we were getting a lot of cases of twin lamb disease," Tom recalls.

Their nutritionist suggested adding maize silage to the ration.

Minimising health risks

Owen admits he initially had reservations, because ewes are known to gorge on maize and become fat, putting them at risk of metabolic disorders in late pregnancy.

But by introducing maize silage into the ration just three weeks before lambing, the Reeses say the condition of ewes can be maintained.

“Although we were advised twin lamb disease could be an issue with feeding maize, we haven’t had a single case since we introduced it two years ago," Tom points out.

He adds: “If anything, the flock is doing better on maize because ewes are producing more milk and the lambs are born stronger.”

Expert advice on feeding maize to pregnant ewes

Below, independent sheep consultant Kate Phillips offers some advice on feeding maize to pregnant ewes.

1. Analyse grass and maize silage to establish if supplementary protein is needed.

E To develop an appropriate nutritional plan for pregnant ewes, it is important to know the feed value of the silage being offered.

E Maize has a lower crude protein content than grass silage, but it is generally high in energy, so is an ideal partner to high-protein grass silage.

E The high starch level in maize provides plenty of rumen-fermentable energy; this gives a synergistic effect with the high protein of grass silage.

E It is important the ewe’s protein and energy requirements are met so that colostrum and milk supplies are plentiful. Check the grass/maize silage intake is meeting the ewes needs by assessing silage dry matter intake and comparing it to the standard energy and metabolisable protein needs as ewes approach lambing.

E Supplements may be needed to provide additional protein, but the level depends on the forage analysis. Rapeseed meal, beans and soya bean meal are all possible supplements.

2. Condition score ewes

E It is very easy to overfeed single-bearing ewes, so care should be taken to check ewe body condition and feed ewes according to body condition score and litter size.

E In late pregnancy, ewes on maize can become fat and prone to metabolic disorders, such as twin-lamb disease, so when condition scoring, feel for backfat rather than visually scoring ewes.

For advice on feed rates see p4 of the Improving ewe nutrition PDF.

3. Allow sufficient feed barrier space

E Allow a minimum 15cm of feed space a ewe when feeding a total mixed ration to avoid cramming, which increases stress and may lead to abortion in extreme conditions.

4. Don’t overlook minerals

E Maize has lower mineral and vitamin concentrations.

E Provide additional minerals – particularly calcium and trace elements.

The feeding process

The system at Bryn Farm is simple: a bucket of fresh maize is deposited in the central passage once a day and forked into the silage.

“There is no science behind it, but it is roughly 50:50 grass silage and maize silage," says Owen.

The feed is pushed up with a fork about three times a day.

In 2019, the maize analysed at 33% dry matter (DM) and 11 megajoules (MJ) of metabolisable energy (ME)/kg DM . The grass silage analysed at 32% DM, 15.9% crude protein, 11MJ ME/kg DM  and had a D-value of 69.

The Rees family give no supplementary feed. Instead, the aim is to produce lamb as cheaply as possible while maintaining ewe performance.

“Margins are very tight, and we are trying to keep costs low by making more use of home-grown feeds,’’ says Tom.

“Some of the ewes get a bit of barley when they are at grass, if they are a bit lean.’’

Ewes are typically at grass until they are housed three weeks before lambing, depending on the weather. Grass intakes are supplemented with baled silage and hay fed from a ring feeder.

Practical considerations

Maize can easily be incorporated in the diet because the Reeses grow a large acreage as feed for their beef herd – the 2019 harvest yielded 49t/ha, with about 50t fed to the sheep.

Although it has been straightforward to add maize to the ewe diet at Bryn Farm, Owen admits it can be impractical to grow maize in some sheep systems.

“If we needed maize just for our sheep, we would only need to grow 2.5 acres [1ha], and at that level we wouldn’t do it, because it would need to be harvested and clamped,” he says.

Another option for sheep farmers is to buy maize from a local grower, he suggests, although keeping it fresh could be a challenge if it is delivered in large quantities.

Owen admits it is not always easy to get the feeding of ewes right, but with maize silage, he says, he has found a system that works for him.

“Some farmers can overcomplicate their systems, adding to their costs, but we keep everything as simple as possible, to keep our costs to a minimum,” he says.

JOURNAL : Farmers Weekly

Buying “waste” dairy bull calves and finishing them on low-cost feed and crop waste is helping to keep feed costs low while improving arable ground.

Each year, Will King buys 1,000 dairy bull calves and dairy cross beef calves from the three main commercial dairy herds in Essex.

After rearing, they move on to a low-cost ration that uses unsaleable crops from the arable business and bought-in feed waste. This helps maximise potential margins.

See also: Target daily liveweight gains to cut beef finishing times

“I’m buying a low-cost animal that no one has tried to get a profit from before me,” explains Mr King.

“We’re feeding them waste products – while still providing a quality diet – and homegrown feed such as potatoes and homegrown fodder beet this year. My physical capital outlay is minimal.”

With Arla among a growing number of milk processors moving to stop the slaughter of dairy bull calves under eight weeks old, Mr King’s model could prove useful to dairy farmers looking for an outlet for calves.

Farm facts

Old Oaks Farm, Little Bentley, Essex.

Will King farms in partnership with parents, Brian and Judy (WL King & Son).

162ha at Old Oaks Farm, including 121ha of arable.

Will King is also part of Wix Farms, a co-operative farming arrangement with two neighbouring arable farmers. This business farms 810ha.

Grows winter wheat, winter barley, spring peas, potatoes, onions and maize and grass leys for cattle. Fodder beet also grown this year.

Grass and maize for cattle are bought at cost rate from Wix Farms by WL King & Son.

Construction business: K&J Construction – fabricates and manufactures steel-framed ***agricultural*** buildings.

This could be particularly attractive to arable farms looking to address diminishing soil fertility by reintroducing stock.

“Big arable farms are turning to AD plants and they’re feeding the concrete cow,” says Mr King.

“What’s the point when you can feed the real thing, get the muck back and produce a product the market wants?”

Sourcing calves

The value of mixed farming has long been recognised by the King family, who traditionally ran pigs and cattle alongside the arable.

The decision to source dairy-bred calves locally came about seven years ago when Mr King began to experience health challenges in bought-in cattle.

“We started buying from a dealer in Cheshire, but we were starting to get TB problems and pneumonia as they were coming from so many farms,” explains Mr King.

As a result, he instigated discussions with three Essex producers to see if he could source stock directly.

This would minimise any disease risk as they would be coming from herds of known health status on a four-yearly testing regime.

He now buys from three dairy farms and takes every beef calf they produce. Mr King works closely with the dairy farms to discuss requirements.

Good colostrum management is expected. Calves are also vaccinated for infectious bovine rhinotracheitis (IBR) and all herds are monitoring for bovine viral diarrhoea (BVD).

To maintain relationships, and encourage calf quality, on average, producers are paid slightly above market price, with Mr King aiming to take out the peaks and troughs of the market.

Rearing process

Mr King buys the calves from one week of age. They are then picked up from the dairy farms by contract calf rearer, Daryl King, who feeds calf milk replacer twice daily before weaning them at eight weeks of age.

At 14 weeks, they move to Will King’s farm, where they are housed year-round. Bulls are castrated. Will King believes diet consistency is essential to prevent dips in growth rates. With that in mind, he continues to feed the same pre-weaning pellet up to six months old.

He also avoids making any changes to the total mixed ration (TMR). The current TMR includes grass and maize silage, brewers grains, waste bread, homegrown fodder beet and some feed-grade urea. Sometimes, potatoes may be used instead of fodder beet.

Onions may also be fed to younger animals, but they must not be fed three months before slaughter to avoid meat taint. Some wheat or barley bran may be bought in, but the aim is to avoid concentrate feeding.

The proportions in the ration will be altered to deliver a 14% crude protein diet until 11 months of age, when this reduces slightly to a 13% grower/finisher ration.

The aim is to make the most of the better feed conversion efficiency in younger animals and finish them by 18 months old. Mr King believes keeping them any longer just encourages frame growth and adds to overhead costs, which reduces margins.

Half of the beef animals are finished and sold to Dunbia. These typically achieve 320kg deadweight at 18 months old at O- or O+3. The rest sold as stores. On average, cattle are hitting growth rates of 1.2kg/day from arrival to slaughter.

He explains: “Others will get better growths than me. I’m not getting the fastest growth, but I’m doing it economically.

“The margins in beef are very tight and you have to be careful with your overhead costs; they can easily spiral.”

Resilience

With the recent crash in beef prices, Mr King says all farmers will struggle to make money. However, he feels his low-cost model puts him in a better position than some.

“At the current price of £2.91/kg, any profit is very marginal. However, I feel we are in as good a position as we can be to weather the forthcoming storm,” he says.

He believes his model also proves there is a market for dairy-bred beef, particularly considering the demand for smaller cuts and processed beef – something that has increased in light of coronavirus.

Mixed farming benefits

Grass and maize provide a breakcrop for blackgrass.

Grass leys may be planted after barley to provide a cover crop over winter before maize drilling – this helps soil fertility and prevents winter run-off.

Maize can be put on ground not suitable for onions or potatoes.

Muck from cattle goes back on arable land to help fertility.

Leftover wheat may be ground for cattle. Stock feed potatoes are also fed to stock – converting waste into a valuable product.

JOURNAL : Farmers Weekly

Money-back schemes designed to compensate growers for some of the economic risk associated with failed oilseed rape establishment are being offered on seed purchases of selected varieties again this year.

After pilot initiatives in 2019, most breeders have launched risk-sharing or establishment guarantee schemes for 2020 drillings, with funding either coming direct from the breeder or through the existing Bipo model royalty system.

As such, it means OSR crops that are drilled but then fail to establish by a certain date – usually late October/early November - will be eligible for an agreed rebate of about £30/ha.

See also: Guide to which OSR varieties to drill in summer 2020

However, only named varieties nominated by the different breeders are covered and growers will be expected to submit evidence of crop failure in order to receive the money.

Crop support

The finer details of the various schemes may vary, but the intent is the same and reflects the industry’s willingness to support the crop at such a critical time, says James Barlow, head of seed at ADM ***Agriculture***.

“After two very tough years for oilseed rape establishment, there is recognition that growers are under pressure with the crop and reluctant to expose their businesses to more risk.

“These initiatives, which apply when the crop is still in the danger zone, can be a useful part of a risk-management strategy. There’s no extra cost associated with them, so there is no downside for growers.”

Where oilseed rape is to remain in the rotation, Mr Barlow recognises that farm-saved seed can seem attractive if establishment problems have been encountered previously and growers are looking for up-front savings.

“Remember that you won’t get useful traits such as turnip yellows virus resistance if you home-save. If you want top-line genetics and all the advantages they can bring, then you do need to go down the hybrid route and buy new seed,” he stresses.

Uptake in 2019

Last year, RAGT saw about 900ha of the crop sold through the company’s royalty payment scheme.

Of that, growers claimed on about 40% of the area, reflecting the tricky combination of high flea beetle pressure and lack of soil moisture at the critical establishment stage.

Tom Dummett, cereal and OSR product manager at RAGT, expects greater engagement with the company’s scheme this year and predicts 6,000ha of rape will be covered by it.

“It’s a very straightforward process to sign up – it takes two minutes and can be done online,” he says. “The system is based on the existing Bipo model, and it means we are sharing the risk with growers – our royalty income is affected if crops don’t establish.”

Just two RAGT varieties are included – the company’s new Clearfield variety, Nizza CL, and a French-bred hybrid variety, Azurite, which is not going through the Recommended List system.

“We want to encourage farmers to grow oilseed rape, so we’ve chosen varieties that have the vigour required for good establishment.”

Risk mitigation

Not all of the breeders are taking part; Limagrain has no current plans to offer an oilseed rape establishment guarantee.

With a very strong oilseed rape portfolio, including the top-yielding conventional and hybrid varieties, the company believes it has built-in risk mitigation.

“The conventional varieties have a lower seed cost and the hybrids are packed with traits,” says Will Charlton of Limagrain. “We think the genetics speak for themselves.”

What schemes are on offer for 2020/21?

RAGT

RAGT is putting its weight behind an oilseed rape royalty payment scheme, which means growers will save about one-third of their overall seed costs, or £30/ha, where crops fail.

Growers declare the area of oilseed rape established by 1 November and pay the royalty due. Failed areas are exempt - so there will be no royalties paid if crops don’t make it.

To be eligible, growers must have a signed royalty area ***collection*** agreement with an RAC number and have to declare the crop area established by 1 November.

Two RAGT varieties are in the scheme - Clearfield variety RGT Nizza CL and hybrid RGT Azurite.

BASF

BASF is backing all of its InVigor winter oilseed rape varieties with a seed risk-sharing scheme that will also pay growers £30/ha for crops that don’t establish.

Providing drilling takes place before 22 September and crops have failed by 31 October 2020, payment will be triggered.

All purchasers of InVigor seed will be automatically registered onto the programme, following a successful launch last autumn.

Bayer

Bayer has introduced an enhanced establishment scheme that will compensate growers by £100/bag or about £33/ha for any crops of more than 6ha of certain Dekalb hybrids that are lost by 31 October.

Three of its hybrid varieties are eligible – DK Exstar, DK Extremus and DK Excited. To take advantage of the scheme, growers need to purchase their seed through one of Dekalb’s participating distributors and register on the brand’s website.

Validated claims for crops drilled before 20 September that failed to establish by the end of October will be issued with credit notes by 20 November.

KWS

KWS has extended its Oilseed Establishment Partnership, which it introduced last year following concerns about the establishment of oilseed rape crops.

Growers will be expected to pay about 50% of the seed costs upfront, with the rest waived if the crop does not establish. Two conventional varieties are covered by the scheme – Blazen and Codex – with crops that have failed by 1 November being eligible.

The compensation amounts to £25-£28/ha, as the seed costs £115-£120 for packs with 4m seeds.

DSV

In a different approach to establishment risk, DSV will be supplying three of its triple-layer hybrid varieties – Duplo, Darling and Dazzler – in a larger seed bag, at no extra cost to the grower.

In practice, it means growers will be getting 20% more seed than before, with the bag now containing 1.8m seeds rather than 1.5m seeds. The company calculates the move is worth £50/bag.

HOLL varieties

Seed of two high-oleic, low-linolenic acid (Holl) varieties, V316OL and V367OL, will be replaced for free if the crop has failed by 15 September. To be eligible, the replacement seed has to be redrilled in the same year, highlights United Oilseeds.

Grower reaction

In Dorset, Tim Hall is halving his OSR area and does not plan to buy in any seed, so guarantee schemes aren’t relevant this year. He also wants the best varieties for his farm and system, rather than have them dictated to him.

The current OSR YEN winner, Richard Budd, in Kent, will be sticking to his tried-and-tested approach of using home-saved seed, drilled late at a high seed rate. This approach does not suit hybrids, he points out, as the seed cost would be prohibitive.

Andrew Wells, agronomist and farmer in Nottinghamshire, says he is very unlikely to grow oilseed rape this autumn, no matter what seed deal is available. He believes a co-ordinated regional break from the crop for more than one year is needed, to reduce the pest load.

In Staffordshire, farm manager Tim Parton intends to continue with his successful oilseed rape production and would take up the right money-back offer, just as he did last year. However, a planned move towards conventional varieties may limit his chance of benefiting from such schemes.

JOURNAL : Farmers Weekly

Genetics and a programme of tailored nutrition have helped two Herefordshire farmers successfully lift the laying cycle of their flock of free-range hens beyond the UK’s 72-week average.

As long as everything is working well, 100 weeks is definitely achievable, believes Nick Panniers, who farms with his father, Allan.

“The back end of the cycle is where you get the most profit; that is when you make the money to cover the cost of the pullets," he says.

See also: 4 key poultry management factors influencing egg size

The Panniers produce eggs from 64,000 Dekalb Whites at Wellington Farm, Bishops Frome, switching from brown layers in 2018 in response to a new supply contract.

Their existing packer, Stonegate, had asked the business to supply white eggs for Waitrose's essential free-range brand.

In response, they sourced white birds from Hendrix Genetics.

After visiting farms stocked with Dekalb Whites in Holland, they were confident the breed would last longer in their system than the typical 74-week cycle they had with Brown Lohmanns, although they did have initial concerns that the Dutch systems are mostly barn, while theirs is free range.

“That was a big point of difference to consider but we discovered that white birds perform extremely well in free-range," Nick says.

He initially set a depopulation target of 90 weeks, but increased that to 100 weeks to supply the Christmas market.

“As the hens were laying well we agreed to keep going and did so with very few issues," says Nick.

Their rate of seconds did increase to 12% at week 85, but this was due to an infectious bronchitis challenge.

“That knocked them a bit, so without that we think we can improve on our seconds rate this year,’’ says Nick.

He admits the practicalities around when to depopulate are a consideration.

“This year, if we deplete at 100 weeks it will fall in August when we are busy with the harvest, which doesn’t suit us very well, so perhaps we will need to deplete a bit earlier to balance the work out a bit.’’

The challenges of longer lay

One of the challenges of keeping flocks for longer is maintaining consistent performance. Nick says the system is set up to take pressure off the birds.

“We have to make sure that everyone involved is singing from the same hymn sheet. The routine is very important, we always pack at the same time, feed at the same time."

Four ways Wellington Farm  increased depletion age and maintained productivity

1. Genetics and vaccination

Through selection and breeding programmes there are now efficient laying hens with greater persistence of lay, alongside acceptable egg quality and egg numbers.

The Panniers pay about 5% more for white birds, but say this cost is balanced by the breed’s hardiness and longevity.

Their pullets are comprehensively vaccinated for Newcastle disease, Marek’s disease, egg drop syndrome, salmonella, infectious bronchitis, and also for E coli due to a challenge on the farm.

2. Nutrition

Helping the bird preserve good eggshell quality for a longer laying period requires specifically tailored nutrition.

The flock is run on a four-stage diet, with a high but consistent energy structure across all the rations to lower consumption and minimise stress on the birds when they are introduced to a new ration.

The farm’s nutritionist, Tom Lander of Lloyds Animal Feeds, devised the feeding programme. He says taking birds to 100 weeks is “a marathon, not a sprint".

“Really large, early egg size will render the 100 week programme unviable," he warns.

The strategy for feeding is as follows:

Start of lay ration

This is 18% protein to help birds recover from the stress of transit and to build bodyweight as they come into lay.

5% lay to peak ration

Crude protein level reduces to 17%, but fibre levels increase slightly to 5% and calcium to 3.75%.

Mr Lander says fibre content is designed to help slow digestion so that faecal matter is drier.

“Layers coming into lay very quickly can become stressed easily and their faecal matter can become quite loose," he says.

The extra calcium is important as the birds’ rate of lay increases.

“We give the bird every opportunity to absorb the right amount of calcium to reduce second quality eggs," says Mr Lander.

Post-peak ration

Once birds have maintained peak production for several weeks and egg quality and size are appropriate, the amino acid profile is slightly reduced, for methionine and lysine in particular, to prevent eggs getting too large very quickly.

This diet is 5.5% fibre, combining digestible and non-digestible elements, with supplementary dried lucerne bales used in the housing.

Home-grown oats are milled on farm and included at 5% post-35 weeks, increasing to a maximum of 8% later in lay.

Oyster shell and limestone content is increased every 10 weeks to reduce calcium exhaustion in the medullary bone and aid its transfer to the digestive tract.

Post 75-80 weeks

Eggs start to reduce in quality but increase in size, putting pressure on the bird.

To manage this, this diet is lower in lysine and methionine while, at 4.5%, the maximum level of calcium that can be usefully absorbed and digested by the birds is included.

Crude protein is 15.5% and fibre 6%

Regular analysis of home-grown feeds

At 12-week intervals, wheat is tested against target specification requirements

Finished feed analysis is also scrutinised to ensure it is at the correct specification

This policy pays off, says Mr Lander. “We had some wheat samples where protein was a little higher than what we expected so we addressed the balancer to take account of that result."

This made sure that they were not over-supplying the bird with crude protein and the amino acid profile stayed in line with target levels.

3. Management

The birds are flighty when they arrive, which can make weighing and stock management a challenge. But the Panniers and their stockmen, Gary Morgan and Jackie Dorrington, overcome this by weighing before the lights come on.

White birds pick up both good and bad habits in no time, says Nick.

“They quickly learn to go up into the system at night and into the nest boxes but they will also learn to lay floor eggs, so you have to be on the ball."

The early morning routine is consistent with birds walked every morning, at the same time, to check for feed, water and any changes to behaviour. Birds are not disturbed in the afternoon.

Dimmer lighting regimes help control egg size and quality at end of lay. “We run the sheds a bit darker to keep the birds calmer," says Nick.

4. Water quality

Water is tested every 12 weeks. If it is high in bacteria, with a total viable count (TVC) exceeding 100, an acid is applied and flushed through the drinker line. However they consider anything over 50TVC to be undesirable.

Water is particle and UV-filtered for each house to help reduce the TVCs further. “This maintains a low TVC on the farm, this solves a big part of the production puzzle," says Mr Lander.

JOURNAL : Farmers Weekly

Jim and Julia Beary have transformed an upland farm by doubling stocking rates and cutting 30% off prime lamb cost of production since moving to Yorkshire.

Rotational grazing, hard work and a helpful landlord, who contributed to the cost of improving water infrastructure, have made the gains possible.

Now farming a total of 250ha of grassland, ex-Farmer Focus writer Mr Beary has fulfilled his dream of farming full-time after several years of balancing farmwork with off-farm income, which still comes in from Mrs Beary’s part-time nursing.

See also: How beef herd is delivering £350/cow net profit with deferred, mob grazing

Now based near Sheffield, the Bearys moved to their current second tenanted farm – on a 10-year farm business tenancy – at the 140ha Ughill Hall Farm, Bradfield, in 2017.

Glen Farm: getting started

The first big step for the Bearys came in 2012 when Mr Beary took on his first farm, Glen Farm near Aston, in 2012 – an 34ha county council farm.

Mr Beary contract reared 900 dairy-cross calves a year and developed a flock of Aberfield cross New Zealand Romneys.

He also contract gritted through the winter.

Farm facts

Beary Farming

800 Aberfield cross Romney, Cheviot and Highlander ewes and 200 breeding ewe lambs

Lambs sold to Kepak on Tesco cost of production contract

Growing 100 dairy-cross steers a year on Dovecote Park contract for Waitrose

3,750 pigs grown for BQP a year on Freedom Foods system

Average rainfall of 1200mm/year

Land rising to 365m

250ha in total

140ha at Ughill Hall, 60ha at Dronfield and 50ha of grazing/cropping

Ughill Hall: chance of a bigger farm

In 2017, the Bearys applied for a larger tenancy at Ughill Hall after a friend had seen it advertised. Equipment and 600 sheep were moved from Staffordshire to South Yorkshire.

“The farm was in good order, but it was set up for set stocking,” explains Mr Beary.

“There were only four gates on the whole farm and two water troughs.”

The Bearys borrowed money to fence the farm and increase flock numbers, buying 200 one-to-three-year-old Cheviots from South Wales in 2018. Contract growing arrangements on batches of cattle and pigs were added last year to further dilute fixed costs across more output.

Previously, sheds were only required in the spring to lamb ewe lambs and some triplets, but the arrival of 900 pigs means sheds are used most of the year.

Weaned pigs arrive at 7kg and are grown to 50kg on loose-housed straw as part of the Better Quality Pigs (BQP) supply chain on a bed-and-breakfast contract. Dairy-cross cattle continue to be reared for Dovecote Park.

Cattle now arrive at about 150kg as strong weaned calves from Waitrose dairy farms and are targeted to gain 0.8kg/day over 12-14 months, taking them up to 450kg.

Apart from being built up from 1.5kg to 2.5kg a head a day of a 16CP grower pellet when housed for winter, the cattle just get silage and grazed grass until being sold to a finisher farm.

The mixture of enterprises helps with cashflow and the pigs and cattle produce P and K for the land. The cattle also help control parasites for the sheep.

Investments

A fencing overhaul at Ughill Hall has so far seen £15,000 spent on electric, semi-permanent and permanent fencing. Initially Mr Beary started by simply halving the biggest fields for grazing and then enlisted consultants Precision Grazing to map out paddocks.

Subsequent subdivision left 40-50 paddocks and required £20,000-worth of infrastructure, which was covered partly by the landlord.

Mr Beary opted for a 45,000-litre Agrismart bladder tank – enough for all stock for five days. Liming one-third of the farm has increased pH levels from an average of 5.5 to 6.

Mr Beary calculates a 30% return on investment on lime, fencing and water infrastructure.

Rotational grazing on 2.5ha paddocks has improved swards. Seeds have been stitched in to diversify species – only 20ha of reseeding has taken place after winter forage swedes (plantain, Aber grasses and clover). Nitrogen use has fallen from 70-80kg/ha on the lambing paddocks to just 25kg/ha.

“Letting the sheep graze and stitching in deeper-rooting varieties such as chicory, timothy, cocksfoot, plantain and clovers has helped soil health, helped clover return and cut nitrogen use.”

Progress

Stocking rates have lifted from 90 livestock units (LSUs) to 200, not accounting for 900 housed pigs. Grass use has also lifted. The farm grew 6t/ha DM of grass last year and used 80%, compared to growing 4t/ha DM and using 50%.

This has allowed Mr Beary to run the sheep without hard feed, which, hand-in-hand with a growing flock, has seen cost of production drop by £2/kg.

Future

Another 100 calves are arriving this spring, which will mean stocking rates will peak at a total of 200 cattle on the farm for four months until the previous year’s cattle are sold.

The farm expanded last year when the Bearys took on a 60ha ex-dairy farm 14 miles away, near Dronfield, in April 2019. The current plan is to re-establish the paddocks and water troughs at the new farm and use that as a finishing unit.

The upland farm is currently stocking at a little over one LSU/ha when accounting for moor, banks and restricted grazing, but Mr Beary says they could probably stock 20% more.

“We could expand but the plan is to make better use of what we have,” says Mr Beary, who would like to regenerative farming and possibly convert to organic.

“I am really excited by the holistic and regenerative farming principles of Joel Salatin and others.

“It makes sense to start with soil health, what’s there ends up in the plant and what’s in the plant ends up in the animal.”

“Whatever we do, we need to keep it simple, keep costs down and try to finish off forage, so we sell a better product at the end.”

Tips for expanding for new entrants

Try to expand steadily and maintain a secondary income. The Bearys did this with contract gritting and Mrs Beary’s nursing work.

Always have cash to buffer yourself as a plan B if things go wrong, such as bad weather, low output, disease.

Limit spending to infrastructure that you can take with you – for example, electric fencing, portable troughs and essential machinery.

Ensure quick returns from improvements the landlord will benefit from after you’re gone. Lime, fencing and reseeding can see a 30% return on investment if done well.

Keep machinery to bare essentials as it depreciates. Invest in stock instead as this can appreciate and grow your balance sheet to take more land or increasing borrowings. The Bearys use contractors for most work and have a load-all, 120hp tractor, quadbike, trailer, aerator and fertiliser spinner.

JOURNAL : Farmers Weekly

Feeding a 50:50 ration of grass and maize silages to pregnant ewes three weeks before lambing is improving their ability to produce milk.

Home-grown maize silage is fed to the 500 Mule ewes at Bryn Farm, near Cowbridge, when they are housed before lambing.

“The maize makes the ewes very milky,” says Owen Rees, who oversees the sheep enterprise and farms with his father, Ed, his uncle, Robert, and cousins, David and Tom.

Farm facts

384ha farmed, of which 243ha are owned

Lambs sold to Dunbia at a liveweight target of 40kg

Most lambs sold by the end of September

100 lambs retained as replacements

Aberdeen Angus cross Friesian and Hereford cross Friesian suckler herd, calving from April to June

Offspring sold at 26-28 months old at a target of 280-330kg deadweight. Angus cattle are sold to Scotbeef and the Herefords to Celtic Pride

Why did they switch to feeding maize?

The business is largely self-sufficient in feed, growing 10ha of maize and up to 16ha of spring and winter barley.

The maize had been grown as feed for the 120-cow suckler herd, and was introduced into the ewe diet two years ago when the family were seeking an alternative to energy blocks.

“We were using the energy blocks to balance the grass silage and hay the ewes were getting, but they were costing us about £25 each and we were getting through two pallets of them," Owen calculates.

See also: All you need to know about feeding sheep a total mixed ration

With limited feed space, the blocks were positioned in ring feeders in a yard adjoining the housing.

“The blocks were expensive. We never knew which ewes were taking them and we were getting a lot of cases of twin lamb disease," Tom recalls.

Their nutritionist suggested adding maize silage to the ration.

Minimising health risks

Owen admits he initially had reservations, because ewes are known to gorge on maize and become fat, putting them at risk of metabolic disorders in late pregnancy.

But by introducing maize silage into the ration just three weeks before lambing, the Reeses say the condition of ewes can be maintained.

“Although we were advised twin lamb disease could be an issue with feeding maize, we haven’t had a single case since we introduced it two years ago," Tom points out.

He adds: “If anything, the flock is doing better on maize because ewes are producing more milk and the lambs are born stronger.”

Expert advice on feeding maize to pregnant ewes

Below, independent sheep consultant Kate Phillips offers some advice on feeding maize to pregnant ewes.

1. Analyse grass and maize silage to establish if supplementary protein is needed.

E To develop an appropriate nutritional plan for pregnant ewes, it is important to know the feed value of the silage being offered.

E Maize has a lower crude protein content than grass silage, but it is generally high in energy, so is an ideal partner to high-protein grass silage.

E The high starch level in maize provides plenty of rumen-fermentable energy; this gives a synergistic effect with the high protein of grass silage.

E It is important the ewe’s protein and energy requirements are met so that colostrum and milk supplies are plentiful. Check the grass/maize silage intake is meeting the ewes needs by assessing silage dry matter intake and comparing it to the standard energy and metabolisable protein needs as ewes approach lambing.

E Supplements may be needed to provide additional protein, but the level depends on the forage analysis. Rapeseed meal, beans and soya bean meal are all possible supplements.

2. Condition score ewes

E It is very easy to overfeed single-bearing ewes, so care should be taken to check ewe body condition and feed ewes according to body condition score and litter size.

E In late pregnancy, ewes on maize can become fat and prone to metabolic disorders, such as twin-lamb disease, so when condition scoring, feel for backfat rather than visually scoring ewes.

For advice on feed rates see p4 of the Improving ewe nutrition PDF.

3. Allow sufficient feed barrier space

E Allow a minimum 15cm of feed space a ewe when feeding a total mixed ration to avoid cramming, which increases stress and may lead to abortion in extreme conditions.

4. Don’t overlook minerals

E Maize has lower mineral and vitamin concentrations.

E Provide additional minerals – particularly calcium and trace elements.

The feeding process

The system at Bryn Farm is simple: a bucket of fresh maize is deposited in the central passage once a day and forked into the silage.

“There is no science behind it, but it is roughly 50:50 grass silage and maize silage," says Owen.

The feed is pushed up with a fork about three times a day.

In 2019, the maize analysed at 33% dry matter (DM) and 11 megajoules (MJ) of metabolisable energy (ME)/kg DM . The grass silage analysed at 32% DM, 15.9% crude protein, 11MJ ME/kg DM  and had a D-value of 69.

The Rees family give no supplementary feed. Instead, the aim is to produce lamb as cheaply as possible while maintaining ewe performance.

“Margins are very tight, and we are trying to keep costs low by making more use of home-grown feeds,’’ says Tom.

“Some of the ewes get a bit of barley when they are at grass, if they are a bit lean.’’

Ewes are typically at grass until they are housed three weeks before lambing, depending on the weather. Grass intakes are supplemented with baled silage and hay fed from a ring feeder.

Practical considerations

Maize can easily be incorporated in the diet because the Reeses grow a large acreage as feed for their beef herd – the 2019 harvest yielded 49t/ha, with about 50t fed to the sheep.

Although it has been straightforward to add maize to the ewe diet at Bryn Farm, Owen admits it can be impractical to grow maize in some sheep systems.

“If we needed maize just for our sheep, we would only need to grow 2.5 acres [1ha], and at that level we wouldn’t do it, because it would need to be harvested and clamped,” he says.

Another option for sheep farmers is to buy maize from a local grower, he suggests, although keeping it fresh could be a challenge if it is delivered in large quantities.

Owen admits it is not always easy to get the feeding of ewes right, but with maize silage, he says, he has found a system that works for him.

“Some farmers can overcomplicate their systems, adding to their costs, but we keep everything as simple as possible, to keep our costs to a minimum,” he says.

JOURNAL : Farmers Weekly

Genetics and a programme of tailored nutrition have helped two Herefordshire farmers successfully lift the laying cycle of their flock of free-range hens beyond the UK’s 72-week average.

As long as everything is working well, 100 weeks is definitely achievable, believes Nick Panniers, who farms with his father, Allan.

“The back end of the cycle is where you get the most profit; that is when you make the money to cover the cost of the pullets," he says.

See also: 4 key poultry management factors influencing egg size

The Panniers produce eggs from 64,000 Dekalb Whites at Wellington Farm, Bishops Frome, switching from brown layers in 2018 in response to a new supply contract.

Their existing packer, Stonegate, had asked the business to supply white eggs for Waitrose's essential free-range brand.

In response, they sourced white birds from Hendrix Genetics.

After visiting farms stocked with Dekalb Whites in Holland, they were confident the breed would last longer in their system than the typical 74-week cycle they had with Brown Lohmanns, although they did have initial concerns that the Dutch systems are mostly barn, while theirs is free range.

“That was a big point of difference to consider but we discovered that white birds perform extremely well in free-range," Nick says.

He initially set a depopulation target of 90 weeks, but increased that to 100 weeks to supply the Christmas market.

“As the hens were laying well we agreed to keep going and did so with very few issues," says Nick.

Their rate of seconds did increase to 12% at week 85, but this was due to an infectious bronchitis challenge.

“That knocked them a bit, so without that we think we can improve on our seconds rate this year,’’ says Nick.

He admits the practicalities around when to depopulate are a consideration.

“This year, if we deplete at 100 weeks it will fall in August when we are busy with the harvest, which doesn’t suit us very well, so perhaps we will need to deplete a bit earlier to balance the work out a bit.’’

The challenges of longer lay

One of the challenges of keeping flocks for longer is maintaining consistent performance. Nick says the system is set up to take pressure off the birds.

“We have to make sure that everyone involved is singing from the same hymn sheet. The routine is very important, we always pack at the same time, feed at the same time."

Four ways Wellington Farm  increased depletion age and maintained productivity

1. Genetics and vaccination

Through selection and breeding programmes there are now efficient laying hens with greater persistence of lay, alongside acceptable egg quality and egg numbers.

The Panniers pay about 5% more for white birds, but say this cost is balanced by the breed’s hardiness and longevity.

Their pullets are comprehensively vaccinated for Newcastle disease, Marek’s disease, egg drop syndrome, salmonella, infectious bronchitis, and also for E coli due to a challenge on the farm.

2. Nutrition

Helping the bird preserve good eggshell quality for a longer laying period requires specifically tailored nutrition.

The flock is run on a four-stage diet, with a high but consistent energy structure across all the rations to lower consumption and minimise stress on the birds when they are introduced to a new ration.

The farm’s nutritionist, Tom Lander of Lloyds Animal Feeds, devised the feeding programme. He says taking birds to 100 weeks is “a marathon, not a sprint".

“Really large, early egg size will render the 100 week programme unviable," he warns.

The strategy for feeding is as follows:

Start of lay ration

This is 18% protein to help birds recover from the stress of transit and to build bodyweight as they come into lay.

5% lay to peak ration

Crude protein level reduces to 17%, but fibre levels increase slightly to 5% and calcium to 3.75%.

Mr Lander says fibre content is designed to help slow digestion so that faecal matter is drier.

“Layers coming into lay very quickly can become stressed easily and their faecal matter can become quite loose," he says.

The extra calcium is important as the birds’ rate of lay increases.

“We give the bird every opportunity to absorb the right amount of calcium to reduce second quality eggs," says Mr Lander.

Post-peak ration

Once birds have maintained peak production for several weeks and egg quality and size are appropriate, the amino acid profile is slightly reduced, for methionine and lysine in particular, to prevent eggs getting too large very quickly.

This diet is 5.5% fibre, combining digestible and non-digestible elements, with supplementary dried lucerne bales used in the housing.

Home-grown oats are milled on farm and included at 5% post-35 weeks, increasing to a maximum of 8% later in lay.

Oyster shell and limestone content is increased every 10 weeks to reduce calcium exhaustion in the medullary bone and aid its transfer to the digestive tract.

Post 75-80 weeks

Eggs start to reduce in quality but increase in size, putting pressure on the bird.

To manage this, this diet is lower in lysine and methionine while, at 4.5%, the maximum level of calcium that can be usefully absorbed and digested by the birds is included.

Crude protein is 15.5% and fibre 6%

Regular analysis of home-grown feeds

At 12-week intervals, wheat is tested against target specification requirements

Finished feed analysis is also scrutinised to ensure it is at the correct specification

This policy pays off, says Mr Lander. “We had some wheat samples where protein was a little higher than what we expected so we addressed the balancer to take account of that result."

This made sure that they were not over-supplying the bird with crude protein and the amino acid profile stayed in line with target levels.

3. Management

The birds are flighty when they arrive, which can make weighing and stock management a challenge. But the Panniers and their stockmen, Gary Morgan and Jackie Dorrington, overcome this by weighing before the lights come on.

White birds pick up both good and bad habits in no time, says Nick.

“They quickly learn to go up into the system at night and into the nest boxes but they will also learn to lay floor eggs, so you have to be on the ball."

The early morning routine is consistent with birds walked every morning, at the same time, to check for feed, water and any changes to behaviour. Birds are not disturbed in the afternoon.

Dimmer lighting regimes help control egg size and quality at end of lay. “We run the sheds a bit darker to keep the birds calmer," says Nick.

4. Water quality

Water is tested every 12 weeks. If it is high in bacteria, with a total viable count (TVC) exceeding 100, an acid is applied and flushed through the drinker line. However they consider anything over 50TVC to be undesirable.

Water is particle and UV-filtered for each house to help reduce the TVCs further. “This maintains a low TVC on the farm, this solves a big part of the production puzzle," says Mr Lander.

JOURNAL : Farmers Weekly

Improving soil health and establishing a cover crop is helping farmers overcome the effects of extreme weather on their cropping system.

The past few months have seen big swings in conditions, with a winter that was so wet that a proportion of winter cropping never got drilled. This was followed by a spring that has seen little rain, with growers trying to establish crops in bone-dry seed-beds.

Therefore, there is a need for more resilient cropping systems that cope better with the extreme weather patterns seen in recent years.

See also: How ethylene can help control sprouting in potato stores

Here we look at two farmers who are looking to improve resilience on contrasting soil types.

Ian Wilkinson, Honeydale Farm, Oxfordshire

Ian Wilkinson has developed his own unique system by introducing sheep into the cropping system on the 43ha demonstration farm on poor Cotswold brash soils.

“There is nothing worse than soil being left bare over the winter,” he says.

“I saw very little green [cover] around here, as many had expected soils to be drilled, but they are now dry and I can’t see how farmers can grow a crop in it.”

His system is based on having 100% ground cover “pretty much all year round”. This helps retain moisture for spring seed-beds, which otherwise would dry out.

Farm facts

Cotswold Seeds purchased the farm in 2013 with aim of developing it as a centre for farming diversity, demonstrating how small family farms can use sustainable farming practices while maintaining a respectable income

Area 43ha

Soils Costwold brash

Cropping Herbal fertility building leys, wheat and oats

At the heart of his low-input system is an eight-year crop rotation, which begins with a four-year deep-rooting herbal ley to build soil fertility. He describes this as “the engine of our rotation”.

The herbal leys sequester carbon and fix nitrogen. “It’s the only way I can see of building fertility on these soils. The soils have no inherent fertility and organic matter is low,” Mr Wilkinson says.

A flock of 100 ewes, owned by a neighbour, is sufficient to manage the forage areas and they are moved every 24 hours to a new 0.1ha block. It takes about 40-50 days for the flock to move around and mob graze the blocks.

Sheep graze about half of the forage and the other half is left for carbon sequestration, as the sheep are moved on. “It is delivering good sheep production and biodiversity.”

While cover crops are grown, he is looking to take this further by having permanent green covers and is currently looking into drilling wheat into a white clover which protects soil and fixes nitrogen.

“I don’t know if it will work yet, but trying a way to have a continuous green mulch with a crop growing in it.”

Mr Wilkinson also highlights sanfoin as a potentially useful crop, as it is drought-tolerant, which is ideal for the dry spells. However, it doesn’t like being sat in wet soils.

Phil Jarvis, Loddington Estate

Phil Jarvis farms 330ha at Loddington and says the swings in weather can have major effects on the heavy land.

He says soils that were "like sludge” a month ago are now bone dry. Repairing drains on heavy soil is paramount and the wet weather highlighted some areas that needed attention. Consequently, Mr Jarvis has spent recent weeks repairing 17 drains on the farm to help improve drainage for next time.

It’s not just the wet, he also points out that heavy land can go from extremely wet to extremely dry very quickly, so they need care to prevent drying out in spring. “Having moisture at the right time is key.”

Farm facts

The Allerton project has been researching farm ecosystems and the effects of different farming methods on wildlife and the environment for more than 20 years at Loddington.

Area 330ha

Soils Denchworth and Hanslope clay

Cropping Winter wheat, oilseed rape, winter oats, spring oats and spring beans

To help build resilience into soils at Loddington, Mr Jarvis has successfully widened the rotations, introduced cover crops and is making the transition to direct drilling.

“The direct drill approach allows our soils to remain undisturbed by leaving crop residues on the surface from harvest until sowing.”

This helps to conserve moisture for spring drilling, which is critical in a dry spring like 2020.

Online farm tours and discussions

Agricology has put together a series of virtual events over the summer, helping farmers to learn more about sustainably farming based on agro-ecological principles.

New this summer are the virtual field days, which aim to bring together farmers and researchers to discuss key practices on “tour” around a farm. Participants can interact via a webinar, dial in or watch it on YouTube Live.

The summer programme also includes virtual discussions, which are 30-minute webinars/live podcasts offering Q&As and discussions on key agro-ecological practices and themes.

Kicking off the programme on 28 April is a virtual field day looking at helping farmers take the first steps to agroecological farming. Other topics to be covered include intercropping and herbal leys.

Find out more at the Agricology webpage.

Both farmers were speaking at a recent briefing organised by Agricology.

What is Agricology?

Agricology is a knowledge exchange network of farmers, researchers and farming organisations aimed at sharing best practice on agro-ecological practices (such as reduced tillage, cover crops and reintegrating livestock).

The project was set up in 2015 and is run by three core organisations: the Game and Wildlife Conservation Trust Allerton Project, the Daylesford Foundation and the Organic Research Centre

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A new V-Spread disc design on Bergmann’s huge 24t 6240 muckspreader has increased working width to 36m for farmyard manure and other materials.

The patented blueprint consists of a three-roller milling unit and two 1,100mm discs that are mounted at an angle to make spread widths and pattern consistent.

See also: Driver’s view: Vredo 5518 self-propelled muckspreader

The system will also be available on the tandem-axle 5210 and tri-axle 7340S.

Elsewhere, Bergmann has added its widest-ever pick-up (2,270mm) to the 34t tri-axle Shuttle 510K forage wagon. At 1,840mm, it claims to have the biggest drum on the market, too, and the 53-knife kit offers a chop length of 34mm.

The German firm has also made much of its mainline kit Isobus compatible, including the forage wagons.

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**Body**

Zagreb,Hrvatska02 December 2020 (Hina) - Croatia logs 3,539 new COVID cases and 55 deaths ZAGREB, Dec 2 (Hina) - Croatia registered 3,539 new cases of coronavirus in the past 24 hours and 55 people have died as a consequence of COVID, the national COVID response team saidon Wednesday. The number of active cases is22,610, including 2,408 hospitalised patients, 252 of whom are on ventilators. Since 25 February, when the first case was registered in Croatia, a total of 134,881 people have been infected with the virus and 1,916 have died. A total of 110,355 have recovered, of whom 2,124 in the past 24 hours. There are currently 52,079 people in self-isolation.

To date a total of 769,091 people have been tested for coronavirus, with 10,077 tests conducted in the past 24 hours. Healthcare employers' association: System under strain but functioning ZAGREB, Dec 2 (Hina) - The healthcare system capacity has been strained to the utmost but the system is functioning, the director of the association of employers in the healthcare system, Drazen Jurkovic, said at a news conference in Cakovec on Wednesday. Earlier on Wednesday a delegation of the association visited hospitals in four northern Croatian cities -- Varazdin, Cakovec, Koprivnica and Bjelovar -- after which they held a news conference to inform the public of their findings. Jurkovic said that the system was operating at full capacity and was functioning. He admitted that the biggest challenge in the current coronavirus epidemic was how to organise the health system, adding that problems with drug suppliers had been settled in the short run and that the problem of unpaid overtime in the health sector remained to be solved. The system is resilient, it can respond to all challenges, said Jurkovic. The president of the association, Mladen Busic, praised medical professionals -- physicians, nurses and medical technicians -- as well as non-medical staff in the four hospitals for their extraordinary contribution to the fight against COVID-19. "The healthcare system has not collapsed and will not collapse. We are dealing with this situation and will win and provide all the patients with the necessary care, both COVID-19 and other patients," Busic said. The head of the Cakovec hospital, Tomislav Novinscak, informed the delegation that currently, 110 COVID-19 patients were being treated in the hospital and that some of them would be transferred to a local hotel that has been repurposed to admit COVID-19 patients. He added that the situation with available medical staff was stable. In Varazdin, the local hospital is treating 257 persons diagnosed with COVID-19, and of them 24 are in intensive care wards. The head of that hospital, Nenad Kudelic, expects hospital capacity to be fully occupied until the end of this week, and that 40 more COVID-19 patients could be transferred to the hospital for medical rehabilitation in Varazdinske Toplice. More than 120 employees of the Varazdin hospital are out of work due to infection with COVID-19 or self-isolation. Kudelic said that one could not say that the system was collapsing, however, it should be made clear that the current high number of COVID-19 patients required hospital and personnel capacities that would otherwise be used for the treatment of other diseases. The head of the Koprivnica hospital, Mato Devcic, said that there were currently 82 COVID-19 patients in the institution, and eight of them were on ventilators. The hospital has allotted 110 beds for COVID-19 patients and a maximum 200 beds can be used for that purpose. The system is not on its knees, it is adapting to the extraordinary circumstances, Devcic said. In Bjelovar, the head of the hospital, Allouch Ali, said that 80 beds were made available for COVID-19 patients and that an additional 40 could be made available. "The situation is under control," he said. Every 17 seconds a person dies due to COVID in Europe, EC calls for caution in winter ZAGREB, Dec2(Hina) - The European Commission on Wednesday outlineda strategy for sustainably managing the COVID-19pandemic inthe coming winter months, underscoring that every 17 seconds this infection takes a life in Europe. In its strategy the EC points outthat winter is "a period that can bring a risk of increased transmission of the virus owing to specific circumstances such as indoor gatherings,"which is whythe strategy "recommends continued vigilance and caution throughout the winter period and into 2021 when the rollout of safe and effective vaccines will occur." The European Commissioner for Health and Food Safety,Stella Kyriakides, warned of the risks stemming from gatherings and celebrations during the Advent, Christmasand New Year holidays. "We cannot jeopardise the efforts made by us all in the recent weeks and months. This year, saving lives must come before celebrations. But with vaccines on the horizon, there is also hope. All Member States must now be ready to start vaccination campaigns and roll-out vaccines as quickly as possible once a safe and effective vaccine is available." The Commission will then provide further guidance on a gradual and coordinated lifting of containment measures. Considering the latest guidelines for member-states, the strategy highlights physical distancing and limiting social contacts, testing and contact tracing and safe travel. The EC says that physical distancing and limiting social contacts are key for the winter months, including the holiday period. "Measures should be targeted and based on the local epidemiological situation to limit their social and economic impact and increase their acceptance by people." Testing and contact tracing is perceived as "essential for detecting clusters and breaking transmission." "Most Member States now have national contact tracing apps. The European Federated Gateway Server (EFGS) enables cross-border tracing," says the EC. Pandemic fatigue The Commission says that "pandemic fatigue and mental health are natural responses to the current situation." Member States are urged to follow the World Health Organisation European Region's guidance on reinvigorating public support to address pandemic fatigue. Psychosocial support should be stepped up too. Parliament discusses bill on protection of population against infectious diseases ZAGREB, Dec 2 (Hina) - The parliament on Wednesday discussed amendments to the Act on the Protection of the Population Against Infectious Diseases introducing penalties for non-compliance with measures designed to protect against COVID-19, which the ruling majority supports and the Opposition considers belated. Health Minister Vili Beros said that the measures were balanced and were designed to protect citizens' health and lives and that they would be in force as long as it took to respond to the pandemic. He stressed that the measures included the compulsory wearing of protective masks to prevent the transmission of the disease. The measures include a ban on public events and gatherings and private gatherings. Their violation will be penalised in line with the Misdemeanors Act and compliance with them will be checked by the police and the State Inspectorate, Beros said. He said that the government's position was that at the start of its next session the parliament should be informed of the implementation of the measures and activities in the fight against COVID-19. The new measures are necessary in the fight against coronavirus and the proposed amendments are an act of adapting to the new circumstances for the benefit of all, Beros said, adding that the measures did not restrict freedoms, did not constitute double standards and were not politically motivated. They have been adopted so that we could manage the epidemic in the best possible way, prevent the spread of the disease and enable a speedy recovery of the nation and the health system, said Beros, underlining the importance of personal responsibility and solidarity. He dismissed reports that the new regulations would give police additional powers, enabling them to enter citizens' homes and count the people present there. Asked by MP Sandra Bencic of the green-left coalition if he felt politically responsible for the current situation, he said that she had the advantage of hindsight and that the government had tried to strike a balance between health protection and economic activity. No country has a magic recipe, we have been working in line with professional standards and adapting to the circumstances, he said. Asked by Social Democrat MP Arsen Bauk if the current growth in infections could have been predicted, Beros said it could not have been mathematically determined. Bridge MP Miro Bulj said that citizens' trust in the national COVID-19 response team had been betrayed because the team had made political and contradictory decisions, while Beros replied that the government did not want to punish citizens but prevent the spread of the epidemic. Parl. debate on DORH deferred after Chief Prosecutor tests positive A parliamentary debate on the performance of the Office of Chief State Prosecutor (DORH), set for Thursday, will be delayed until the end of theisolation of the Chief State Prosecutor, who tested positive for coronavirus,Deputy Speaker Furio Radin said on Wednesday. On Wednesday morning, it was reported thatthe Chief State Prosecutor Zlata Hrvoj-Sipek was diagnosed with coronavorus and must be isolated in the coming period. SDP parliamentarian Arsen Bauk agreed that it made no sense to discussthe performance of the prosecutorial authorities without the participation of the DORH chief in the debate. No restriction of citizens' freedoms, no need for two-thirds majority, says speaker ZAGREB, Dec 2 (Hina) - Parliament Speaker Gordan Jandrokovic has said that an amended law on the protection of the population against infectious diseases will go into force on Saturday and thatits adoption does not require two-thirds majority support as it does not restrict citizens' freedoms. "Since there are no new measures, no new restrictions of citizens' freedoms, I believe there is no need for a two-thirds majority," Jandrokovic said in an interview with the RTL broadcaster on Wednesday while commenting on the bill, which is being discussed by the parliament. The bill will define penalties for non-compliance with the latest measures designed to protect the population against coronavirus. Jandrokovic said that he did not agree with the Opposition which demands the activation of Article 17 of the Constitution and adoption of the bill by a two-thirds majority. He recalled that the Constitutional Court had earlier, in a case of similar Opposition criticism, ruled that everything was in line with the Constitution and law. Jandrokovic said the bill in question did not contain any new restrictions and only defined more precisely the already existing restrictions and penalties and did not encroach on rights that would require the activation of Article 17 of the Constitution. "Everything is provided for in Article 16 and the Act on the Protection of the Population Against Infectious Diseases. If the opposition thinks differently, they can again address the Constitutional Court," said Jandrokovic. FinMin says tax changes should boost employment and wages ZAGREB, Dec 2 (Hina) - Legislative amendments that are part of the fifth round of tax reform should lead to higher employment and wages, Finance Minister Zdravko Maric said in parliament on Wednesday where the bill,which is expected to enter into force on 1 January 2021, received a second reading. "The amendments are expected toencourage employment and wage growth," Maric said after the parliamentary debate. The proposed amendments are expected to result in a tax revenue loss of HRK 2 billion a year but the minister expects them to have a positive effect for citizens and the economy. He added that not all taxpayers can be encompassed bythe latest amendments but thatabout 900,000 can expect some financial benefit, depending on the amount of their income. He recalled that ofa total of 2.8 million employed people and pensioners, 1.9 million did not pay income tax. The minister underlinedthat the government would not refrain from the newest tax changes despite the situation with the COVID-19 epidemic and that this was an essential part of its last election platform. The tax changes so far have left more than HRK 8 billion to citizens and the business sectorwhile therange of non-taxable income has been expanded, and employers can pay workers more thanHRK 1,000 extra a month without having to pay any taxes. The latest round of tax reformincludes changes to the financing of local government units increasing those units' share in income tax revenue distributionwhile the Fiscal Equalisation Fund will be taken over by the state budget. The fifth tax reform round also includes changes to income tax, profit tax, VAT, and fiscalisation in cash transactions. Income tax brackets are being decreased from 24% to 20% and from 36% to 30%, which means thatlocal government will receive about HRK 2 billion less in revenue. However, the government will compensate local government units for that amount by increasing the share of municipalities, towns and counties in income tax distribution -from 60% to 74% for municipalities and towns and from 17% to 20% for counties, while the share for decentralised functions will remain at 6%. In addition to these proposals, the amendments are geared towards reducing the 12% tax rate for annual income and one-off taxation for renters to 10%. The changes also decrease the standard tax rate for turnover of up to HRK 7.5million from 12% to 10%. The withholding tax rate for dividends and profit shares would be reduced from 12% to 10% and the withholding tax for remuneration to foreign artists, entertainers and athletes would be reduced from 15 to 10%. Opposition says tax reform cosmetic, benefits the rich ZAGREB, Dec2(Hina) - While the ruling HDZ's MPs on Wednesday commended the government's bills from the fifth tax reform round, the opposition insisted the amendments were superficial,that they would benefit the rich, andthat Croatia needed a new taxmodel. Finance Minister Zdravko Maric said in parliament the amended tax laws would go into force on January 1 and that the tax relief would total HRK 2 billion net. The Homeland Movement applaudsthat but there will be no real tax relief, said MP Stijepo Bartulica, adding that the amendments were rathera cosmetic change whenCroatia needed a new taxation model. We areenablingover HRK 10 billion in tax relief The fact is that with this round we are enabling over HRK 10 billion in tax relief, Maric said. The amendments to the laws on income tax, profit tax, VAT and fiscalisation in cash transactions propose cutting the income tax rates from 24% to 20% and from 36% to 30% as well as cutting from 12% to 10% the profit tax for businesses which make up to HRK 7.5 million a year. That is coupled with amendments to the law on local governmentfinancing, which Maric said would boost local governments'fiscal capacity and EU fund absorption. In order to avert a reduction of local government revenue, those amendments envisage increasing the share of towns, municipalities and counties in income taxdistributionwhile exempting the share forfiscal equalisation, the money for which would be earmarked in the state budget. There is money in the state budget for that and payment would occur by the 15th of the month, Maric told Anamarija Blazevic (HDZ) in response to a question. During the debate, Katarina Peopovic of the Workers' Front and Social DemocraticParty (SDP) lawmakers proposed that the nontaxable income should be raised to HRK 5,000. Crisis is no time for talks on cutting VAT, says economy minister ZAGREB, Dec2(Hina) - A crisis is no time for talks on cutting VAT, Economy Minister Tomislav Coric said on Croatian Radio on Wednesday. Asked for acomment on bar and restaurant owners' complaints about the government's refusal to discuss cutting VAT to help the economy, he said "the VAT amount should be discussed in stable economic conditions." "VAT is the main source of budget financing. In conditions of a record high budget deficit in 2020 and the fact that in 2021 we finally have to stabilise expectations, it's not correctto take VAT out of that context and say that it would be a short-term model for the survival of the hospitality sector." Coric said the government'sroom for maneouvre to help businesses see the crisis through "is not in question at all," but added that it was narrower due to a 2.9% budget deficit projected for2021 andthe question of how long the crisis would last and if it would spill over into next year. He said he did not expect this year's GDP to fall 10% but "around" 8% and that next year it would depend on when COVID vaccination would begin and when life would go back to normal, among other things. He said that if vaccination in the EU began at the turn of the year, 2021 "should not be marked by lockdowns."He added that economic growth in Croatia next year could be 5%. Asked if the government was talking with banks about extending a moratorium on loan repayments after March 2021 if necessary, Coric said he hoped it would not come to that and that "the situation in January and February will provide a clear perspective onthe direction to take." He added, however, that if the health crisis lasted longer, the moratorium would have to be discussed. Coric said the government was not late with its measures to help businesses affected by the COVID crisis. HUP urges local authorities to take on a part of burden of crisis ZAGREB, Dec 2 (Hina) - The Croatian Employers' Association (HUP) on Wednesday called on local authorities to take on some of the burden of the crisis and to exempt entrepreneurs from paying local fees and charges. HUP said in a press release that it had called on the association of counties and cities to take on some of the burden and to write-off or defer all local fees and charges for businesses that have been seriously affected by the negative consequences of the corona crisis. HUP members consider that support will be essential in the first half of 2021 too and appealed to local government to ensure relief measures to buffer the consequences on enterprises and trades. Employers have called for similar measures that were introduced during the spring lockdown tocontinue. They also called for the abolishment of surcharges and suspension of enforcement actions among other things. Education sector workers discuss sector problems with minister ZAGREB, Dec 2 (Hina) - Education sector unions said on Wednesday, a year after the longest strike in the history of the Croatian education system, that the government had met their demands regarding job complexity indices but that other problems had cropped up since, which they discussed with Minister Radovan Fuchs. Ministry hiring new workers rarely SHU teachers' union leader Sanja Sprem told a news conference that at a meeting with Fuchs on Tuesday, unionistsdiscussed the most important problems that had cropped up during the coronavirus pandemic - parallel work (online and physical classes), self-isolation, and compensation for self-isolating teachers. She said the union officials also warned about a ban on the employment of auxiliary staff, which was insufficient also before the pandemic, noting that the ministry was hiring new workers rarely. "People are overburdened, there are not enough cleaners," said Sprem. "Primary schools have requested the employment of 791 workers, 28 cleaners have been given permanent employment contracts and 90 fixed-term employment contracts. That means that only 14.9% of the actual needs have been met. The chance of the pandemic ending is greater than the chance of the ministry hiring the necessary school staff," she said. She also warned about school employees with fixed-term contracts being laid off just before Christmas, noting that this was being done to avoid paying out Christmas bonuses. The unionists proposed defining additional programmes for the prevention of stress and additionally motivating teachers and students because the pandemic has been taking a toll on their physical and mental health. According to an online survey conducted by the SHU union, which covered 511 schools in 14 counties, 96% of the respondents said they worked extra hours, in line with principals' written or oral instructions, and 95% said that substitute teachers were not paid, Sprem said. She said that 86% of the respondents are dissatisfied with the ministry's position that in schools which work in line with Model A (physical classes), work with students in self-isolation is not paid. Also, 99% of the respondents believe that cleaners have been affected the most by the crisis, and 86% say that the ministry is not answering their queries and that its communication with teachers is not good. Sprem dismissed claims that there is no transmission of coronavirus in schools. "The number of teachers who get infected at work is growing on a daily basis. Such situations require adjustment and additionaleffort of all employees so students can be as safe as possible," she said. Online classes no substitute for physical classes Asked if all schools should switch to online classes, the head of the NSZSSH union of secondary school employees, Branimir Mihalinec, said that the horizontal approach was not good. "I believe that, depending on the situation on the ground, local COVID-19 response teams should be in charge of making a decision to that effect, in agreement with the national team. There are parts of Croatia where there is not a single infected person and holding online classes there makes no sense," he said, noting that according to all indicators,physical classes in schools were the only truly effective type of classes while remote education was not a real substitute for physical classes. "Holding only online classes would be the worst option," he said. Pensioners' union warns of neglect in aged care homes ZAGREB, Dec 2 (Hina) - The SUH pensioners' union and the "Treca Dob" association of aged persons on Wednesday warned of neglect of elderly people in private aged care facilities, particularly during the pandemic and called for urgent control ofthose facilities. "Even though Minister Josip Aladrovic has informed that the number of welfare inspectors has doubled (to possibly 20), and that criteria for private facilities have been made stricter, in reality there has not been any improvement" the pensioners' associations said. Some beneficiaries are in absolute isolation and are not receiving regular health and welfare attention or support and we are getting more and more reports of residents in aged care facilities that their movement is being restricted and personal hygiene has been reduced and that they are not being fed regularly or even being given water. Some are not being showered at all but just wiped down with wet wipes, they say. The worst thing is that considering they are not allowed to leave these facilities their fundamental rights are being jeopardised, the SUH and the NGO say. "Due to a shortage in staff they are not being fed regularly, showered, allowed to step out in the yard, to call family and everything is being justified with the COVID-19 situation." In those facilities where social welfare workers are employed, they cannot be reached on the phone and are rude to residents and their families and cover up all the misdoings, SUH said. The associations called on the Ministry of Labour, Pension System, Family and Social Policy to urgentlytake action and form an expert inquiry commission that will systematically investigate the situation in these facilities. They also call for a reform of the welfare inspection and for its de-centralisation and for civil volunteers to be introduced who will be allowed to enter these facilities. Huge financial damage caused by failure to proclaim EEZ, says opposition ZAGREB, Dec 2 (Hina) - After the announcement that theparliament would proclaim anExclusive Economic Zone(EEZ) before the end of the autumn sitting, some opposition parties on Wednesday welcomed the decision but added that its proclamation isoverdue, which hascausedhuge financial damage toCroatia. MP Miro Bulj (Bridge) told reporters in the parliament that the decision should have been adopted long ago. "In the last parliament we submitted a motion to that effect several times butthe government said it was unnecessary and that theEcological and Fisheries Protection Zone (EFPZ) was the same as an exclusive economic zone while we claimed that an exclusive economic zone was Croatia's sovereign right, particularly in terms of protecting the fish stock from the Italians, as well as in terms of underwater cultural heritage andenergy resources," said Bulj. This is a victory for the Croatian people but unfortunately it has come quite late but better late than never because we have lost billions and the damage to our fishermen and fish stock cannot be compensated and no one will be called to account, Buljsaid. "Thosewho calls us populists and useless have finally endorsed our stance. An exclusive economic zoneis by no meansthe same as theEFPZas claimed by Andrej Plenkovic and theCroatian Democratic Union. With his proclamation we are finally gaining full control andsovereign rights over 24,000 square kilometres of our sea," concluded Bulj. Sovereignsts: Croatia is anything but a sovereign state MP Hrvoje Zekanovic of the Croatian Sovereignistswarned that declaring the exclusive economic zone the same way that the EFPZ was proclaimed would be problematic. "All EU states have the right to fish in theprotected economic-fishing zonethat has been declared by Croatia and if there are plans to proclaim an exclusive economic zone in the same way, the Croatian Sovereignists will be against it. That is deluding the public andis being done only so that theItalians can protecttheir part of the Mediterranean Sea. If this is just for show,we are against it. If the intention is to truly protect the economic belt, the offshore zone and all that it entails, without any exceptions,we will support that decision," he said. HDZ whip: Exclusive Economic Zone won't bring Croatia any major financial benefits ZAGREB, Dec2 (Hina) - Ruling HDZ party whip Branko Bacic said on Wednesday that Croatia would not significantly benefit financially from declaringan Exclusive Economic Zone in the Adriaticbecause most of its elements were already incorporated inthe existing Ecological and Fisheries Protection Zone (EFPZ). "The Exclusive Economic Zonewill be declared very soon but it will not bring billions of kuna, as claimed by opposition lawmakers," Bacic told reporters in the parliament. He explained that the common fisheries policy was implemented in every EU zone, that Croatian fishermen must comply with EU rules and that the Exclusive Economic Zone would bring no major financial benefit. In relation to the existing EFPZ, the proclamation of a Protected Economic Zone provides Croatia only with two additional possibilities - to build artificial islands and use wind and sea energy in that zone, he said. The Exclusive Economic Zone is a small element that will build on the EFPZ, he said. SDP MP says Exclusive Economic Zone won't change anything ZAGREB, Dec2 (Hina) - Social Democrat MP Domagoj Hajdukovic said on Wednesday his party supported plans to declare an Exclusive Economic Zone in the Adriatic but that that decision would not bring any major changes for Croatian fishermen but rather accompanied Italy's decision to that effect. "The Exclusive Economic Zone will be declared because Italy is doing soto protect its part of the Adriatic. Italy currently does not have any similar document that protects its waters from fishing boats from third countries," Hajdukovic told reporters in the parliament. He added that it would be interesting to hear what the ruling HDZ had to say about this and why it had changed its position on the matter. "The Croatian public should know that the Ecological and Fisheries Protection Zone, declared in 2003, had all the characteristics of an Exclusive Economic Zone. Under decisions made in 2004, 2006 and 2008, during the terms of Prime Ministers Ivo Sanader and Jadranka Kosor, the EFPZ ceased to apply to EU member-countries. That is how we actually lost the benefits that we could have had with the EFPZ before our admission to the EU," Hajdukovic explained. He added that after accession to the EU, economic zones become the EU waters and EU law, that is, the common fisheries policy, starts to apply to them. "Third-country fishing fleets that have fished so far in those waters will no longer be able to do it. Only Italian and Croatian fishing boats will be able to do so. I am talking about the waters that are neither Croatia's nor Italy's territorial waters,that's the whole difference here," said Hajdukovic. Post-quake reconstruction opportunity to boost local construction sector ZAGREB, Dec 2 (Hina) - The reconstruction of Zagreb and its environs, following the 22 March quake,is a unique opportunity to strengthen the local construction sector, it was said at a virtual conference organised by the Croatian Chamber of Commerce (HGK) on Wednesday. Physical Planning and Construction Minister Darko Horvatsays that preparations were underway to enable the start of reconstruction as soon as possible and that a systematic approach over a period of ten years will result in a more beautiful and earthquake-proof city and environs. He informed the conference that the ***collection*** of applications for reconstruction had started and that a special department has been established in the ministry for this purpose. Horvatrecalled that an estimated cost of the reconstruction of damaged buildings is about HRK 42 billion while current available funds amount to HRK 12 billion. These initial funds come from the EU solidarity fund and a World Bank loan of $200 million. Soon a statute and work organisation will be adopted for the Zagreb Reconstruction Fund which will equip teams to supervise the implementation of the post-quake reconstruction, said the minister. The head of the fund, Damir Vandjelic, told reporters that there would be work for everyone during the reconstruction. He informed that last year the total revenues pfthe construction sector amounted to HRK 18 billion, while3-4 billion kuna is expected to be invested in reconstruction projects annually.. Deanof the Construction Faculty in Zagreb, Stjepan Lakusic, told the virtual conference that there are sufficient construction companies to conduct the rebuilding. HGK President Luka Burilovic sees this as an opportunity to bail out Croatia's construction sector and the economy in general. "Construction has pulled Croatia out of crises and it can do that again," he said. HGK catalogue lists more than 4,000 products HGK vice president for construction and transport Mrijana Cagalj underlined that the share of construction to GDP last year was 5.7% and that according to the Croatian Pension Insurance Fund (HZMO) last year more 116,600 people were registered as working in construction. Despite the fall in GDP this year the construction sector is the one of the few branchesthat has recorded a growth, she said, explaining that all the trends are strongly impacted by large investment projects through EU funds and partially from removing debris after the earthquake. She claimed that the rebuildingis a unique opportunity to strengthen the local construction sector. The HGK has for years been promoting Croatian products to be bought and installed and this could be an opportunity to improve competitiveness of the construction sector in Croatia, Cagalj added. She explained that Croatia has more than 4,000 excellent products available with a major part of them related to installations and equipping. Croatia has 17 producer organisations with just 700 members - analysis ZAGREB, Dec 2 (Hina) - Croatia currently has 17 producer organisations in eight sectors but they have only 700 members of a total of 170,000 farms, the Smarter consultancysaid in an analysis, adding that amalgamation of farmersshould be a strategic objective in ***agriculture***. The process of amalgamatingproducer organisations has picked up somewhat over the past few years but is still unsatisfactory and needs to be enhanced, the consultancy said in a press release. It conducted its analysis based on the latest ***data*** from the ***Agriculture*** Ministry which show that recognised producer organisations are active in just nine counties in continental Croatia. Amalgamation has best been seen in the fruit and vegetables sector with 4 producer organisations, followed by 3 each inthe cereals, milk and dairy, and beef and veal producer organisations. As far as geographic location is concerned, Osijek-Baranja and Vukovar-Srijemcountieshave the best amalgamation results - with 3 organisations each while amalgamationin Istria, Dalmatia and Lika counties has not picked up. At the end of October another four applications for recognition of producer organisations were submitted, one for bee products and three for potato producers. "The coronacrisis and announcement of a new EU Common ***Agriculture*** Policy for 2023, should additionally encourage the process of amalgamating producers and raise awareness of the need for horizontal networking, greater connectivity with buyers and the processing industry as they havedeveloped and stable channels towards retail outlets and export markets," Smarter added. A goodexample of success in producing and selling a product is the Jabuka apple farm cooperative, which has a good position on the shelves in local retail outlets and in export, Smarter said. Amalgamation strategic objective in ***agriculture*** Smarter believes that amalgamation of farmers should be a strategic objective for Croatia's ***agriculture*** policy. That is a reasonable and rational approach to resolving the problem of the survival of farms and enables anequal chance on the market, Smarter underlined. Smarter recalled that of the 170,000 registered farms 83% or about 110,000 are small farms. The EU supports farmers who wish to associate in producer organisations by concentrating supplies, improving marketing, providing technical and logistic support for its members and improving quality management and the transfer of know-how. Associations guarantee economic feasibility for individual producers, as evidenced by a large number of examples in the EU, the analysis notes. Smarter adds that it is necessary to strengthen the vertical integrationof the supply chain, from producer organisations to buyers to processing andretail, with associated producers acting together at each of these levels. The ministry needs to provide the regulatory frameworks,simplify procedures for amalgamation and recognise producer organisations as well as approvefunds to support their work, Smartersays. EU has 3,505 producer organisations, mostly for fruit and vegetable farmers According to the analysis, in 2017 the EU had 3,505 producer organisations, with more than half (52%) in the fruit and vegetables sector, followed by the dairy sector (38%). France has the most producer organisations -724, followed by Germany(692), Italy(583) andSpain (579). R&D outlays in Croatia in 2019 half the EU average ZAGREB, Dec2(Hina) - In 2019 Croatia spent close to half the EU average on research and development, expressed as a percentage ofGDP, but expenditure on R&D increased compared to the year before, Eurostatfigures show. EUcountries in 2019 spent more than €306 billion on R&D, almost the same as the year before. Expressed as a percentage of GDP, expenditure on R&D in 2019 was 2.19% and was almost unchanged compared to the year before. Ten years ago, it was 1.97%. The business sector invested the most in R&D in 2019, with a share in total expenditure of 66%. It was followed by the sector of higher education, with 22%, and the state, with a share of 11%. Sweden tops ranking Sweden spent the most on R&D in 2019, 3.39% of GDP. It wasfollowed by Austria and Germany, with 3.19% and 3.17% respectively. Denmark and Belgium invested close to 3%of their GDP inR&D. France's investment in R&D was at the level of the EU average, and the Netherlands and Slovenia were close as well, with 2.16% and 2.04% respectively. With R&D outlays of 1.11% of GDP Croatia was in the same group as Luxembourg and Spain, which spent 1.19% and 1.14% of their GDP respectively on R&D. In 2018 expenditure on R&D in Croatia was 0.97% of GDP. Romania had the lowest rate, of 0.48% of GDP. Modest growth Over a ten-year period ending in 2019, expenditure on R&D, expressed as a percentage of GDP, grew in 19 EU member-countries, and it grew the most in Belgium, by 0.89 percentage points. Poland and the Czech Republic followed, with increases of 0.66 and 0.65 percentage points respectively. Croatia's R&D expenditure in 2019 was 0.27 pp higher than in 2009. In the said period, R&D expenditure dropped the most in Finland, by 0.94 pp and Ireland, by 0.83 pp. In France and Sweden it was the same as in 2009. Unemployment in EU unchanged, slightly down in Croatia in October ZAGREB, Dec 2 Hina) - Unemployment in October in the European Union remained unchanged from September, whereas in Croatia it decreased slightly drawing closer to the EU average, according to a report released by Eurostaton Wednesday. The seasonally-adjusted EU unemployment rate was 7.6% in October 2020, almost identical to September when it was 7.5%, while in October 2019 it was one percentage point higher. Unemployment in the euroareawas 8.4% and was 0.1 percentage point lower than in September and one percentage point higher than in October 2019. ***Eurostat*** estimates "that 16.236 million men and women in the EU, of whom 13.825 million in the euro area, were unemployed in October 2020." "Compared with September 2020, the number of persons unemployed decreased by 91 000 in the EU and by 86 000 in the euro area. Compared with October 2019, unemployment rose by 2.186 million in the EU and by 1.692 million in the euro area." Croatia closer to EU average The seasonally-adjusted unemployment rate in Croatia was 8% in October 2020, down 0.2pp compared to September. In October 2019, unemployment in Croatia was 6.4%. In October, there were 144,000 jobless persons in Croatia, which is 5,000 fewer than in September, but 30,000 more than in October last year. The highest unemployment rate in October was again registered in Spain (16.2%), followed by Cyprus (10.5%) and Lithuania (10.4%). The lowest was registered in the Czech Republic (2.9%) and Poland (3.5%). Company sues Dubrovnik over land sale ZAGREB, Dec2(Hina) - The Razvoj Golf company has sued the City of Dubrovnik forthe damage resulting from the purchase of 38,000 square metres of farmland on the Srdj hill overlooking the city in 2009, the company said on Tuesday. Eleven years afterCroatia launched legal proceedings, it wasestablished that the city was not authorised to sell the land, as a result of which Razvoj Golf lost both the land and the HRK 2.7 million paid for it, the company said. Due to the absence of a peaceful resolution and the upcoming expiry of the statute of limitations, Razvoj Golf has launched legal proceedings to protect its rights, the company said, adding that it remained open for a peaceful resolution. NGOs: Frenkel has launched second arbitration against Croatia Representatives of the Green Action and Srdj Is Ours NGOs said on Wednesdaythat Razvoj Golf owner Aaron Frenkel had filed a new arbitration request against Croatia due to a golf course project on Srdj based on the Croatia-Israelinvestment protection agreement. Enes Cerimagic told the press in Dubrovnik that Frenkel was filing the new request at a time when it was likely that the first one would not succeed. "We assume that it's again about the half-a-billion-eurosdamages claim. They are showing that they don't care about either European environmental law or European law, but are trying to bypassthe European legal order. We will get involved in all future proceedings whose only goal is to take half a billion euros from Croatian citizens' pockets," he said. Razvoj Golf demanded about HRK 300,000 in damages from Green Action as well ascriminal accountability for damaging its reputation. Djuro Capor said Srdj Is Ours had warned Prime Minister Andrej Plenkovic a number of times that Croatia must withdraw from bilateral agreements such as the one with Israel because they riskedtaxpayers' money due to "a corrupt and broker's project." "It's especially dangerous that... those who served the interest of the Razvoj Golfcompany are still publicly active," he said. Capor and Cerimagic said the ruling HDZ party's Dubrovnik branch should pay for the possible damage incurred in the sale ofthe land on Srdj. Capor said the sale was carried out in 2009 by the then mayor Dubravka Suica (HDZ) and that the HDZ's Dubrovnik branch "isresponsible for the mistakes". He said the current city administration was not innocent either as Mayor Mato Frankovic (HDZ) kept mum about the company's actions for years. Index shows terrorism has no impact on Croatia, daily says ZAGREB, Dec2(Hina) - Croatia is among the countries on which terrorism has no impact at all, according to the annual Global Terrorism Indexpublished by theInstitute for Economics & Peace which shows which parts of the world fear terrorism the most, Vecernji List daily said on Wednesday. ***Data*** in this year's index refer to 2019 and the index of terrorism's impact on Croatiawas 0.0. Only next year will it be known if this October's shooting at the government building will change Croatia's status. The attack shocked the Croatian public and Prime Minister Andrej Plenkovic said it had elements of terrorism. Terrorism has the strongest impact on Afghanistan, Iraq and Nigeria. Terrorist groups there are very strong, changing the everyday lives of their citizens, who are aware that there is a chance that a car bomb or an armed terrorist might randomly kill or wound them in the street. The situation is especially tough in Afghanistan, whose index score is 9.5. In 2019, the country accounted for 41% of the global deaths from terrorism. Nigeria is next with a score of 9. But the 2020 index brings good news as well. The number of deaths from terrorismhas been decreasing for the sixth consecutive year after peaking in2014, when Islamic State was on the rise, Vecernji List said. About 10,000 tourists staying in Croatia ZAGREB, Dec2(Hina) - There are about 10,000 tourists in Croatia and given the circumstances and restrictions in international travel, no major turnover is expected this month, although some hotels,campsites and privateaccommodation areopen, Croatian Tourist Board director Kristjan Stanicic has told Hina. Of that number, about 6,000 are foreign tourists and most are staying in private accommodation and hotels, Stanicic says, adding that the largest number of tourists are in Zagreb, on Vir island, in Split, Rijeka, Dubrovnik and Pula. Speaking of the results this year to date, he says they are as expected. According to the eVisitor system, 7.7 million touristsvisited Croatia, generating over 54 million overnights, down 50% on the year. There were 1.6 million domestic tourists who generated 11.2 million overnights, coming second after the Germans. After the Germans, the most numerous foreigners were Slovenians, Poles, the Czech and Austrians. Most overnights were generated in private accommodation (22 million), followed by campgrounds (8.8 million) and hotels (7 million). Broken down by county, most overnights were recorded in Istria, Primorje-Gorski Kotar, and Zadar, while the top destinations were Vir, Rovinj, Medulin, Porec, Mali Losinj, Crikvenica and Umag. In November alone, 94,000 tourists visitedCroatia, generating 470,000 overnights, which was 46% of the November 2019 numbers. Of that number, 59,000 were domestic tourists who generated 229,000 overnights. Most overnights were recorded in private accommodation (150,000) and hotels (120,000). Greenpeace brings economy ministry 65,000 signatures for banning plastic bags ZAGREB, Dec2(Hina) -Greenpeace on Wednesday handed to the economy ministry a petition for banning lightweight plastic bags which was signed by 65,000 citizens, and the ministry said the ban was envisaged in a new law as of 1 July 2021. With the petition, Greenpeace wants to encourage the government to ban lightweight plastic bags as well as point to the damage of pollution with single-use plastic. It also wants to encourage the ministry to implement as ambitiously as possible the European legislation on single-use plastic in the waste management bill that is in public consultation. Greenpeace activists put outside the ministry two-metre props - a crossed plastic bag and the number 65,000. "We are glad that citizens have recognised the Economy and Sustainable Development Ministry's intention to ban putting lightweight plastic bags on the market through a new law as of 1 July 2021," Assistant Minister Anamarija Matak said accepting the petition. The bill also envisages banning some single-use plastic products. Matak said the ministry was glad to be able to cooperate with civil society organisations during the public consultation as well as future activities aimed at finding solutions to the use of plastic. Activist Petra Andric said "large amounts of plastic end up in the environment and find their way to the seas, which are becoming the largest dumps in the world. They endanger marine life and reach the food chain." She said existing legislationhad not reduced the use of plastic bags and that only a ban could result in progress. Bosnia Federation lower house endorses gas connectivity with Croatia ZAGREB, Dec 2 (Hina) - The House of Representatives in the Bosnia and Herzegovina Federation entity on Wednesday adopted a law on a new gas pipeline, thus paving the wayfor Bosnia and Herzegovina (BiH) to be linked to the south interconnection of Croatia's gas network. The South Interconnection between BiH and Croatia was presented as a high priority project for the Federation entity which would run from Zagvozd in Croatia acrossPosusje-Tomislavgrad-Suica-Kupres-Bugojno-NoviTravnik and a branch on toMostarwhich would provide the country with an alternative supply route. Currently BiH relies solely on Russian gas from a pipeline running across Serbia. Director of theBH Gas company,Jasmin Salkic, said that the project would be implemented jointly with Croatia's Plinacro gas pipeline operator, The construction of the new gas interconnection is essential to maintain gas supply security and to diversify supply routes, Salkic said. The project has been classified as a key strategic project and is part of the country's energy framework strategy to 2025. The south interconnection project was launched after authorities in the Serb entity refused to connect to Croatia'sgas network in Slavonski Brod on the left bank of the Sava River, which would have been the cheapest approach. Authorities in Republika Srpska plan to build a pipeline that would run across Serbia again and rely exclusively on Russian gas. The south interconnection project is supported by the European Union throughits investment programme for the Western Balkans. The €101 million project envisages the building of180 kilometres of pipeline, 160 kilometres of which runs through BiH. Minister claims number of illegal migrant entries into BiH has decreased ZAGREB, Dec 2 (Hina) - There are between 7,000and8,000illegal migrants in Bosnia and Herzegovina while their influx into the country this year has decreased significantly due to measures taken by police agencies, Bosnia's Security Minister Selmo Cikotic has said,as carried by local media on Wednesday. In an interview withthe Sarajevo Hayat TV, Cikotic explained that temporary accommodationcentres have about 6,300 migrants registered, while it is estimated that another 1,500are staying in private accommodation. The number of migrants entering the country hasdecreased significantly, claimed Cikotic. According to him, that isdue to increased efforts not just by border police but also by the State Investigation and Protection Agency (SIPA) and entity interior ministers as well as the Intelligence-Security Agency (OSA). They are jointlypreventing migrants from entering the country or if they manage to get through, theysend them back to the country from which they came as well as prosecutingsmugglers. The concrete result of those efforts is that the 150 to 200 daily entries during the summer have been reduced to 20 or 30 a day in November. He commented on demands by cantonal authorities who are unhappy with migrant centres being in downtownurban areas. Una-Sana Canton, for instance, demandsthat migrants be relocated as it is faced with the highest concentration of migrants attempting to continue on through Croatia to other EU countries. Previously, due to pressure by local authorities, the Bira centre was closed down and migrants were resettled in a village some 20 kilometres away. Authorities in Velika Kladusa also demand the closure ofthe Miral centre,located in the very centre of the town. Similar demands are coming from the population near Sarajevo, particularly following an incident in late November when a 36-year old resident was killed after he was confronted by several violent migrants. The police managed to identify and arrest two suspects for that crime in Belgrade where they fled to after the incident. PIC Steering Board supports Inzko, his mandate, Russia against ZAGREB, Dec 2 (Hina) - The Steering Board of the Peace Implementation Council (PIC) in Bosnia has expressed clear support for High Representative Valentin Inzko, calling on local politicians to focus on reforms to help the country draw closer to European associations while Russia has distanced itself from this position. The PIC Steering Committee, which comprises the most influential Western countries, Turkey and Russia, held a meeting in Sarajevo on Wednesday at the level of political directors in the member-states' foreign ministries, and in a joint statement issued afterwards it once again affirmed its full support to the international community's High Representative "in ensuring full respect for the General Framework Agreement for Peace and carrying out his mandate under Annex 10 and relevant UN Security Council Resolutions, which remains unchanged." The statement came after repeated demands from the Serb entity, which have been joined by the local Croat HDZ BiH party, that the Office of the High Representative be closed down as soon as possible and all responsibility for the situation in the country be transferred to local authorities. In the international community, these demands are supported only by Russia, which has distanced itself from the joint statement of the PIC Steering Board, noting that Moscow could not accept interference in Bosnia and Herzegovina's internal matters. All the other members of the PIC Steering Board supported the statement which dismissed pressure on Inzko and his office as well as his mandate which leaves open the possibility of imposing laws and replacing elected officials if they are perceived to be violating provisions of the Dayton Peace Agreement. The PIC Steering Board "underlined that the International Community retains the necessary instruments to uphold the GFAP", with its members confirming that the basic precondition for the closure of the OHR was lasting stability in Bosnia and Herzegovina. It warned that local politicians should focus on reforms, notably those that refer to the rule of law and the fight against corruption as a key part of the EU accession process. It explicitly called for the reorganisation of the the High Judicial and Prosecutorial Council, which has been shaken by scandals due to suspicion regarding the integrity of its chair Milan Tegeltija. The OHR previously called on Tegeltija to resign over a scandal in which he was linked with irregularities concerning the appointment of a judge. Bosnia reports 1,200 new infections, 45 deaths ZAGREB, Dec2(Hina) - Bosnia and Herzegovina on Wednesday confirmed a little over 1,200 new coronavirus cases and45 COVID-related deaths asauthorities in parts of the country claim the situation is gradually improving and that their spread of the infectionis under control. In the past 24 hours a little over 3,400 samples have been tested, with 869 coming back positive in the Croat-Bosniak Federation entity and 349 in the Serb entity. The relatively high 24-hour death toll of 45 keepsBiH near the top of European states with the highest number of death-to-population ratio. The COVID death toll from March to date is 2,772. The epidemiological situation is not the same across the country. Sarajevo, for instance, is pleased with the trends. "The weekly incidenceis decreasing. Since November 1, when it was 776 per 100,000 inhabitants, it dropped to 448 on December 1," Kemal Beganovic, a member of the Sarajevo Canton's response team, told the press. On the other hand, Western Herzegovina and Herzegovina Neretva cantons are recording the highest rises in infection-to-population ratios. Slovenia logs 2,428 coronavirus cases, 57 deaths; 1 in 3 tests positive ZAGREB, Dec2(Hina) - In the past 24 hours 2,428 coronavirus infections have been registered in Slovenia and 57 COVID-19 patients have died, the government said on Wednesday. On Tuesday, 1,292 new infections were confirmed. The number of positive tests has jumped to 33.83%, which was last recorded a month ago, before the strictest measures were introduced. The head of the government's COVID-19 team, Bojana Beovic, told Slovenian Television last night that experts would propose that the government accept their plan for a criteria chart for a gradual relaxation ofthe restrictions. She said they would not propose new restrictions but insist on keeping the current ones and consistently applying them. As of today, 1,285 COVID patients are hospitalised, including 199 in intensive care. The death toll has reached 1,547. The mortality rate for COVID patients in the past week is the highest in Europe, Slovenian media said. EANA supports STA after Slovenian gov't suspends its financing ZAGREB, Dec 2 (Hina) -The European Alliance of News Agencies (EANA) on Wednesday expressed its support to theSTA, one of its members, after the Slovenian government's decision to suspend the funding of that national news agency put the agency in a precarious position. "Taking notice of the pressure exercised on our member STA by severely cutting or even stopping its income from the public service contract with the state owned UKOM, EANA - the European Alliance of News Agencies - expresses its support for the independence of its member, urging the Slovenian government to make sure that any further moves against STA, that would alter the Slovenian news agency's workflow, reputation and business, come to an end," the EANA said. "Mass media is the cornerstone of democracy, and news agencies are the backbone of free media worldwide. More so, national news agencies represent one of the most important voices of their respective countries in the world. This is why, especially during crisis times like the ones we are all crossing right now, maintaining the freedom of these voices is of the greatest importance to both the mass media environment and for the perpetuation of democratic societies.," the alliance said in a press release. "STA must continue to function as an independent and reliable national news agency. Its contribution to the Slovenian democracy should be supported, rather than hindered by the relevant authorities." The Slovenian government's decision to cease funding the national news agency has not yet been formally announced. However, local media outlets have reported that the outlays for November have not been paid to the STA and the government's communication office UKOM has decided not to renew the contract with the STA for 2021. Media outlets have reported that the Janez Jansa cabinet is irritated by the fact that during the corona crisis, the news agency gave more attention to less important events than to the statementsand the work of the cabinet and Prime MinisterJansa. Two coalition partners in the four-member ruling coalition have distanced themselves from the cabinet's intention. However, another partner, the SMS party of Deputy Prime Minister Zdravko Pocivalsek, said thatit would be prudent forboth sides to fulfill their part of the responsibilities, which, he believes, will facilitate the cooperation between the government and the STA. The government has threatened not to finance the news agency citing insufficient information about the STA business activities. UKOM head Uros Urbanija accused STA manager-general Bojan Veselinovic of failing to provide UKOM with the full business documentation despite repeated requests. Urbanija says that the documentation is necessary for efforts to determine "adequate amounts" for the smooth performance of the agency's work. The STA says that it informs its supervisory board and UKOM about all the elements of its business, however, they did not want to send its commercial contracts to UKOM. The STA adds that it "regularly informs the Supervisory Board of the STA about its operations and provides other information in a transparent manner, and its annual reports are also discussed by the National Assembly and the National Council." Journalists' associations and trade unions in Slovenia have informed the general public and the international community of the government's attempts to restrict media freedoms and to exert pressure on the editorial policies of media outlets. President Pahor expresses support to STA ZAGREB, Dec2(Hina) - Slovenia's President Boris Pahor on Wednesday extended his support to the national news agency STA afterthe government's decision to suspend its financing put the agency in a precarious position. "The Slovenia Press Agency (STA) is doing important work in the interest of the public, which is why its existence should not be jeopardised,"President Borut Pahor was quoted by the STA as saying on Wednesday after he held separate meetings with STA director Bojan Veselinovic and the head of the government's press and communication office (UKOM), Uros Urbanija. Pahor "called on the government and the STA management to resolve, in line with regulations, issues that have resulted in suspension of financing forthe agency." Serbia reports 7,919 coronavirus infections, 52 deaths ZAGREB, Dec 2 (Hina) - A total of 7,919 new coronavirus infections and 52 related deaths have been confirmed in Serbia in the last 24 hours, the country's health ministry said on Wednesday. A total of 7,611 COVID-19 patients are hospitalised, of whom 270 are on ventilators. Since the start of the epidemic in late March, 191,356 people have caught the disease and 1,704 have died, with the mortality rate standing at 0.89%. The Serbian government is expected to adopt, by the end of the week, new measures that have been proposed by the national coronavirus crisis management team, which refer to additional restrictions on opening hours anda ban on work on weekends except for shops, pharmacies and petrol stations, which will be allowed to sell petrol only. According to official ***statistics***, since the start of the epidemic Serbia has tested 1,822,488 people, including 22,069 in the last 24 hours. Starting from November 24, the health authorities have been testing more than 22,000 people on a daily basis. Montenegrin parliament debates formation of new government ZAGREB, Dec 2 (Hina) - Montenegro's prime-minister designate Zdravko Krivokapic on Wednesday presented a draft government programme to the parliament, and after a debate,which is expected to last at least two days, MPs will vote on the programme and the proposed candidates for ministerial positions. Presenting the programme, Krivokapic noted that the government's priority wouldbe the fight against corruption and crime, justice and equality, good neighbourly relations, ensuring fair play at elections, reducing the cost of public administration, creating public trust and ensuring complete transparency in state administration procedures. He added that the new government "will continuenegotiations with the European Union atfull capacity, so that Montenegro can become a member as soon as possible." Krivokapicadded that the outgoing government waspursuing "a scorched-earthpolicy in order to make our work more difficult". The existing crisis can only be overcome with reforms, fair administration andcompetence and by permanently strengthening the economy and improving the rule of law, said Krivokapic. He added that his government wanted to work on boosting the manufacturing industry, food production, IT sector, tourism and sustainable and inclusive economic development. Last week Krivokapic presented a proposal for his cabinet consisting of 12 ministers andone deputy prime minister, while the outgoing government led by Dusko Markovic had 18 ministers and four deputy prime ministers. Attending the presentation of the new government's programme was also President Milo Djukanovic. Some coalition partners do not support all cabinet members but will support the government? Nebojsa Medojevic, one of the leaders of the Democratic Front whose coalition slate was headed byKrivokapic, said at the start of the parliament session that he did not consider the presentation of the government platform to be serious as it did not contain any deadlines and asked that Krivokapic be given one more day to amend it, but his proposal was rejected. The Democratic Front (DF) is one of the fiercest critics of Krivokapic's proposed governmentalong with Djukanovic's opposition Democratic Party of Socialists because it did not get any ministerial posts and it has said that it willgive the government 200 days to show results, promising its deputies will vote for the new government. DF claims the government is actually a minority government,formed by the 'Black on White' coalition led by Dritan Abazovic andthe Serb Orthodox Church sincemost of the proposed ministers are close to the SerbOrthodox Church. The new government holds 41 of 81 parliamentary seats so just one vote can tip the scales. The only deputy prime minister is Abazovic, who is also the only minority representative in the government as parties representing other minorities have refused Krivokapic's proposal to join the government. In other news: Croatian Pensioners' Party gets new leader ZAGREB, Dec 2 (Hina) - The Croatian Pensioners' Party (HSU) elected its new leader, retired general Veselko Gabricevic, in intraparty election held on Monday. Gabricevic succeeds Silvano Hrelja, who recently resigned after being at the helm of this parliamentary party for 12 years. During the election, which was adapted to the current circumstances marked by the COVID-19 pandemic, 307 HSU delegates sent their ballots from offices of public notaries to the party's main office from 10:00 to 13:00 hours Monday. Former deputy minister sentenced to 3 years in bribery retrial ZAGREB, Dec 2 (Hina) -A former director of the Housing Administration and deputy veterans' affairs minister, Dinko Mikulic, was sentenced by Zagreb County Court to three years in jail pending appealfor taking a €50,000 bribe. The time he hasspent in custody, from 28 December 2012 to 28 June 2013, will be credited to his sentence. Mikulic has been ordered to pay the unlawful gain of HRK 362,800 into the state budget within 15 days of the ruling becoming final. He is also obliged to pay the costof experts' reports in the amount of HRK 146,000. 35-year-old man charged with threatening prime minister ZAGREB, Dec 2 (Hina) - A 35-year-old man has been indicted by the Osijekcounty prosecutor's office on the suspicion that he madethreats on social networks against Prime Minister Andrej Plenkovic, the prosecutor's office said on Wednesday. Without naming the state official who was the target of the threats, prosecutorial authorities said the suspect was charged with making threats ona social network on several occasions against a state official whose policy he was unhappy with, with the intent of intimidating him. The indictment says that due to the risk of the crime being repeated, prosecutorial authorities recommendextending police custody for the suspect who has been in detention since his arrest onNovember 19. Indices leap for 3rd day in a row ZAGREB, Dec 2 (Hina) - The main Zagreb Stock Exchange indices leaptfor the third day in a row with the Crobexsoaring by 2% to 1,749 points and the Crobex10 by 1.84% to 1,088 points. This is their highest level since the start of March and in the past three days both indices recorded increases of more than 3%. All sector indices closed in the green too with thetourism sector recording the biggest increase of 5.5%. Regular turnover amounted to almost HRK 13 million or about 7 million more than yesterday. The highest turnover of HRK 1.87 million was generated by the Valamar Riviera hotel group with the price of its shares jumping by 2.14% to close at HRK 28.6. That last time Valamar shares were at that price was on 10 Junethis year. The preferred shares of the Adris tourism and insurance group generated a turnover of almost HRK 1.7 million with the price of its shares also jumping, by 2.11% to HRK 388. The HT telecommunications stock generated a turnover of HRK 1.63 million. HT shares increased in price by 1.38% to their highest price since February, closing at HRK 183.5 per share. (€ 1 = HRK 7.549922) THIS BULLETIN INCLUDES NEWS ITEMS RELEASED BY 2100 HRS WEDNESDAY. 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Americas

Canada-based Ingenia Polymers has acquired the La Porte, Texas, masterbatch tolling operations of LyondellBasell, also known as Bayshore Industrial. Financial terms were not disclosed. This is the first acquisition by the company. Ingenia’s line of business includes the manufacturing of synthetic resins, plastics materials, and non-vulcanisable elastomers. This is the first acquisition for Ingenia Polymers

Plastic packaging manufacturer Berry Global Group has begun commercial production of its trademarked non-woven material Spinlace at its facility in Moorsville, North Carolina. This is the latest decision taken by Berry to meet demand for healthcare materials in the wake of the coronavirus. The facility is adding 17,000 tonnes/year of capacity to the marketplace. The Spinlace asset makes various wipes for the healthcare, hygiene, household cleaning, foodservice, and industrial markets.

Brazilian energy major Petrobras will proceed with plans to idle a nitrogen fertilizer plant in Parana state following the end of a strike by the nation’s oil workers union (FUP).“The factory has stopped its production, operating only systems to maintain the safety of the equipment,” the company said. The two sides reached a resolution earlier in March, with the workers agreeing to accept a benefits package proposed by Petrobras and Brazil’s Superior Labour Court.

Canadian midstream energy and petrochemicals company Pembina Pipeline is cutting capital spending by between Canadian dollar (C$) 900m to 1.1bn ($625-764m) as it reacts to the coronavirus pandemic and the recent decline in global energy prices. Several projects will be deferred, including Pembina’s investment in the Canada Kuwait Petrochemical Corp (CKPC) petrochemicals joint venture. Pembina expects its revised 2020 capital budget to be C$1.2-$1.4bn - down from previously planned C$2.3bn.

Carol Hochu, CEO and president of the Canadian Plastics Industry Association (CPIA), will leave the group on 18 March, she confirmed in an email to ICIS. Her resignation comes as CPIA is set to merge with Chemical Industry Association of Canada (CIAC) and then continue as a new Plastics Division within CIAC. Jon Pyper, a former CPIA board member, will take over as CPIA’s interim leader to oversee the merger, scheduled for 1 July.

Finnish refining and renewable fuels company Neste has agreed to acquire Mahoney Environmental, a US-based collector and recycler of used cooking oil. Mahoney, of Joliet, Illinois, ***collects*** used cooking oil and turns it into renewable fuels. With the acquisition, Neste will gain access to “a substantial volume” of used cooking oil as well as a platform to grow its raw material supply chain in North America, CEO Peter Vanacker said.

Bartek plans to raise its malic acid capacity by 10,000 tonnes/year, the Canadian producer of malic and fumaric acids and maleic anhydride (MA) said. The expansion, to be completed in Q1 2021, follows a 4,000 tonne/year expansion completed last year, as well as the previously announced installation of a new 22,500 tonne/year MA reactor, which will also be operational in early 2021. With the expansions, Bartek will have in excess of 30,000 tonnes/year of malic acid capacity in place.

German fertilizer firm K+S plans to sell its North and South American salt business, with a deal expected to be signed before the end of 2020. The divestment is part of a “comprehensive realignment and restructuring of K+S.” The sale of the salt business, along with other measures, will make it possible for K+S to reduce debt by more than 2bn over the next two years, it said.

Hess Midstream is cutting its 2020-2021 expansion capital expenditures by $200m, compared with earlier plans. For 2020, Hess is cutting the expenditure to $260m, down by $75m or 20% from its previous guidance. Full-year 2020 maintenance capital guidance of $15m remains unchanged. For 2021, Hess Midstream plans to reduce expected expansion capital expenditures by about $125m, or 55%, to about $100m, relative to its previous plan.

US president Trump issued an order on 13 March to purchase oil for the country’s strategic reserve (SPR), a move not enacted since 2011. This comes following the declaration of a national emergency in the wake of the coronavirus outbreak. No details were provided on volumes or purchase price. A memo was issued later that evening by the Energy Secretary to start an “expedited process” for this purchase. The reserve, the world’s largest, has 713.5m bbls of authorised capacity.

europe

Covestro has inked a new expanded 2.5bn credit facility to provide additional financial stability, the Germany-headquartered chemicals major said. It has agreed terms with 16 banks for a revolving credit facility to replace its existing 1.5bn financing line. The new credit line is linked to the environmental, social, and governance (ESG) rating, where strong performance allows for lower interest levels.

Inflation in the eurozone sank to 1.2% in February amid lower energy pricing, ***statistics*** body ***Eurostat*** said. Inflation levels for the currency bloc fell 0.2 percentage points month on month, with energy pricing falling during the period. EU inflation fell 0.1 percentage points over the same period to 1.6%.

Sika is building a new plant at Sarnen near Lucerne, Switzerland, to produce flexible polyolefin (FPO) water-proofing membranes, the Swiss construction and specialty chemicals major said. Sales of the SikaProof membrane products - used to waterproof below-ground structures and basements - are expected to double by 2023. More stringent requirements for water-tightness of basements in the wake of growing urbanisation and densification are fuelling demand.

The board of chemical tanker specialist Stolt-Nielsen has voted to cancel its proposed final 2019 dividend pay-out as it looks to preserve liquidity for the impact of the coronavirus outbreak. The board of directors voted to withdraw the proposal to pay out $0.25/common share ahead of the of its full-year 2019 results announcement, which would have brought its full dividend for the year to $0.50/share.

BASF has postponed its annual shareholders’ meeting due to bans on large public assemblies in Germany during the coronavirus crisis, meaning that its proposed dividend will not be ratified by the original 6 May pay-out date. It had been expected to convene the meeting on 30 April in Mannheim but has pushed back the date after assemblies of more than 100 people were banned in the country. The company aims to hold the meeting within six months of the start of the fiscal year, running to 30 June.

Sasol is to expand and accelerate its asset disposals programme, may seek a partner for its US base chemicals operations, and is contemplating a rights issue worth up to $2bn as part of a raft of measures to pay down debt, the CEO of the South Africa-based producer said. The company is looking to raise around $6bn by the end of its fiscal year 2021 through a mix of cash savings, expanded asset sales, and a sale of new shares to existing investors. CEO Fleetwood Grobler said the measures are intended to “reset” Sasol’s balance sheet

BASF is set to begin production of hand sanitizers at its Ludwigshafen petrochemicals hub in Germany and will distribute them for free to nearby hospitals to help alleviate supply bottlenecks amid the coronavirus crisis. The company has obtained quick regulatory approvals to begin the production, and several tonnes of isopropanol have already been re-allocated to enable hand sanitizer production at the site.

Germany’s Volkswagen Group (VW) is shutting down most of its automobile production in Europe on the back of the coronavirus pandemic. Plants in Spain, Portugal, Slovakia and Italy are already down, and most of the remaining European production is set to be shut for about two weeks, CEO Herbert Diess said in a webcast press conference. The company has been hit by auto parts supply disruptions, officials said.

MOL is preparing substantial new investments in the petrochemicals space as the Hungary-based oil and gas major seeks to rebalance its revenues toward higher-value products. The firm has been developing a new roadmap to diversify its business towards higher-value areas such as petrochemicals and sustainability and away from its core oil and gas business, according to Ferenc Horvath, executive vice president of MOL’s downstream business.

German economic sentiment plummeted by the sharpest level since records began in 1991, economic research firm Zew said, on expectations of GDP contraction on the back of the coronavirus outbreak. The institute’s survey of analyst sentiment fell 58.2 points compared to the previous month in March, to a level of -49.5 as markets brace for a GDP decline in the first quarter, according to Zew president Achim Wambach, who said the economy was on “red alert”.

asia

China will increase export tax rebate for melamine to 13% from the current 10% from 20 March, in a measure to boost the country’s exports. The export tax rebate also will benefit close to 1,500 products, according to an official statement from the Ministry of Finance. “The news may weigh on the melamine export market, as buyers may ask lower prices,” a major Chinese melamine producer said.

Certain Southeast Asian ports have issued fresh restrictions this week amid increased cases of the coronavirus outbreak in the region. Johor port in Malaysia issued a notice this week that declarations must be submitted and ship crew must obtain clearance for shore leave from the immigration department. Ship crew are also not allowed to depart the ship unless in the event of an emergency. Anyone on board who has travelled to China, South Korea, Japan, Italy and Iran within the past 14 days will not be allowed to enter the port.

China will increase tax rebates for over 1,400 export items from 20 March, including many chemicals such as ethylene, propylene, 1-2 butene, styrene, polystyrene etc, the Ministry of Finance said. Products like o-xylene, m-xylene, formaldehyde, acrylonitrile-butadiene-styrene (ABS) resins and toluene diisocyanate (TDI) are also included in the list. The rebate rates for those chemicals will be hiked to 13%. Their current rates are mostly 9%.

Pengerang Refining and Petrochemical’s (PRefChem) shut its refinery complex in Johor, Malaysia following a fire and an explosion that hit the site late on Sunday, killing five people and injuring one. The incident occurred at the diesel hydro treating (DHT) unit within the Pengerang Refinery Complex.

China saw a heavy battering on its economic performance in the first two months of 2020 amid the coronavirus outbreak. Industrial output contracted by 13.5% year on year in January to February, the steepest fall in 30 years, according to ***data*** published by the National Bureau of ***Statistics*** (NBS). Fixed asset investment dropped by 24.5% year on year in the first two months, compared with 5.4% growth in December 2019.

China will cut its reserve requirement ratio (RRR) for banks that have met inclusive financing targets by 0.5-1.0 percentage points from 16 March to support growth and reduce funding cost, the central bank announced. The RRR for qualified commercial banks will be reduced by an additional 1 percentage point, the People’s Bank of China said. The move will inject CNY550bn ($79bn) of long-term liquidity.

India’s overall vehicle output fell by 18% year on year in February as producers cut output ahead of the implementation of new emission standards from April this year, industry ***data*** showed. Vehicle sales and exports also posted double-digit declines in February, the Society of Indian Automobile Manufacturers said. Production of two-wheelers, which made up of 78% of overall output, fell by 18% year on year to 1.58m units.

China’s n-butanol (NBA) plants posted an average operating rate of 61% in the week ended 12 March, unchanged from the previous week, according to the ***data*** compiled by ICIS. Sinopec Qilu Petrochemical cut the operating rate of its 85,000 tonne/year NBA plant from 100% to 90%. PetroChina Daqing Petrochemical reduced the run rate of its 80,000 tonne/year NBA plant from 80% to 70%.

middle east & africa

Saudi Aramco, the world’s kargest crude exporter, will cut its capital expenditure (capex) this year amid a low oil price environment and weakening demand, as it reported a 21% decline in full-year 2019 net profit. It will reduce total 2020 capital spending to between $25bn-30bn from $32.8bn in 2019, “in light of current market conditions and recent commodity price volatility”, the state-owned energy firm said.

JOURNAL : Farmers Weekly

Clever loader attachments from our 2020 Inventions Competition included a pukka wheel weight lifter, swivelling telehandler bucket and a brilliantly simple feeder hook.

Keith Maxwell’s hydraulic lifting jib

Steel frame erection has been simplified by Keith Maxwell’s 3m-long hydraulic lifting jib.

See also: Workshop tips: What you need to know to use grinders safely

The telehandler attachment was constructed from universal beam, a hydraulic ram and Manitou headstock, and has a second hook halfway along its length for lifting heavy items.

Hydraulic side shift is by way of a ram plumbed into the loader’s third service, and it offers a total articulation of 150deg. Combined with the headstock tilt/crowd and boom in/out functions, it offers movement along three axes.

This means there is no need to move the whole telehandler to make slight adjustments, which has improved safety and accuracy, says Mr Maxwell.

It took a week to construct and, so far, has been employed on six shed building projects.

Kevin Trotter’s excavator adaptor plate

A neat attachment adaptor plate has allowed Kelso-based Kevin Trotter to get more use out of his 360 digger.

The steel assembly allows attachments designed for a JCB Q-Fit carriage to be hooked to the farm’s recently purchased JS130 excavator.

Expenses were modest, as Mr Trotter already had all the essential components – spare Q-Fit carriage, 2.5cm-thick steel plate and pins – tucked away in the workshop. Manufacturing took just an evening, though it involved a fair bit of planning, he says.

It’s meant that in wet years – last autumn being a prime example – he can load muckspreaders with the tracked machine, significantly reducing ground compaction compared with a telehandler.

DJ’s wheel weight loader attachment (simple category highly commended)

Wrestling with wheel weights carried on pallets often takes two men, lots of time and, probably, the odd health and safety breach, but not so with Derek Howard’s loader attachment.

His smartly finished tool was built from an old cultivator stub axle bolted to a steel frame that forms the telehandler attachment. To the turning axle he fitted six nylon-lined carrier brackets and three locking arms.

In use, the operator slides the hub through the centre of the weight. Once in position, the locking arms are turned through 90deg to hold it in place.

The weight can then be offered up to the tractor wheel and the beauty of mounting it on a free-turning axle is that it can easily be lined up with the bolt holes.

Mr Howard says it has proved particularly useful on his Fendt 828 with Variogrip tyre inflation system, as the weights include a recess that must be carefully positioned over the check valve.

The build cost totalled just £150, as most of the components were already in stock.

John Adams’ feeder hook

Stock farmer John Adams from Ringwood, Hampshire, knocked together a gloriously simple hook for shifting ring feeders while still having a bale of silage on the loader tractor.

It’s notoriously difficult to repair and reseed the ground around permanently positioned ring feeders in the spring due to poaching, a build-up of uneaten silage and a trench of slurry. Therefore, he chooses to move the feeders at every refill.

To do this, he made a hook from 20mm bar roughly 75cm long. The top part of the hook hangs on the front loader or bale spike, allowing the feeder to be lifted at the front and dragged backwards to fresh ground.

The two bottom hooks are welded at right angles to each other so at least one of them will catch on the top ring of the feeder. The hook also works well on tombstone feeders, he says.

Robert Wright’s swivelling telehandler bucket (intermediate category highly commended)

Narrow feeding passages are pretty common on livestock units and getting grub into the right places with modern kit can be a bit of a challenge.

Northern Irish engineer Robert Wright was tasked by one of his dairy farming neighbours to build a swivelling bucket for the front of his loader. The clever design means the bucket can be used in a normal fashion or be spun 90deg to deposit material at the side of the handler.

For this, Mr Wright attached the bucket supplied by the farmer to a box section frame with a pivot point located vertically for the bucket to swing from. This was approximately one-third in from the right-hand edge and it took a fair few attempts to get the weight distribution correct.

This means when the bucket is turned 90deg, the weight distribution is 70% in front of the headstock and 30% coming back towards the machine.

A solenoid valve has ben piped to the third service, so the bucket and subframe can be swung out and still have tipping and crowding functions, thanks to two rams fitted between the subframe and the bucket.

A clever latch system was needed during normal work, as the bucket tended to creep away from the frame. It is based on a single-acting hydraulic ram and a spring mechanism working on the principle that oil takes the path of least resistance, so when the flow begins, it unlatches before the bucket is pushed out.

The spring-loaded part of the system will automatically lock the bucket when it returns to its original position to avoid any creeping.

The whole project took about a month to complete and cost in the region of £4,500. Mr Wright admits that if he were doing it again, the positioning of the rams to crowd the bucket would be altered.

Simon Frederick’s bale kit

In order to take full loads back to the yard, Kent farmer Simon Fredricks adapted his flat eight-bale sledge so it was leaving piles of 10 bales that would take up the full load-bed on his trailer.

The 10-bale affair turns the end two bales and according to Mr Fredricks, actually ties in better and makes the stack more stable during transport.

Local mechanic Joe Still helped to convert the sledge, which involved using some half shafts from a Land Rover as well as beefing up areas of the machine to get the bales flowing out correctly.

To unload the bulging trailer back at the yard, the pair converted a couple of Browns eight-bale grabs into a huge 20-bale lifter. The grabs cost the grand total of £95, with the most expensive parts being the new hydraulic pipes.

It took the best part of a week to make and fits the farm’s John Deere 3800 articulated loader. The grabs have been braced with some heavier-grade steel, as the original units needed some reinforcing.

Adrian Marsh’s knife bucket

Shropshire fertiliser spreading contractor Adrian Marsh was determined to stop his workforce putting themselves in danger by climbing up on fertiliser spreaders to split bags.

He came up with the idea of building a bucket that could take 4.2t of fertiliser before being tipped into the spreaders. Made from 3mm sheet steel, the bucket has a set of forager wagon knives in the top to split bags as they are lowered in, so the operator doesn’t leave the seat and can unload six bags at once.

Once full, the Claas telehandler hooks on and tips into the hoppers. All the staff are now so set on the idea, that if the bucket has been moved, they’ll go and find it rather than loading the old way. So far, more than 6,200t have been loaded with the bucket, with no spillages.

It took two days to put together. The first day was spent assembling it, but when it was tested, there wasn’t enough angle to tip the fertiliser out. So, the second day was needed to tweak the design, although it never received a lick of paint.

Mark Wagstaff’s bale grab

Bawtry contractor Mark Wagstaff was looking for a squeeze grab that didn’t have the D-shaped paddles on, as he wanted to get tighter bale stacks to stop vermin and birds nesting in the holes.

Realising he couldn’t find anything, he set about designing and making his own. He used a couple of lengths of 100mm box section for the arms,  which are tapered at the end to slide in between bales. It is also possible to unstack without puncturing the wrap.

The build took about a week to complete in April 2019, once all the pipework and metal had been delivered. Mr Wagstaff shifts up to 7,000 bales a year and although he reckons the grab cost him similar to a new one, the end product is something that is fit for the job, and he no longer has to leave gaps in between bales.

Gary Brandrick’s bale grab

Switching from chopped silage to round bales meant Gary Brandrick had to find an easier method for splitting up the bales to feed his 60-strong herd of dairy cows.

His feed shed consists of two long, narrow passages and, rather than spending money on a feeder wagon, he came up with the idea of mounting two shear grabs together in order to break round bales into manageable chunks.

He already had a 20-year-old Parmiter grab and managed to source another identical one on eBay for just £65, conveniently located only 10 miles down the road. He took the forks off and mounted the grabs together, leaving a little gap between them to avoid any pressure issues when they close.

Luckily, his JCB 530-70 doesn’t show any slowdown in hydraulic flow while coping with two grabs, and they shut evenly every time. Mr Brandrick is able to cut bales up into little chunks and he is now a dab hand at removing the plastic as well.

The grab is now four years old and handles about 800 bales a year on the Derbyshire farm.

JOURNAL : Farmers Weekly

Several inventive tractor attachments, entered into the 2020 Farmers Weekly Farm Inventions Competition, have helped resourceful farmers reduce work hours and expenses.

See some of the best, including Tom Jefferies with his front linkage conversion and Charlie Land's linkage-mounted mudguards.

See also: Workshop tips: A guide to oxy acetylene gas cutting and welding

Harri Whittingham’s carrier frame

An L-shaped, front-mounted load carrier has allowed sheep farmer Harri Whittingham to complete more tasks with fewer machines.

The box-section frame and chequerplate base – together with reflectors and paint – cost £450 to assemble.

It allows him to carry races and gates, or the ATV, on the front of the tractor – held in place by ratchet straps – while the stock box is hooked on the back.

This has turned out to be particularly useful as the farm fattens lambs 30 miles from its base, saving two people transporting all the kit across separately.

Niall Murphy’s front-mounted cameras

After purchasing a front-mounted mower, Niall Murphy decided he needed to come up with a way of improving visibility for him and other motorists when pulling out on to the road.

His solution was to mount two night-vision cameras on the mower bed – one looking left and one right – and add lights protruding above the mower guards so drivers can quickly spot the mower as he is inching out.

To make use of the cameras when he isn’t mowing, he also made a bracket to attach them to the front of his Deutz-Fahr X720.

This has a fairly long bonnet, so the cameras significantly improve safety for other jobs that involve driving on the road.

The cameras were purchased online for £70 apiece and rather than opting to view them on a split screen, each has its own large display.

Tom Jefferies’ front linkage conversion

Somerset farmer Tom Jefferies and his brother, Josh, designed a front linkage adaptor that allows them to harrow and aerate grassland at the same time.

The new frame was constructed predominantly from box section, with flat plate used to form the mounting clevises.

It clamps around the main beam of the Hatzenbichler harrow and stretches over the tine assembly to a new linkage at the rear of the machine.

Mounting to the Massey Ferguson 7620’s front linkage is via an old scraper A-frame. Other bits used in the build include muckspreader repurposed as reinforcing plates.

Pairing the grass harrow and Browns Slitmaster aerator has saved countless field passes and it also appears to have impressed some of the neighbours, as Mr Jefferies has landed several contracting jobs.

Paul Spinks’ Skeyton Slop Slinger

In a bid to keep roads as clean as possible during the sugar beet lifting campaign, Paul Spinks from Skeyton, Norfolk, made some clever modifications to his Suton sweeper brush.

This involved extending the original 1.75m rotor to 2.25m – tailoring it better to the width of his tractor – and adding a separate 0.5m unit to the rear, set at 90deg to the direction of travel.

This flings the slop well away from the edge of the road so vehicles hugging the verge don’t end up splashing it back onto the carriageway.

It was put together over a couple of days using recycled metal, a few extra brush sections and a second hydraulic motor borrowed from Mr Spinks' home-made chaser bin.

Charlie Land’s linkage-mounted mudguards

A set of linkage-mounted mudguards have helped keep Charlie Land’s John Deere 6250R relatively clean.

The kit, which fits pretty universally to all 6R tractors, was made from 75x25mm steel off-cuts combined with worn-out conveyor belts previously used on concrete crushers.

The only cost was for the welding gas and wire, electric and spray paint, but if it was built with new materials, Mr Land reckons it would cost roughly £80.

To drop them off, he typically sits them on the drawbar of a trailer or props them against a wall.

Stuart Pears and Kevin Lester’s straw-baling press

A ground-driven straw press built in the farm workshop by Stuart Pears and Kevin Lester, from Faldingworth, Lincolnshire, has helped put a stop to regular blockages under the tractor and improved the flow of material into the baler.

The front-mounted kit was built predominantly from old power harrow parts found in the hedge, with the 250kg packer unit forming the main press.

This can be filled with water to add more weight, if needed.

Warning lights across the front help when pulling out from concealed gateways. The total cost was £110.

Paul Woolsey’s tractor crane

Lincolnshire farmer Paul Woolsey needed a lifting device that would work on the rough ground in his shed to help him split a David Brown 1490 without spending thousands of pounds on expensive engine hoists.

His design uses parts cobbled together from his yard, including an old plough ram, which had to be welded into a tube to make it longer.

The top lifting bar is reversible to gain extra height and wheels were added at the base to take the weight of the heavier items, such as the David Brown’s engine.

Fine adjustments can be made with the top link for lining up gearboxes. All in, the build cost half a box of welding rods over a few afternoons.

It has already proved extra useful for other lifting and shifting jobs.

David Cook’s potato digger

David Cook grows a small area of potatoes for farm shops near Preston, Lancashire, and has built a one-man lifter that chops the tops and loads into a trailer towed behind.

The starting point for the project was a single-row Johnson digger with 22in webs that Mr Cook bought for £400.

To the front of this, he has added a flail, which has been fashioned out of parts scavenged from a Ransomes self-propelled mower.

These include the petrol engine and the original grass-cutting cylinder, which has been cut down and fitted with home-made flails.

The height of this can be adjusted so it’s skimming the top of the ridge.

Finally, a cut-down elevator from an old Ransomes Faun lifter was added at the rear to load into a trailer towed behind.

Mr Cook admits that it’s a bit of a “Heath Robinson” set-up, but it only cost £600 to put together and will comfortably lift 4t a day.

It’s also the only outfit he has seen that does all these jobs in one.

Tonka’s gear shifter and camera

Spending 1,500 hours a year driving a hedgecutter for JS Rose Country Contractors in Dorset prompted Tony Adams, known locally as Tonka, to develop a nifty solution to save chronic neck ache and make his life a little easier.

The John Deere 6920 he drives has standard powershift buttons on the right-side of the tractor, but no way of changing gear on the left side, where the hedgecutter controls are positioned.

So, he extended the wires under the seat from the shifting button on the right and mounted a new £40 switch next to the hedgecutter joystick.

He has also installed a rear-facing camera on the bottom of the external mirror that gives him full view of the trimming head.

His work involves a lot of council verges and mowing around signposts and Armco barriers.

He says he is so used to it that he now controls the hedgecutter solely from the camera’s 18cm display, even when the head gets cosy with the tractor’s wheel.

It cost about £100 for the camera and screen, but has transformed his job.

JOURNAL : Farmers Weekly

A growing number of farmers are overhauling their systems and are now farming in a way that has little impact on soil health, includes greater diversity and leads to more resilient crops which need fewer inputs.

Enthusiasts of 'Regenerative ***Agriculture***' – which is also referred to as conservation ***agriculture*** – also point out that healthy soil functions can deliver carbon and ecosystem services.

This is something that growers will increasingly need to be able to demonstrate as direct payments are replaced by support based on environmental measures.

See also: How a grower slashed insecticide use by splitting fields

What is regenerative ***agriculture***?

Sometimes referred to as conservation ***agriculture***, regenerative ***agriculture*** is a system of farming principles and practices that aims to increase biodiversity, improve soils, protect the environment and enhance ecosystem services.

Common principles include:

Limiting soil disturbance

Building diversity through rotation

Keeping the soil covered

Integrating animals.

Resource use efficiency

Already using resources more efficiently, Regenerative ***Agriculture*** practitioners are also starting to measure reduced tillage's contribution to carbon sequestration, the value of greater biodiversity and the potential for farmland to reduce the risks from hazards such as flooding.

At the recent Biodiversity, ***Agriculture***, Soil and Environment (Base) conference in York, those who have already taken the plunge and changed the way they farm all agreed on one thing – there is no blueprint.

Instead, they are having to find ways of making it work on their own farms, learning from each other and from their mistakes. For this, knowledge transfer is key, which is why Base was formed eight years ago.

Water holding

“It’s never been so relevant as this year,” said Northumberland farmer and Base chairman Edwin Taylor.

“After such a difficult winter, there’s renewed focus on soils and their ability to deal with water. It’s been a steep learning curve for everyone, but the system has performed.”

There was no shortage of ideas and enthusiasm at the event. As Scottish farmer Robert Brewster, one of the conference speakers, explained, having a “low-tech, high-biology” farm which follows nature’s model has made his business more resilient and sustainable, with wildlife also being a winner.

His system has recorded slow and steady increases in soil organic matter, less poaching and much better water holding capacity, despite receiving up to 1,000mm annual rainfall.

Nitrogen reductions

For south Lincolnshire farmer George Sly, who has already cut machinery, fuel and labour costs and improved his soil through strip-tillage and cover crops, the next focus is to further reduce inputs, specifically synthetic nitrogen fertilisers.

As his business moves towards carbon neutrality, he plans to eliminate the broadcasting and spraying of nitrogen on to crops by 2021.

“All of it will be sub-surface or side dressed in very small doses,” he says. “I’m hoping to have stopped using it altogether by 2025.”

For that to happen, he will be making greater use of white clover sown in between crop rows and then hand mown, so that it releases nitrogen and allows the crop to grow.

The same topic is also on Oxfordshire farm manager Julian Gold’s mind. The current Soil Farmer of the Year, Mr Gold has calculated the carbon footprint of his farm and identified nitrogen fertiliser as his main target.

“We need to improve nitrogen use efficiency. In order to do that, I am investigating companion cropping, the use of a clover under-storey, and direct drilling spring crops into established winter beans.

“There are ways of reducing nitrogen fertiliser use and it’s up to us to learn about them, before restrictions come into force.”

Resilient cropping systems

Adrian Newton of the James Hutton Institute has been working on resilient cropping systems, looking at the role of variety blends and intercropping, as well as the effect of different cultivation systems on crop performance.

Prof Newton’s findings include:

Variety blends give a 6-7% yield increase in most situations and have up to 50% less disease, as well as being less susceptible to lodging.

Some varieties respond differently with less soil disturbance, making them more suitable for no-till regimes. A good example is the spring barley variety Sassy.

A measurable effect of tillage on some cereal diseases, with yellow rust and powdery mildew being as much as 20% lower in direct drilled crops.

These disease effects can be explained by the fact that ploughing disturbs mycorrhizal fungi networks, which work with plant roots to prime resistance mechanisms.

Different soil management approaches have effects on soil biology, with greater diversity found in direct drilled soils.

Where soil biology has shifted through reduced cultivations, soils have better water infiltration rates and more soil carbon.

Case Study: HB & LJ Lear, Aylesbury, Buckinghamshire

The sudden realisation in 2016 that his system was not sustainable was the prompt that Steve Lear needed to make radical changes to his farming business.

Farming 1,020ha – some of which is heavy clay soils – across five sites from his base at Creslow Manor, he was finding it increasingly difficult to create a seed-bed as soils became harder and harder to work.

“At that time, we needed up to three power harrow passes to get them in to shape. Not surprisingly, our crop establishment costs kept rising and our fixed costs were far too high,” he recalls.

In addition, yields had plateaued while workloads had increased. Being told that his soils were dead was the final straw – so the decision was made to put far greater emphasis on soil health.

That initially involved moving towards no-till, so Mr Lear’s first step was to use a trial area of 32ha to try out a number of drills and see whether they would be suitable for his new system.

“We had a list of things that the new drill had to be able to do,” he says. “It ranged from dealing with uneven ground to having enough down pressure to drill into sun-baked soil, as well as being low disturbance and able to seed pastures.

“We were also keen to avoid smearing in the slot and hair-pinning.”

Drill choice

Given this list, the most suitable drill turned out to be the Cross Slot, so with the help of a 40% Leader grant, a new drill arrived on the farm.

“Of course, I then realised that I needed to change the whole system, not just the drill. So we ventured into cover crops, controlled traffic, muck management and including perennials in the rotation. We also started reducing inputs.”

His original strategy of using a cover crop where there will be an eight-week gap between crops has since been tweaked to take account of soil moisture. “Now, if we know we are going to get growth, we’ll put one in.”

Soil trafficking has been reduced, not by adopting a Controlled Traffic Farming system but by insisting that operators drive on the tramlines at all times. At the same time, bigger tyres are being used and fieldwork is abandoned if it’s wet.

“This year has been a good test of that. With a 12t drill, we had to make the decision to stop drilling.”

Using the muck from the farm’s Turville herd of pedigree Limousins has evolved so that he now composts it first, making it more biologically active. By mixing it with woodchip, the end product has a higher C:N ratio and helps to feed the soil fungi.

“It’s also a lighter product, so we’re not causing compaction when we’re spreading it or running up against complaints about the smell,” he points out.

Grass/clover leys

Bringing perennials, in the form of grass/clover leys, into the arable rotation has helped with blackgrass control and also ticked the diversity box, although wireworm control was difficult in following cereal crops.

“As a result, we’ve changed that and now have beans growing after grass.”

Neither insecticides nor seed treatments have been used for the past three years, with Mr Lear expecting further reductions as the system matures and he continues to farm in a more biological way. Untreated home-saved seed is now the norm, providing the test results come back clear.

He freely admits to making mistakes along the way but has learned just as much from them than from getting things right. He now knows that clover is not killed by glyphosate and that fields with compaction are not suitable for direct drilling.

Conversely, problems that he expected to arise haven’t been obvious. “Slugs are no worse than they were and there’s been no sign of the yield dip that some others have experienced.”

Water infiltration rates have improved, as has blackgrass control. He also believes the health of plants is better in the no-till areas and is committed to moving as little soil as possible.

Looking ahead, Mr Lear is planning to start soil benchmarking and hopes to mob graze the cover crops with sheep. “I thought this would be an arable project, but it is integrating well with our livestock enterprises,” he says.

JOURNAL : Farmers Weekly

We are facing some tough times at the moment. Farming and the country as a whole is taking a relentless beating from Mother Nature.

Many peoples lives and businesses are being literally left in ruins by the mighty force of the harsh elements, with people frantically battening down the hatches, sandbagging the doors and doing everything they possibly can to protect their livestock, livelihoods and loved ones.

Seeing the despairing footage and reading the heartbreaking stories on social media, I found myself totally sympathising with the victims of this winter's raging floods and storms.

See also: Tips to help livestock farmers plan winter feed on a budget

On our farm we have been incredibly fortunate and have thankfully avoided the floods, even though parts of South Wales have been some of the hardest hit areas in the country.

Charity begins at home

The situation has really got me thinking and my honest conclusion is – charity begins at home.

This might not be a very politically correct opinion, but I imagine it is one that will be shared by many folk.

We need to start looking after our own first and make sure their wellbeing is paramount.

I don’t say this lightly, but if there really is no more money available from the government to help the people of this country in their hour of need, then should we be pushing more of our charitable aid resources towards our own communities?

This would allow resources to be pumped into making sure that infrastructure is in place to protect us all from the elements, as well as looking after the needs of British people caught in the middle of these destructive episodes.

From a purely farming perspective the industry is already enduring difficult times, without the added pressure of weather-related disasters.

Arable farmers have seen hundreds of acres of crops destroyed and some still haven’t even had the opportunity to establish crops in the first place.

Nowhere to turn?

Then there are the heartbreaking images of sheep farmers trying desperately to keep their ewes and lambs alive with the sheds filling up full of water.

With helpless situations like this and those affected often feeling they have nowhere to turn for help, it comes as no surprise that our Industry has a tragically high suicide rate.

There are many, many fantastic charities out there that support our ***agricultural*** communities in their hour of need.

Rabi – emergency grants, DPJ Foundation – emotional support, Farm Community Network and Forage Aid – providing forage/bedding, to name but a few.

These incredible charities provide invaluable practical and emotional support in times of need.

We never know when tough times are going to hit. We or someone we care about may need to reach out to one of the charities for a bit of support and I would like to think that there were enough resources in the pot to make a difference to them.

That’s why I think charity begins at home.

JOURNAL : Farmers Weekly

In the rare event that a large holding comes to the market in Northern Ireland, high demand from non-farming buyers pushes prices to a premium.

The majority of farms of more than 100 acres are bought by people currently involved in ***agriculture*** but supported financially by a second, more profitable business, said James Butler, head of country agency at Savills.

These purchasers are also willing to be flexible about location in order to secure scale, especially within a single block.

See also: Land in your area: Wales

“Typically, the average size of each farm or block of land offered for sale is about 35 acres, with between 0.5% and 1% of the province’s total area of farmland coming to the market each year,” says Mr Butler.

“Usually no more than one farm in excess of 100 acres comes to the market in each county and it is rare for multiple farms of more than 200 acres to be offered for sale throughout the entire province.”

Pressure on farming profits over the past year has continued to bring economies of scale into focus and all large farms offered for sale by Savills in 2019 generated competitive bidding, he said.

Average land values across the country remained steady, though variations remain based on region, infrastructure and the need for capital investment.

The sales success of smaller blocks of land is determined by the demand from local buyers and commitment to realistic pricing by sellers.

“The majority of purchasers are already based in Northern Ireland, and with a strong farming heritage throughout the country we expect demand for land to continue, despite local and international political uncertainty,” Mr Butler says.

“However, an emphasis on scale and quality will be to the fore, and discounts will be applied to farms that require capital investment or lack viability.”

What sold well?

Altahammond Farm, Carrickfergus, in County Antrim was launched by Savills and guided at £1.45m.

The coastal farm includes 124 acres, two properties and a range of buildings.

It sold in lots in excess of the guide price to local farmers.

English farmland market round-up

This week marks the end of Farmers Weekly’s annual regional analysis of the land market across the UK.

Here are some key numbers for the 2019 English land market, compared with 2018:

69,200 acres of farmland were marketed – 35% lower than in 2018, 20% below the five-year average and well below the 10-year average of 86,400 acres

225 farms were publicly marketed (2018: 260)

60 farms were launched in south-west England, the most across England (2018: 59)

North-east England marketed the least number of farms: 12

The biggest drop was seen in the southern half of England where the number of farms for sale was down 13% on the five-year average

The top price paid for arable land was £17,500/acre in the East Midlands (2018: £15,000/acre)

The average price of arable land was £9,200/acre, unchanged from 2018

For the past three years, about 30% of arable land has traded at £10,000/acre or more, with about one-quarter selling for less than £8,000/acre. At the peak of the market in 2014-15, almost half traded above £10,000/acre.

The most expensive grassland was sold for £11,000/acre in Buckinghamshire, south-east England (2018: £15,000/acre)

The lowest price paid for grassland was £2,800/acre, in Cumbria, north-west England (2018: £3,000/acre)

About 55% of purchases were made by farmers, below the 10-year average.

Source: Strutt & Parker Farmland Database

Land markets

If you missed your area’s land information, you can find all the land round-ups here, along with further insights, advice and case studies.

JOURNAL : Farmers Weekly

Ewes with low body protein levels are more likely to lose lambs between scanning and birth, according to a new study.

While ewe body condition and energy balance in late pregnancy were already known to influence lamb survival, the effect of protein status has been less well understood.

Now, though, research led by the University of Edinburgh has revealed that protein plays a vital role in newborn lamb survival.

See also: Mastitis antibiotics shortage likely, say vets

The study

Metabolic profiling carried out across a single flock showed good energy balances among all of the individual in-lamb ewes.

But the blood samples highlighted that long-term protein balance in half the ewes was variable.

After lambing, the results showed that ewes which had lost one or more lambs between scanning and tagging at 24 hours old had lower blood protein levels than those with surviving lambs.

Researchers said the trial indicated that poor long-term protein status was an important factor.

But further work was necessary to determine whether this was due to concurrent disease such as liver fluke or poor dietary protein supply during pregnancy.

The trial was backed by the AHDB, Quality Meat Scotland (QMS) and Hybu Cig Cymru – Meat Promotion Wales (HCC).

A joint statement by the three levy boards said the results highlighted the importance of ensuring ewes were fed to meet both their energy and protein requirements in late pregnancy.

It also demonstrated that any diseases which might affect protein status should be tackled.

“This project has highlighted the importance of ewe nutrition during the lead-up to lambing and the potential outcome of the lamb,” the statement said.

“In order to provide sufficient colostrum for their newborn lambs, ewes require a diet which meets their nutritional requirements in the final weeks before lambing.”

Edinburgh’s project partners, the University of Liverpool, University of Nottingham, Bangor University and Synergy Farm Vets, will continue to explore the risk factors for poor long-term protein status in late pregnancy.

A second strand in the study looked at the use of antibiotics.

This area of the trial found that medicine records showed most beef and sheep farms were able to manage infectious disease and maintain production, without resorting to High Priority Critically Important antibiotics.

It also found that prophylactic oral antibiotic treatment at birth in a well-run flock did not improve lamb survival or performance.

Further information

Interim results of the study can be found on the AHDB's website

JOURNAL : Farmers Weekly

Liveweight lamb prices eased back over the past week despite lower throughputs caused by the bad weather and a general lack of supply.

According to AHDB figures, auction market numbers fell by nearly 12% to 102,400 head in the week to 26 February.

But despite the tighter supply, old season lamb SQQ prices dropped to average 234.88p/kg – down 4p/kg compared with a week earlier.

See also: Levy boards to get £3.5m to promote red meat

Sedgemoor Auction Centre reflected the trends with 13% fewer sheep through at 1,036 lambs and hoggs on 24 February.

The 1,024 SQQ hoggs averaged 232.08p/kg, down by almost 6p/kg on the previous week, while just 12 finished lambs averaged 248.82p/kg.

Greenslade Taylor Hunt auctioneer Paul Ashton at Sedgemoor explained that prices had eased on the back of significant hikes in values over recent weeks.

“In the past three weeks prices have risen by £20/head to £109/head,” he said.

“This rise was too fast and has met resistance from buyers this week, so causing prices to ease back even though numbers are down.”

Mr Ashton suggested that the tighter supply went beyond transport difficulties caused by the appalling weather and flooding across the country.

“This year’s weather is only partly to blame for lower throughputs,” he said.

“There are simply fewer numbers available on UK farms, because so many producers capitalised on the good grass growth last summer and finished lambs early.”

The 2019 lamb crop was also lower because producers cut ewe numbers back in the wake of the 2018 drought which hit grass and forage stocks, he added.

Deadweight still rising

Meanwhile the AHDB has reported that deadweight prices in the week up to 22 February continued to track upwards.

The overall deadweight SQQ price averaged 532p/kg – more than 9p higher than the week before, according to AHDB red meat lead analyst Duncan Wyatt.

Estimated slaughter fell in the week, to 184,400 head, which was 18,000 head lower than the week before and 38,500 head lower than in the same week last year.

In the year to date, slaughter was 59,000 head behind where it was a year ago, Mr Wyatt reported.

JOURNAL : Farmers Weekly

Liveweight lamb prices have continued to rise this week, with markets reporting a brisk trade, according to AHDB Beef and Lamb.

Figures for the week ending 11 March, show the GB old-season lamb (OSL) liveweight SQQ up by 4p to average 242.8p/kg on the previous week.

The higher price was achieved despite an increase in throughput of 4,800 head, which took the total across the seven days to 111,700 head.

See also: 7 ways to help hit lamb growth targets

AHDB analyst Hannah Clarke said the trade was reportedly brisk at the moment, with well-presented lambs attracting the premiums.

Bakewell market, in Derbyshire on 12 March, was typical of the buoyant trade.

Auctioneer Bagshaws reported 782 sheep sold, including 476 finished hoggs, 120 cull sheep and 186 store lambs.

“Despite several lots being end of season, last draw types, meated sorts were still very much in demand, with three pens more than 265p/kg to peak at 269p/kg,” a Bagshaws’ spokeman said.

The best heavyweight lambs grossed more than £128 a head, with an overall market average of 238.91p/kg.

The 120 cull sheep on offer also attracted very brisk bidding for all types, with top prices of £175 a head for Texels, £115 for Mules and horned ewes to £88, said Bagshaws.

The overall average for cull ewes was £83.33.

Deadweight

While liveweight prices lifted, the deadweight GB OSL SQQ plateaued in the week ending 7 March, after its recent rise.

Prices increased by just 0.6p compared with figures from a week earlier to average 530.9p/kg.

However, the price is still about £1/kg up on the same week last year and on the five-year average, Ms Clarke said.

As with liveweight, throughput for deadweight was up on the week, with an estimated increase of 3,800 head to total 208,000 head.

However, these weekly increased numbers are still down on 2019 throughputs.

During February 2020, there were 835,600 lambs forward – about 70,000 fewer than 12 months earlier.

Ewe numbers at 119,500 head were also back year-on-year at 17,000 head down.

Rebecca Wright, red meat analyst for the AHDB, said the lower ewe headage was not surprising because the kill at the same stage in 2019 was relatively high.

“Lamb carcass weights were back slightly, which is also not surprising considering the poor pasture conditions over winter,” said Ms Wright.

Global trade

Meanwhile, fears that the coronavirus crisis would see New Zealand sheepmeat exports diverted from China to Europe have been allayed.

“So far, at least, the diverted product has mainly headed towards the Middle East,” reported Ms Wright.

To date, this year’s imports have actually been lower, Ms Wright added.

However, she said it would be premature to suggest that there was no chance of additional product coming to Europe, although the quantity involved may be limited.

“An issue not just affecting the sheep industry, but almost all industries, is shipping container availability.

“Chinese ports are still somewhat backlogged.

“This means containers are not being emptied and therefore not available for use again,” she suggested.

JOURNAL : Farmers Weekly

Dairy farmers supplying Meadow Foods in Cumbria face a 2p/litre price drop from April after the processor lost a key contract to supply Arla.

Producers in its northern milk field will see their price cut to just 24p/litre, while the rest will remain on 26p/litre, according to multiple sources.

The company has about 650 farmer suppliers split into two groups, with one located in Cumbria and the remainder based within about 80 miles of the company’s main factory in Chester.

See also: How multi-cut can deliver profits of £333/ha over three-cut silage systems

The move is likely to put severe financial pressure on farmers as the price will be below the cost of production for many, with Kite Consulting putting the average net cost of production at 29.1p/litre for the year ending March 2020.

The figure includes both variable and fixed costs, and allows for rent, finance and family labour, but also takes subsidy income into account.

Supply surplus

Meadow Foods representatives told farmers at a series of meetings this week that its has lost a 150m-litre contract to supply Arla, leaving it with a surplus.

Farmers in Cumbria are bearing the brunt of the losses as their milk is the most expensive because of its higher transport costs.

The price change will see the Cumbrian group move to the bottom of the liquid milk price league, based on ***data*** from market analyst Milkprices.com.

The site put Pensworth Dairy as the bottom-ranked processor for March, with an adjusted price of 25p/litre for 4% butterfat and 3.3% protein.

The highest non-aligned liquid price is currently Arla, on 29.75p/litre.

Reversal in fortune

The move is a reversal in fortune for Meadow Foods, which had increased its milk price twice in the past two months by 0.5p/litre each time.

In January, it revealed pre-tax profits of £25.6m in the year to March 2019, up from £22m the previous year, and trumpeted its expanding product portfolio.

The news fuelled speculation that a number of the Cumbrian group will seek to leave their Meadow Foods contracts when they expire and move to rival processors with closer facilities.

This could include Yew Tree Dairy, which specialises in the production of milk powder, and is located in Lancashire.

A spokesperson for Meadow Foods said: “We are meeting with our producers over the coming week to discuss milk pricing and market performance.

“We are unwilling to offer further comment until we have communicated directly with our producers first.”

JOURNAL : Farmers Weekly

Milk processors are working flat out to keep shelves stocked as demand for liquid milk at retail level spikes higher than at Christmas. UHT sales have also risen.

How long this lasts and whether it will compensate for the drop in sales to the café, restaurant and other food service sectors remains to be seen.

Food service accounts for 10-15% of the UK’s liquid milk sector, which in turn represents about 50% of UK milk consumption.

“The food service sector is struggling big time and it’s getting worse every day,” said Chris Gooderham, AHDB Dairy head of markets specialist.

See also: So you want to sell produce at a farmers' market

However, while cafes and restaurants were suffering a huge fall in demand, hospitals and schools, which account for a big element of food service milk use, were still operating .

“It’s more the impact on individual processors – cashflow will be a big issue for them,” said Mr Gooderham. “It will be fairly rocky for certain processors.”

There would also would be knock-on effects for the spot market, as food service demands change and spot volumes fluctuate.

Mr Gooderham said processing kit could come under a lot of strain and any breakdowns could add to spot market pressures.

Many of the parts required are manufactured abroad and many of the fitters are based in continental Europe, so any issues with availability, travel time and access could exacerbate the situation.

There has been much recent speculation about the track of spot milk prices, which have fluctuated between 31p/litre and 25p/litre in the past couple of weeks.

“It’s difficult to tell if the downturn in spot prices is due to concerns on Covid19 or just the fact milk production has started to pick up after being flat from the turn of the year,” said Mr Gooderham.

“We would normally expect spot prices to reduce in March, as we start the run-up to the spring peak.”

Dairy market analyst Chris Walkland said the spot market trading was very thin, so prices could be misleading.

“A better one is the cream price - which at £1.25-£1.28/kg is stable on a month ago, but down on last week. At this level, it will do nothing to support milk prices, though,” said Mr Walkland, who is also concerned for the future of processors heavily reliant on the food service sector.

He said we could see another plant come out of production in the next six months or so, or even another processor failure.

GDT sees fourth fall

On a wider scale, the New Zealand-based online dairy commodity GDT auction on Tuesday (17 March) was down 3.9%, with skim milk powder taking an 8% hit. This was the fourth consecutive drop for the fortnightly sales index.

China encourages higher milk consumption

The Chinese government is promoting higher milk consumption to boost the nation’s immune status. It wants to see average daily consumption of the equivalent of 300ml of liquid milk.

Rabobank predicts coronavirus hangover for dairy markets

Global dairy product prices were rising in the final quarter of 2019, but have now stalled because of the uncertainty imposed on the market by coronavirus in addition to the slower global growth that was expected even before the virus took hold.

“Global dairy commodity prices have already priced in the uncertainty,” said Michael Harvey, RaboResearch senior dairy analyst. “But a less-than-favorable expected finish to the New Zealand production season is providing some price support.”

Rabobank expects China's consumer buying patterns to normalise by the second half of this year, with some supply chains already showing an improvement.

However, any setback or a delayed economic recovery in China presents a major downward price risk to its forecasts, it warns.

Milk output is rising among the world’s top seven producers – the EU, US, New Zealand, Australia, Brazil, Argentina and Uruguay.

“The combination of reduced Chinese imports, significant supply chain disruptions, including extreme competition for shipping containers across the globe, and rising dairy surpluses in export regions will keep downward pressure on global markets through much of 2020,” according to Rabobank.

JOURNAL : Farmers Weekly

Growing miscanthus can make sense on poorer-quality land, offering farmers a financial return and a chance to do their bit for the environment.

But the government is being urged by farming unions to offer incentives through the Environmental Land Management scheme (ELM) and help develop the market for sequestered carbon if it wants to significantly expand the acreage of this and other bioenergy crops.

Climate change experts say there needs to be rise in the amount of such crops grown for biomass, because of their potential to deliver carbon savings.

See also: Miscanthus fuels Norfolk growers desire to improve soil

Miscanthus facts and figures

Establishment costs for miscanthus are high, at about £1,800ha (excluding fencing), but the ongoing management costs are relatively low, according to the ***Agricultural*** Budgeting and Costings Book.

Terravesta, which offers growers long-term contracts to grow and sell the crop, suggests growers can make an average net profit of of £530.85/ha over a 15-year period based on a mature yield of 14/t/ha.

There is currently no specific grant funding available to help pay for establishment.

The crop is estimated to have an average lifespan of 15 years, with peak yields achieved from year four onwards ranging from 9-12t/ha on light land to 12-18t/ha on medium to heavy land.

In its recent report, Land Use Policies for a Net Zero UK, the independent Committee on Climate Change called for average planting rates of miscanthus, short-rotation coppice and short-rotation forestry to rise to 23,000ha/year between 2020 and 2050.

No ***data*** is available regarding UK-wide planting areas of miscanthus, also known as elephant grass, but Defra ***statistics*** suggest there were just 7,149ha of the crop grown in England in 2018.

Government failures

Jonathan Scurlock, NFU chief adviser on renewable energy and climate change, says successive government administrations have failed to offer consistent enabling policy measures to promote miscanthus further.

For example, the Energy Crops Scheme was withdrawn in 2013, and despite strong lobbying, Defra had resisted allowing miscanthus to be counted as an ecological focus area (EFA) under greening.

But more positive signals are starting to emerge from policymakers.

Speaking at last month’s NFU conference, the chair of the Environment Agency, Emma Howard Boyd, was asked why government policy was not more supportive of perennial crops such as miscanthus, which could play a role as soft flood defences.

She said: "This is exactly where ELMs should come in. We want to make sure we are working with Defra and others, in joining up these dots and seeing new markets and new rewards [for perennial crops].

“I hope this is something we can start moving on as quickly as possible.”

Markets

While the primary market for miscanthus is for large-scale heat and power generation, the crop can also be used as a construction material and for livestock bedding.

According to Terravesta, the UK’s largest producer group for miscanthus, second-generation markets are also emerging for advanced end uses, including degradable bioplastics, pharmaceuticals, bioethanol and biogas production.

It says the business model for the crop has been developed to the point that it more than competes in commercial terms with most farm enterprises (see case study, below) – but if the government is to meet the targets set out for its uptake, it will need favourable treatment in the ELMs framework.

William Cracroft-Eley, Terravesta chairman, points out miscanthus is a multi-faceted environmental crop that can play an important role in tackling climate change by sequestering carbon and helping to improve soil health.

“Biodiversity in miscanthus, above and below ground, is also much richer than the intensive arable or grass crops that it is likely to displace, and this needs to be recognised,” he says.

“It is also a crop that happily withstands winter flooding, while its root systems improve soil water holding capacity and hold back water flow, meaning it is an excellent strategic option for protecting vulnerable communities.”

Case study: Jon Hatt, Coombe End Farm

Jon Hatt has been growing miscanthus at Coombe End Farm, near Goring Heath in Berkshire, for about 15 years and says it is a straightforward crop to grow, offering significant benefits in terms of locking up carbon and helping wildlife.

Mr Hatt estimates it costs him £1,500/year for a contractor to harvest and bale the crop and another £1,000/year to cover carting, loading, storage and composting costs.

“We earn between £3,000-£4,000/year from the 6ha, plus our basic payment, so it’s not big bucks, but it is low cost once it has been established.”

Mr Hatt agrees that government incentives to encourage farmers to plant miscanthus would be justified and would help to boost the earning capacity of the crop.

Growers should also be able to get paid for carbon credits, alongside ELMs payments to reflect the environmental and soil benefits it brings, he says.

First steps

His miscanthus enterprise began in 2006, when he planted one field of about 6ha as a trial, using a 40% establishment grant available under an old Energy Crops Scheme.

That field is still in production, yielding up to 10t/ha of straw, which he sells for £60-£70/t.

“The government were particularly keen on encouraging miscanthus at the time and we were looking for alternative options for some poorer arable ground to help spread risk,” he says.

“We are near Didcot power station, and at that time they were looking to use miscanthus to co-power it.”

Spotting what looked to be a potential opportunity, Mr Hatt originally signed up a supply contract with Bical, which was promoting the crops and supplied the rhizomes.

Crop establishment

The establishment of the crop was straightforward with the rhizomes planted using a converted potato planter.

The crop was sprayed to control weeds in the first year, but has required no further treatments since.

Although rabbit and deer damage can be a problem during the establishment phase, Mr Hatt had no problems and the crop now seems to be ignored by pests.

Miscanthus can be ready to harvest in year two, but Mr Hatt did not harvest his crop until year three.

“Although you can get a harvest in year two, in our case there was not enough straw there to justify the cost,” he says.

Specialist harvesting

The crop starts to shoot in the spring and grows to 3-4m high by September.

Harvest takes place the following March or April, when a specialist contractor uses a forage harvester setup to cut the straw into 30cm lengths, which are then left in the swath until they are dry enough to bale.

“Harvest in year three was a learning experience and we found it not as cheap and simple as we had originally been told it would be,” says Mr Hatt.

“Rather than out-of-season use of mowers and balers, we discovered we needed a specially set-up forage harvester and heavy-duty, big baler, as miscanthus can wrap around and wreck machinery quite easily.

“Once cut, the straw needs to drop to below 15% moisture content before baling, so if it rains, it also needs to be moved to get enough airflow to dry it out.

"In addition, the baled crop needs to be stored inside or sheeted, as a wet crop will not be saleable.”

Mr Hatt says he was originally told that the crop would require no fertiliser.

“But we found yields dropped off after four or five years.

“The theory is that dropped leaves form a compost layer, so we spread green waste compost post harvest at a rate of 15t/ha to help it break down.

“This reversed the yield drop, so we now continue to apply solid digestate annually.”

While long-term contracts can give growers security, after Bical went into administration in 2009, Mr Hatt chose to find his own markets for the crop.

“Initially, we sold to an East Anglian straw-burning power station [the original aim], but haulage can knock a big hole in the sale price,” he says.

“Since then, we've looked for more local buyers.”

JOURNAL : Farmers Weekly

With just weeks to go until the first of three Britain's Fittest Farmer qualifier events, the judging panel has been seriously impressed by the competition applications so far.

More than 110 farmers and ***agricultural*** industry workers are up for the friendly challenge of putting their all-round fitness to the test, and raising awareness of mental health issues along the way.

Everyone who applies to take part in this year's competition on the Britain's Fittest Farmer website gets an invite to their preferred qualifier event, hosted on farms across the country.

See also: How better exercise improves wellbeing on the farm

On the day, contestants will be put through their paces with a series of physical tasks to test their speed, stamina and strength.

These are set to be fun, free events for the rural community to come together, cheer on our competitors and get talking about physical and mental-health matters in farming.

As the countdown to these fantastic events enters its final stages, we've picked out some more of our favourite entries to date.

How to apply

To apply, go to the Britain’s Fittest Farmer website and answer a few questions on how you keep yourself physically fit and look after your mental health. You will also need to upload a video or photo of yourself.

Check out the fantastic applications so far for some inspiration.

John Taylor

Thirty-one-year-old John runs his own flock of sheep and works as an estate manager in the Peak District.

A self-confessed CrossFit nut, he loves the sport for its camaraderie and competitiveness. He also takes part in local and national competitions either individual or in team events.

"It is the sport of fitness, and I think it gives you a great foundation of fitness and strength for life and especially farming.

He also keeps a tractor tyre in the corner of his six-acre field where he'll be found flipping it from one side to the other, much to the bemusement of his sheep.

"I have found that mental and physical health are so connected," he says. "Getting into the positive CrossFit environment, working hard alongside your mates has helped hugely."

Remembering what he is thankful for and using a meditation app have been helped to aid his positive mindset.

Britain’s Fittest Farmer 2020: Dates for your diary

Qualifier 1: Marlborough, Wiltshire – Sunday, 29 March 2020

Qualifier 2: Melton Mowbray, Leicestershire – Saturday, 4 April 2020

Qualifier 3: Jedburgh, Scottish Borders – Saturday, 18 April 2020

Final: Great Dunmow, Essex – Saturday, 9 May 2020

Katie Littlejohns

Young farmer Katie works on her family's beef and sheep farm in Devon as the main shepherd, taking on lambing duties. She also pilots the straw chopper, does the farm paperwork and works at her local livestock market.

Shepherding work and running up to five times a week keeps her fit to farm. Endorphins released when running out in the fresh air make her feel like anything is possible.

"I have used running as a tool to cope with many low points I have overcome. It has always made me look at things with a more positive outlook," she says.

Flavian Obiero

Flavian has been working in the pig industry since he finished his A-levels at school, and today he works as a pig unit manager in East Sussex.

The 28-year-old is a keen sportsman, playing rugby and badminton and he hits the gym regularly. He has a supportive group of friends and family to listen when he needs to share a problem.

"I'm also fairly thick-skinned, so I let a lot of things that could potentially affect my mentality go over me."

Lindsay Walker

Forty-year-old Lindsay has worked on the same dairy, beef and sheep farm for the past 25 years in Cumbria. A keen road, trail and fell runner, she's the captain of her ladies' running club and also enjoys cycling.

Like many farmers, she sometimes finds her work stressful with the highs and lows of life on the farm. "People often ask how I manage to exercise after a long day at work, but I find even 30 minutes of exercise – either running or on my bike – helps clear my head and makes me feel better.

She says her running club is great for her social life, getting away from work and meeting new people. "Running has made me so many friends, and having days away to look forward to helps."

Britain's Fittest Farmer: Our sponsor and partners

Grenadier: Sponsor

Tough, rugged, agile – the new INEOS Grenadier 4X4 will share plenty of traits exhibited by the winner of Britain’s Fittest Farmer. That’s why we’re so pleased to be sponsoring this rural British physical challenge.

As an uncompromising, no frills, off-road vehicle, the Grenadier will provide all the capability, durability and reliability you need to tackle the toughest tasks on the farm. That’s why we see ourselves as the ideal partner for this true test of grit, endurance and strength.

For more information on Grenadier, pay a visit to their website.

Farm Fitness: Partner

Farm Fitness has rapidly become a burning beacon on the UK fitness scene, attracting spectators and participants from all over the country to come and take a swing at its almost alchemic blend of modified strongman, functional bodybuilding, calisthenics and blistering cardio efforts.

The gym, founded by farmer’s son Tom Kemp, was voted one of the best gyms in the world and 'coolest outdoor space' by Men's Health (PDF)

Tom has blended his farming background with his love of training to create a raw and exciting outdoor environment for people of all strengths and abilities to get fit.

The Farming Community Network: Partner

The Farming Community Network (FCN) is a voluntary organisation and charity that supports farmers and families within the farming community through difficult times.

The charity has helped thousands of people deal with a variety of issues, including financial difficulties, animal disease, mental health and family disputes.

Volunteers provide free, confidential, pastoral and practical support to anyone who seeks help, regardless of whether the issue is personal or business-related. FCN also runs a confidential national helpline and e-helpline.

JOURNAL : Farmers Weekly

Farmers and growers in West Sussex have called for MPs to protect standards and avoid a labour shortage that would “leave food in the ground”.

With the government’s new ***Agriculture*** Bill underway, five MPs from the county were told it must go hand in hand with trade and immigration policy, to support domestic producers and ensure they are not undermined.

The NFU welcomed the expansion of the Seasonal Workers Pilot for 2020 but expressed concern at the lack of an entry route for 2021, which it said would severely impact farm businesses and hit the country’s ability to produce fruit and vegetables in particular.

See also: Tories promise farmers more seasonal migrant workers

The numbers of non-EU workers allowed in under the pilot will be set at 10,000 in 2020 – a fourfold increase on the 2019 scheme, but well short of the estimated 70,000 needed by the UK horticultural sector.

Mark Chandler, NFU chairman for West Sussex, told Farmers Weekly the issue was “absolutely critical” for the sector.

He said: “They need to start recruiting this autumn for next year’s harvest and there will literally be food left in the ground if we can’t make that happen.

“In terms of timescale, that is top of the agenda and it must happen; we need a commitment.”

MPs Andrew Griffith, Gillian Keegan, Jeremy Quin, Tim Loughton and Mims Davies met farmers and growers from the Arun to Adur cluster group at Lychpole Farm near Worthing on Friday 28 February, to hear about a five-year project to improve soil health on nine farms.

Addressing concerns about migrant labour, Andrew Griffith, the Conservative MP for Arundel and South Downs, said it was “absolutely essential” that farmers get continued access to workers and the needs of the different sectors were met.

“What I need and what I am working with local farmers on is: what are those specifics?” said Mr Griffith.

“Where are they [the workers] coming from? What time do we need them to make sure that the [points-based migration scheme] scheme, which I welcome, does actually create an architecture that is very flexible, so you can bolt onto that different programmes for different types of workers.”

With the government piloting its future approach, the time to have these discussions is now, to ensure the labour was accessible, he added.

Global scheme

The NFU is seeking a commitment from government on a global seasonal ***agricultural*** workers’ scheme from 2021 for fruit, vegetable and flower farms and viticulture.

The union added that the scheme must cover labour providers and direct recruiters, allowing the ***agricultural*** industry to access the 70,000 workers nationwide it needs.

Historically, about 60% of these workers have been EU nationals.

From next year, the government will end free movement of EU citizens to the UK and it has decided not to add ***agriculture*** and horticulture to its Shortage Occupation List.

Migrant workers who wish to work in the UK in these industries will have to apply instead through seasonal and other worker visa schemes.

JOURNAL : Farmers Weekly

Almost two-thirds of farmers are still waiting for their Countryside Stewardship (CS) money, with three months of the payment window left, according to new figures.

Defra said in its update on farm payment schemes that 37% of eligible CS customers have been paid their full claim ahead of the June deadline.

The NFU welcomed improvements in the delivery of agri-environment scheme payments in the past year, but said it was still not where it needed to be.

See also: Countryside Stewardship payment delays compounded by flooding

Farmers were told they would receive a single payment between December last year and June 2020 for CS claims submitted in 2019.

NFU countryside adviser Alisha Anstee said the uncertainty of not knowing when payments would be received was causing farmers cash flow problems.

She added: “The payment window leads to financial planning issues for our members; 63% of CS agreement holders are still awaiting 2019 monies with no details of if payment will arrive in the next week or in three months.”

Defra said payments for stewardship schemes have started to arrive four months earlier than last year, with farmers receiving one full payment for the first time as part of plans to deliver a better service.

For Environmental Stewardship (ES) claims, 77% of eligible farmers and land managers have been paid, worth a total of £133m.

Ms Anstee said: “ES is in a better place, with the majority of agreement holders having been paid their full claim value now. We hope to see this level of payment maintained or improved in the weeks ahead to translate into all agreement holders being paid ahead of the June deadline.”

99% of BPS payments made

Meanwhile, the Rural Payments Agency (RPA) has now paid almost 99% of eligible farmers under the Basic Payment Scheme.

RPA chief executive Paul Caldwell said it was “working tirelessly” to ensure remaining payments for all schemes were made as quickly as possible.

In Scotland, more than 17,400 farmers and crofters have received their individual allocation of convergence funding from an £86.2m pot.

The initial payments are the first tranche of a £160m package from the UK government to rectify a historic wrong relating to EU Common ***Agricultural*** Policy funding that it failed to pass on to Scotland between 2014-18.

Every eligible farmer or crofter will be paid by the end of March.

JOURNAL : Farmers Weekly

Newly elected NFU vice-president Tom Bradshaw says food production must remain at the heart of the UK's ***agricultural*** policy as farmers look to a future outside the EU.

Producing and growing food was fundamental to farming, Mr Bradshaw said following his election as a senior NFU officeholder on Wednesday (26 February).

See also: New team elected to steer NFU through Brexit

“Food production has to be a core part [of policy],” he told Farmers Weekly. “It is our raison d'etre as farmers and we have to make sure we drive that message home.”

Mr Bradshaw’s comments follow a week when the government confirmed further details of its plans to phase out direct payments to farmers over seven years, beginning in 2021.

It also shared more details of its planned Environmental Land Management (ELM) scheme – due to be fully up and running by 2024.

The ELM scheme will reward farmers who undertake environmental measures – including encouraging public access to the countryside and climate change mitigation.

Legal guarantee

But the NFU has warned that farmers’ efforts to look after the environment could be undermined by cheap imports of food produced using methods that are illegal in the UK.

It wants legal guarantees that shipments of chlorinated chicken and hormone-treated beef will not be allowed into the country under any trade deal.

In his previous role as NFU combinable crops chairman, Mr Bradshaw campaigned against imports of oilseed rape and cereals produced using neonicotinoid seed treatments.

Neonicotinoids are banned in the UK over concerns they damage bee populations.

Mr Bradshaw runs his family's home farm at Fordham, near Colchester, alongside a contract farming business growing combinable crops across 1,450ha in north-east Essex.

Expertise

He was originally co-opted on to the NFU's combinable crops board to further the industry's understanding and use of on-farm technologies such as GPS and soil mapping.

An experienced public speaker, he has completed a Nuffield scholarship researching soil fertility and fertiliser efficiency – and was the lead farmer in the BBC’s Harvest programme.

Mr Bradshaw said: “We have some really technical policy areas going on at the moment – and I am more than happy doing the public leadership stuff.

“But we have to get the technical detail right.”

The government's net zero carbon ambition, its plant health strategy and clean air strategy were all policies which would have huge impacts on farm businesses, he said.

Net zero was an opportunity for farmers to be paid for storing carbon – but the NFU had to deliver the technical detail of how this would work for its members.

Scientific background

“I think it is that element – that sort of scientific background – that I can hopefully bring to the team and make sure we really do focus on that detail.”

As NFU vice-president, Mr Bradshaw will work alongside NFU president Minette Batters and NFU deputy president Stuart Roberts, who was previously the union's vice-president.

The three officeholders would set their priorities together as a team, he said.

“It is going to be an amazing opportunity to work with Stuart and work with Minette – making sure we do gel as a team,” he added.

“We have to be realistic in our ambitions but there are going to be some opportunities – and in this time of change it is critical we look for those opportunities.

“There will be challenging times – I don't think we can hide from that – but we have got to make sure we create those opportunities too.”

JOURNAL : Farmers Weekly

A pest-repellent bale wrap that protects plastic against bird and rodent attack is set for launch later this spring.

The product, developed by plastic film specialist Rani Plast, could help save livestock farmers money by reducing loses through bale damage or from contamination which may affect cattle health and milk production.

The wrap contains a non-toxic, natural, active ingredient which is forced into the bale wrap at the manufacturing stage.

The wrap then exudes an odour and has a bitter taste that repels crows, ravens, rats and mice.

See also: Video: Homemade silage station reduces round-bale headache

Trials carried out in the USA showed bird and rodent attacks were almost completely eliminated and wrapping remained intact.

The repellent remains active for two years but the company said the additive does not transfer to the baled crop or soil.

A spokesman for Rani Plast said: “Because the repellent is integrated into the outer layer of the film it cannot affect the wrapped crop.

“It cannot be washed off by rain, it is resistant to high temperature variations and remains fully active for two years from the production date.”

The spokesman added that bales are protected against degradation by rodent and bird attack.

See also: Guide to managing rats on your farm

“Damaged bales lead to mould, crop contamination and bacterial toxicity, which in turn can affect cattle health and milk production,” he said.

The product will be distributed in the UK by Tama UAT through the usual network of co-ops, dealers and merchants.

Prices are still to be set but Tama UAT said that the additional cost would be about £1/bale for a four-layer wrapped bale.

For six layers of wrap the extra cost would amount to about £1.50/bale, the spokesman said.

JOURNAL : Farmers Weekly

A newborn lamb was mauled to death by a loose dog just 20 minutes after being turned out into a field.

Sheep and arable farmer Russell Scudamore said the two-day-old Suffolk cross Texel lamb was attacked by a brown terrier on Tuesday (25 February). It had been bitten around the neck and choked to death.

“We were turning out some ewes and one- or two-day-old lambs. As soon as we headed back to the farm, I got a phone call saying there was a dog chasing my sheep. There was no footpath in the field,” he said.

See also: What to do if you’re a victim of sheep worrying

Mr Scudamore, who farms at Sudeley Hill Farm, a 202ha family-run tenant farm in Winchcombe, Gloucestershire, rushed back to the field, but the lamb had already died from its injuries.

“It was dead by the time we got there. It looks like it had been caught around the neck and shook. The other ewes and lambs were visibly shaken,” he said.

The owner and the dog had left the scene. But Mr Scudamore tracked them down as they were walking away. The owner, a local woman, was said to be “very remorseful”.

“I told her, if it happens again, we will shoot her dog. No questions asked,” Mr Scudamore told Farmers Weekly.

“We won’t tolerate it. Last year, we had a dog kill a ewe that had lambs with it. It happens every year.”

Post gone viral

Mr Scudamore said the woman told him her dog had never chased sheep before. “She fully admitted it and took responsibility. We will be sending her a bill for the loss of the lamb and our time having to sort the ewes and lambs out.”

He has posted a picture of the dead lamb on his Facebook page, along with a warning to dog owners to “keep their f\*\*\*ing things on leads”.

The post has gone viral and been shared more than 5,000 times, with more than 4,800 comments.

“It’s not just us. Farmers in general are suffering from these types of attacks,” said Mr Scudamore.

“Some lose a lot more sheep than us. We don’t want to go out to shoot dogs, but if it’s the only way to get people’s attention, we will.”

15% increase in England

Last month, rural insurer NFU Mutual released figures showing the cost of livestock worrying claims has risen by 15% in England over the past year to £837,083.

As the peak lambing and calving season gets under way, NFU Mutual is calling for dog owners to ensure their pets are under control at all times when livestock are nearby and to report out-of-control dogs to a local farmer or the police.

JOURNAL : Farmers Weekly

Coronavirus is having a growing effect on markets as economic activity slows in more countries.

Oilseed rape prices fell £14/t in the week to Wednesday (11 March), to average £309/t spot ex-farm.This followed an oil price crash on Monday, with a slight recovery to put Brent crude at just under US$36 a barrel midweek – about 30% lower on the week.

Ex-farm rapeseed values ranged from £304-£313/t midweek for spot sales, with firm meal prices helping to hold values higher than they would otherwise have been.

The oil crash also brought down the value of the US dollar, in turn helping push down imported feed ingredient prices.

Chicago soya bean futures hit a 10-month low on Monday, and almost all of the main ingredients are down in price on a week ago.

Spot feed wheat lost about £1/t in value over the week, ranging from £138-£150/t ex-farm across the regions and averaging £145.50/t as Farmers Weekly went to press on Wednesday.

Feed barley was also about £1/t down on the week, at an average of £122.23/t ex-farm and ranging from £119-£127/t spot.

Trade has been thin, as both growers and consumers step back from the market and weigh the twin implications of coronavirus and the lack of drilling progress.

Trade estimates now put the size of the UK 2020 wheat crop at just 10.5m to 11m tonnes.

Milling premiums rise again

With drilling still so far behind, fears about quality and supply continue to push up milling wheat premiums. Prices gathered by Farmers Weekly show full-spec breadmaking premium midweek averaging just over £20/t for spot movement.

The average old-crop premium has risen by almost £5/t in five weeks, while new-crop premiums are even higher.

“You could make £25-plus,” said Saxon ***Agriculture*** grain director Mark Smith. “But given the small area and the condition of wheat, understandably, nobody is prepared to sell and there’s a bit of a stand-off.”

New-crop milling premiums will be capped by Germany’s ability to supply milling wheat to the UK, according to traders.

Currency volatility factor

Currency has been a huge factor in price movements. A week ago, sterling was at a four-and-a-half month low against the euro.

Monday saw a big fall in the value of the US dollar, while on Tuesday the Russian rouble hit its lowest value against the dollar since 2016.

Tuesday saw falls in sterling and the euro against the dollar, while Wednesday’s Bank of England surprise interest rate cut pushed the pound down again.

Oil price fall has wider implications

While the oil price drop brings a welcome reduction in farm fuel costs, there is widespread concern about the potential for further economic shocks that could result from it.

For example, the fall has brought into sharper focus the huge short-term debt burden of US shale gas and oil producers, and the potential effect defaults in this sector could have on the wider global economy.

See also: Guide to claiming tax relief on energy efficient kit

Milling wheat premiums continue to rise

Date

Full spec milling premium (£/t)

5 February

16.40

12 February

17.90

19 February

19.80

26 February

19.70

4 March

20.10

11 March

20.08

Source: Farmers Weekly regional grain prices

JOURNAL : Farmers Weekly

Caroline Lucas, Green Party MP for Brighton Pavilion, sets out her vision for a sustainable farming future and an ***Agriculture*** Bill that is fit for this purpose.

Our food and farming system is at a crossroads. The current model too often favours consolidation at the expense of ecology and farmers’ livelihoods.

We need a sustainable, resilient food system that works with nature, not against it; restores rather than undermines biodiversity; and makes a full and fair contribution to our climate goals.

The ***Agriculture*** Bill is an opportunity to start this transition. But without major improvement, it’ll flunk it.

See also: What the new ***Agriculture*** Bill contains for farmers

Yes, there is a welcome mention of soil protection, which was inexplicably absent from the previous version.

Soil degradation

It’s estimated that nearly half of European soils are degraded and have low levels of organic matter, with intensive ***agriculture*** being a key factor.

We need the new farm payment system to prioritise soil health, but we need to recognise the role of well-designed regulation too.

On that, the Bill is worryingly silent, with the government still not banning practices that do unforgivable harm – such as burning of blanket bogs or the use of peat in compost.

Organic farming

With organic farming supporting healthy soils – with an on average 44% higher capacity to store long-term soil carbon – this Bill should also do more for soil by supporting an expansion of organic farming.

Farmers are being let down with this Bill. We ask our farmers to meet strict standards on animal welfare, environmental protection and public health. There should be a watertight requirement that all food imported to the UK is produced to at least equivalent standards.

Less than 3% of UK land is organic. Surely we can do better than that?

And if the objective is to have healthy, living soils – for fertility, biodiversity and carbon storage – then where are the policies to minimise the harmful inputs that cause the damage?

As a minimum, the Bill should set national targets to cut pesticide use.

Climate change

To meet the climate challenge, the Bill also needs a link to carbon budgets and sense of urgency to match the science.

As the Committee on Climate Change said in its report on land use in January: “Continued delay is not an option it is critical that change starts immediately”.

Over recent years, an incredibly strong case has been building for a 10-year transition to agroecology.

That’s the sort of bold vision the Bill needs to rise to the climate emergency, whose effects many farmers are already experiencing.

One proponent of a transition to agroecology is the RSA Food, Farming and Countryside Commission, which had extensive input from farmers and growers.

Food import standards

Crucially, the commission found that farmers agreed they could make big changes to the way they farm in five to 10 years – “with the right backing”.

The ***Agriculture*** Bill should have put that backing on the table. It hasn’t.

There is another way that farmers are being let down with this Bill. We ask our farmers to meet strict standards on animal welfare, environmental protection and public health.

There should be a watertight requirement that all food imported to the UK is produced to at least equivalent standards.

This was the hottest of all topics in the debate during the second reading of the Bill, but no such guarantees were offered.

There are distinctly mixed signals coming from the government. One week, the prime minister dismisses concerns about equivalence as “hysteria”.

The next, the government states: “All products sold in the UK are required to meet our regulatory requirements, and this will continue to be the case.”

If ministers mean it, they need to put it into law – especially when the mood music is that our food and farming standards may be cast aside in pursuit of a trade deal with the US.

The opportunity is there for us to design a new farm policy that rises to the challenge of the climate and biodiversity crises, while simultaneously securing sustainable rural livelihoods for the long term.

JOURNAL : Farmers Weekly

My family were big fans of the late Henry Brewis, the Northumbrian farmer, writer and cartoonist – featuring Sep, Gladys and the collie dog, Sweep – who farmed at the evocatively named “Clartiehole”.

After this winter, I have not only read about Clartiehole, I’m beginning to think I live there.

The storms seem to have continued week after week and the wind, rain and mud have been pervasive.

The marshy bits of the hill are saturated, as you might expect, but in addition, whole new areas of sludge have been left around the house and buildings, deposited by the runoff from our road.

See also: How to protect farm businesses against extreme weather

It isn’t possible to access the premises without your feet squelching and sinking into the mud, and the vehicles get filthy every time they move.

My dream home improvements now consist of a load of concrete and a pressure washer.

Of course, I know we have had it easy compared with many people in other parts of the country.

“Extreme” weather seems to be becoming normal. The type of flooding that was comparatively recently described as a “once-in-a-lifetime event” now just seems to be something that is to be expected and will have to be prepared for.

I caught part of Defra secretary George Eustice’s recent interview on the BBC’s Andrew Marr Show – you know, the one in which he said there was “room for a sensible discussion” about importing chicken washed in lactic acid into the UK.

The main part of the interview was on flooding policy, which seems to be under review.

Mr Eustice indicated that the government’s response to future flooding would feature more nature-based solutions upstream, specifically mentioning “soft dams”.

Initially, I thought this would comprise a lot of officials quietly muttering “damn, damn, damn”.

To be fair, this would build on the existing policy, require no training or additional cost, and would probably be as effective as any other proposed measures.

However, I suspect Mr Eustice was actually talking about leaky woody dams, which are one of a number of soft engineering options for managing river flow upstream of the main towns and cities.

“Extreme” weather seems to be becoming normal. The type of flooding that was comparatively recently described as a “once-in-a-lifetime event” now just seems to be something that is to be expected and will have to be prepared for

Similar measures include tree planting near rivers, blocking upland drains and encouraging rough vegetation to slow the flow of water into the river system.

These options are relatively cheap, easy, environmentally sensitive and sound broadly sensible.

Upland farmers should be willing to engage with them as part of Environmental Land Management plans, both to do our bit and to develop solutions that are effective and acceptable to all parties.

Andrew Marr cited two experts who say the soft engineering proposals are simply not enough on their own and that they would be overwhelmed by the extreme weather events such as those we have been experiencing recently.

But they may be useful as part of a package of measures.

This would likely have to include hard engineering options such as building proper dams, widening or deepening river channels, or constructing relief channels, sluices and barriers.

There may also be a need to restrict developments on flood plains to buildings designed to be flood-proof, even if that is more expensive and thus politically difficult.

I await the Environment Agency’s revised strategy with interest. In the meantime, I’m just hoping for a break in the weather.

JOURNAL : Farmers Weekly

MI5 has a pretty simple maxim that society is “four meals away from anarchy”. In other words, the security agency believes that Britain could be quickly reduced to large-scale disorder, including looting and rioting, in the event of a catastrophe that stops the supply of food.

Given the combination of our growing dependence on food imports, the increasingly “just-in-time” nature of our food supply system and the rapid disruption to global supply chains caused by the coronavirus outbreak, it’s pretty fair to assume that food security will have risen, in recent days, rather rapidly up MI5’s risk agenda.

See also: Defra adviser slammed over ‘farmers not needed’ comments

So, revelations in the press about how unimportant certain advisers to the Treasury consider domestic ***agriculture*** and food production to be are rather poorly timed, to say the least.

Tim Leunig, an economist from the London School of Economics and an adviser to newly appointed chancellor Rishi Sunak, is understood to have said the food sector is “not critically important” to the country’s economy – and that ***agriculture*** and fisheries “certainly isn’t”.

Coronavirus and our pending departure from the European Union has exposed just how vulnerable we are to disruptions to the hitherto apparently seamless international supply lines we have come to rely on

In emails leaked to the Mail on Sunday last week, Dr Leunig is reported to have said that ministers could follow the example of Singapore, which is “rich without having its own ***agricultural*** sector”.

This is not a new idea. It fact, it’s one that seems to find favour with economists and politicians with alarming and hubristic regularity, despite the obvious folly of its adoption as policy during the interwar years that led to more than a decade of food rationing and the near capitulation of the UK in the face of vital food imports being restricted by German U-boats.

While the threat of global conflict may not be nearly so great today, coronavirus and our pending departure from the European Union has exposed just how vulnerable we are to disruptions to the hitherto apparently seamless international supply lines we have come to rely on.

This is not a uniquely British problem. Despite what Dr Leunig seems to think, wholesale reliance on food imports is viewed by Singapore, the very country he holds up as an example of economic best practice, as a major strategic weakness.

The Asian city state, due to its high population density and paucity of ***agricultural*** land, currently imports more than 90% of its food. But as recently as 2019 it introduced an initiative to produce 30% of its requirement domestically by 2030, precisely to mitigate the risks we are seeing today.

That is before we begin to consider the moral imperative for a country blessed with the climatic and natural resources we enjoy to produce at least a significant proportion of its food requirement to alleviate the increasing pressure on the wider world’s food supply and the subsequent effect on food affordability that would disproportionately affect the poorest in society.

The government has an ambitious and potentially transformational agenda for ***agriculture*** that, if judiciously and proportionately implemented, can and will underpin future food security and affordability while enhancing the natural environment.

It will require buy-in, commitment and innovation from all stakeholders. But in the longer term, it is a far more sustainable, economically and politically expedient strategy than the short-sighted and potentially ruinous alternative offered by certain economic experts.

We can only hope that this is one of those "off-the-wall" ideas so favoured by the prime minister’s adviser Dominic Cummings that doesn’t make it past first base.

JOURNAL : Farmers Weekly

As you probably know, I farm in East Anglia, the “driest” area of the UK. So, you might think we have escaped the worst of the wet weather. You’d be right.

That said, I have never seen our farm look as bad as we emerge from the winter.

We have wheat crop failures where the seed appears to have been “drowned”; some part-drilled fields where, in places, the land was too wet to carry a tractor; and some fields not drilled at all.

See also: Why wheat growers may need to target mildew this spring

We have about five acres of sugar beet that the contractor could not harvest because the soil was so soggy.

If he can’t get them out before the sugar factory closes, we’ll either have to plough them in or try to borrow someone’s sheep to graze them off.  We’ve never seen that field flood before.

All we have is Defra secretary George Eustice spouting Boris-based platitudes and waving a few quid, while the rest of the government spreads cash like confetti

Then there’s the rape. Drilled without the protection of neonicotinide seed dressing, of course, we have lost more than half our acreage because of flea beetle damage and/or too much rain. Many of our neighbours have lost all of theirs.

I understand UK rape crops are expected to yield a total of less than 1m tonnes this year, which means that, to satisfy domestic requirements, we will have to import another 1m tonnes from abroad (grown, of course, with the benefit of neonics).

I apologise to those across the rest of the UK, many of whose farms have been flooded for weeks, if not months. They are much worse off than we are.

Indeed, in most countries faced with such a catastrophe, a state of emergency would have been declared, with measures announced to help.

All we have is Defra secretary George Eustice spouting Boris-based platitudes and waving a few quid, while the rest of the government spreads cash like confetti.

I am, of course, aware that we are supposed to be optimistic about the opportunities presented by leaving the European Union.

But that is difficult to manage given the situation described above. For, inevitably, on many UK farms, 2020 will be a financial disaster.

And it won’t all be over in a few months. At a time when we are being urged to improve our soil structure, many of us are facing the worst soil damage for years.

Whether by deep “wheelings” from harvesting potatoes or sugar beet while the land was too wet, or simply because of waterlogging or outright flooding, it will take a few seasons to put things right on many fields.

And we have been warned to expect regular repeats of the kind of weather we’ve experienced. Sounds like some big challenges ahead.

Maybe part of the answer lies in light, robotic tractors. I know they have been written off as toys by some who have continued to develop bigger and heavier equipment.

But if we are to have a succession of wet autumns and winters, we are going to have to learn new skills and use new methods.

Meanwhile, let’s hope the trade deals supposedly being negotiated on our behalf enable us to survive the planned basic payment cuts, thereby giving us time to adj

JOURNAL : Farmers Weekly

Are we losing the fight? You’d be forgiven for thinking so.

As a dairy farmer, I’m well versed with the recent media trolling and fake news surrounding my profession. But it’s starting to wear thin and, quite frankly, emotive arguments are difficult to counter.

See also: Myth buster – the BBC’s anti-meat programme examined

The question I recently found myself asking is “does anyone really care?” The Oscars, where Joaquin Phoenix took a pop at the dairy sector, had its lowest TV audience on record.

The much celebrated Veganuary signed up 400,000 people – less than 1% of the population. To put it in perspective, 500,000 people are in air transit globally at any one point in time.

How much effort is spent chasing the 1%? Perhaps we need to withdraw from the battle in order to win the war.

Social media is by far our biggest tool, but we’re using it wrong. The majority of all anti-farming propaganda is actually spread by our own industry being outraged by it and commenting on it.

So how do we get the British public back on side and realise that British ***agriculture*** is currently the most secure, safest and climate-friendly system of food production in the world?

It’s clear our food system has been overtaken by a plutocracy – big businesses wants part of what we do.

So how do we counter the big advertising budgets that bolt themselves onto our well-established food system?

The direction of travel has to change. ***Agriculture*** has become the byword for climate change. Even the most educated could be forgiven for believing the media circus.

Greenhouse gas levels are rising as a direct result of the burning of fossil fuels for energy and an increasing global population.

That’s the hard reality and, short of advocating genocide or the collapse of capitalism, this is fixed. Population will grow and people will want heat, light and luxuries.

That same population needs to eat, and as yet there is no better way to do that than ***agriculture***. In the UK, the most efficient and nature-friendly way to a balanced, stable, healthy food supply is livestock.

It’s almost by accident that this same system can also play a major part in countering rising carbon dioxide emissions, but the UK is a small island in a massive pond and, ultimately, the steps we take will have little effect on the global problem.

That said, the leadership we could show in the UK could be the blueprint for the world in reversing climate change.

But this effort will all be in vain if all we do is export our climate responsibilities and undermine our home food economy.

So how do we get the British public back on side and realise that British ***agriculture*** is currently the most secure, safest and climate-friendly system of food production in the world? We need to prove it.

Perhaps our fight back in the media should begin by admitting global ***agriculture*** does have a problem.

For me, even some methods here in the UK have a problem, but we are taking steps to look at our environmental effects, record it and improve on it.

But any improvements we make now are lost, as we have no benchmark for success. Current science isn’t up to speed.

We need leadership and collaborative thinking to drive ***agriculture*** forward, because in a new world of open borders, we’ll need every marketing tool we have at our disposal.

So, in answer to my first question, are we losing the fight? No, I don’t think we’ve even joined the war.

JOURNAL : Farmers Weekly

Heifer-rearing rations require careful balancing between weaning and insemination to avoid excess energy and fat heifers calving down with ketosis and other transitional issues.

The issue of overconditioned heifers is affecting cow longevity, warned Stefan Neumann of nutrition company Agrosom. He was speaking at the European Calf Conference held in Bremen last week (12-13 March).

“Approximately 25% of heifers are culled by the end of the first lactation, and one of the key factors is transition and ketosis, caused by being overfat,” explained Mr Neumann.

He said scrutinising energy intake when heifers weigh 250-300kg and thereafter is critical, as this period is when fat deposition starts to physiologically overtake muscle building.

See also: 4 steps to ensure heifers are on track to calve at 24 months

Take-home messages

Weigh as often as possible to understand your heifer growth (birth, weaning, insemination)

Analyse all forage

Weigh feed and calculate dry matter intake, if possible

Evaluate whether you are overfeeding energy at the 250-300kg stage

Manage feed intake and fat deposition with neutral detergent fibre

Pasture is a good solution for controlling body condition in pregnant heifers, but must be managed well

Talk to your nutritionist about supplying enough protein

Mr Neumann stressed some heifers are not developing structurally fast enough, due to low protein levels in rations, and are laying down too much fat because of high energy levels.

At a rough cost of 1,500-2,000 (£1.300-£1,800) to rear each heifer in Germany, Mr Neumann said it is worth analysing forage to ensure money isn’t being wasted on bought-in energy.

Heifer-rearing feed costs total £1,051 a head alone, before vet and med at £22 and fixed costs at £140. Pre-weaning feeding costs £350, the 100-250kg growing stage costs £150 and feeding a heifer weighing 250-600kg costs about £536.

German feeding concept

Mr Neumann detailed a rough heifer feeding programme with guideline energy and protein requirements to meet the desired condition at first calving (see table below).

Weaning-to-insemination feeding programme to calve at 22-24 months

Months old

Live weight kg at end of period

Average dry matter intake (kg)

Management and feeding

Energy (ME)/ crude protein (%)

3

120

2.5-3

Weaning, weighing, introduce new diet

11.5/18

6-7

230-250

5.5-6

Two-thirds corn silage, one-third grass silage

2.5kg soya bean meal/corn

0.1kg mineral

11.2/17.5

7-12

250-360

6-7.2

Two-thirds corn silage, one-third grass silage

2.5-3kg soya bean meal/corn

0.1kg mineral

10.8/17

Use fibre

He said a tried-and-tested way of controlling energy intake is by feeding dietary fibre.

Depending on feed palatability and energy density, neutral detergent fibre (NDF) should be fed accordingly.

NDF recommendations

NDF (g/kg DM)

Feed intake (kg DM/day)

300kg liveweight

500kg liveweight

350

8.6

14.3

400

7.5

12.5

450

6.7

11.1

500

6

10

550

5.5

9.1

Pasture management

Pasture grazing is one way to control energy in the diet, with the option to supplement early or late in the season as grass quality alters, said Mr Neumann.

But he stressed altering stocking rates is vital. A German study found the pasture requirements of 400kg heifers gaining 700g a day increased from 0.25ha a heifer a month in May to 1.05ha in October.

A 500kg heifer growing at 700g a day needed 0.31ha in May, which increased to 1.27ha in October.

Weight targets

He advised farmers to reassess what size cows they are trying to breed and feed accordingly.

Optimal weights and sizes, rather than maximum weights and sizes, had the best yield benefit in first lactation, he explained.

He said a target body weight of 561kg-600kg for a Holstein-Friesian heifer after calving is optimal, with a height of 1.41-1.43m at the sacrum.

“Danish breeders are now advising a maximum of 1.48m,” he said.

JOURNAL : Farmers Weekly

France’s most famous ***agriculture*** show has been closed a day earlier amid the coronavirus outbreak.

The final day of the International ***Agricultural*** Show (IAS) at the Paris Parc des Expositions on Sunday 1 March was cancelled after the country’s total number of coronavirus cases rose to 100 people, including two deaths.

Each year, the show attracts between 630,000 and 650,000 visitors, 1,000 exhibitors and 32,000 professionals from around the world.

See also: Global dairy markets feel coronavirus pressure

The 57th edition of the show was themed “***Agriculture*** welcomes you with open arms”.

But organisers had to cancel the final day after the French government introduced health security measures banning all large indoor gatherings of more than 5,000 people, in an effort to slow the spread of the country’s coronavirus outbreak.

In a statement on Twitter, Salon ***Agriculture*** said: “Following the government and health authority’s decision, every [indoor] gathering of 5,000 people is banned.

“The show will, therefore, close this evening, Saturday 29 February, at 7pm and not reopen its doors tomorrow, following the recommendations and decisions of public powers.”

The organisers said they would reimburse anyone who had bought advance tickets for Sunday’s show. Further details will be announced soon.

UK monitors situation

In the UK, the number of coronavirus cases rose to 40 on Monday 2 March. The government is monitoring the developing issue of the coronavirus.

Prime minister Boris Johnson said on Monday that the spread of the disease now looks “likely”, but he added that people “should go about their business in the usual way”.

If the virus spreads in the UK over the coming months and the government was forced to introduce similar restrictions to France, it could threaten ***agricultural*** show dates and conferences here.

JOURNAL : Farmers Weekly

The acceptance rate for permitted development rights (PDRs) applications has risen to 80%, showing progress has been made compared with the previously lesser-known and misunderstood system.

PDRs enable certain types of development to be granted without applicants having to go through the full planning permission process, and were introduced to tackle the national housing deficit.

In 2018, the right for changing the use of ***agricultural*** buildings to dwellings (Class Q) was amended to allow for up to five dwellings and up to 865sq m floor space to be converted, and this has seen an overall increase in uptake.

See also: How Class Q development rights are working in practice

However, over the past few years, they have been generally misunderstood by local planning authorities and were even often mistakenly refused.

Though more applications are now being made and granted, councils are still interpreting the rules differently with success rates fluctuating even within the same county, say advisers.

Landowners may be more aware of the opportunity than they were previously, but ***agricultural*** conversions still account for a low percentage of the total PDR applications.

The government’s most recent figures (July-September 2019) show that district level planning authorities in England received 106,500 applications for planning permission and granted 90,600 (88% success rate).

Of the 8,600 PDR applications reported in this period, prior approval was not required for 4,900, and permission was granted for 1,900 and refused for 1,800 – an overall acceptance rate of 80%. Just 7% of the applications related to ***agricultural*** to residential changes.

Resisted by councils

According to Georgina Simonds, graduate surveyor at Rostons, in general, PDRs have been resisted by local planning authorities – particularly where development is rife and the number of applications is high and stretching resources.

“Applications in Cheshire are split between two local planning authorities, with one generally more accepting than the other,” she said. “It is important to remember that the problem may not always lie with the council but a lack of understanding of the criteria by applicants.”

If in doubt as to whether an application complies with the PDR criteria, either professional guidance should be sought or a full planning application route, where there is more flexibility, should be considered, says Ms Simonds.

Varied interpretations

Class Q application success remains variable between different local planning authorities and sometimes even within the same council, says Tony Kernon, director of Kernon Countryside Consultants and recently appointed British Institute Of ***Agricultural*** Consultants chairman.

“The greatest area of variability relates to interpretations about whether or not the works go beyond a conversion,” he said. “Some officers interpret the need to install a wall in an open-fronted section, for example, as more than a conversion.”

Class Q does not apply within National Parks, areas of outstanding natural beauty, for listed buildings, or if a landowner has put up any buildings or carried out any Part 6 ***agricultural*** permitted development since 20 March 2013.

Therefore, even if farmers are aware of it, it may not be relevant for a substantial amount of people, says Mr Kernon.

Advice for PDR applications

Provide plenty of information about the structural quality of the building.

Explain what will be retained in terms of walling or roof sheeting.

Research what has been permitted locally under Class Q and refer to that.

Class Q is a rule-based approval – do not make schoolboy errors such as making curtilage too big.

Check your proposal carefully.

You may be asked for an ecological survey – build that into your programme and costs.

Class Q only applies to buildings in ***agricultural*** use on 20 March 2013 – double check this if there is any doubt about the use.

Using your Part 6 ***agricultural*** permitted development rights since March 2013 can result in you losing Class Q. If you need to modify other farm buildings or tracks, for example, consider making a full planning application to protect the Class Q right.

You must complete the conversion within three years, not just start it.

Source: Tony Kernon

JOURNAL : Farmers Weekly

Rising pork prices have boosted pig sector incomes by 95% to £58,000 in 2019, according to Defra’s latest figures.

The pig sector figure is part of Defra’s farm business incomes forecast, which provides estimates for all farm types in the 12 months to February 2020.

It suggested that pork prices were driven up by China’s production losses due to African swine fever (ASF), which created extra demand.

See also: Guide to managing big pig litters

Prices are up by about 5% compared with 2018-19 due to the ASF outbreak in Asia and eastern Europe.

What is farm business income?

For non-corporate businesses, farm business income represents the financial return to all unpaid labour (farmers and spouses, non-principal partners and their spouses and family workers) and on all their capital invested in the farm business, including land and buildings.

For corporate businesses it represents the financial return on the shareholders' capital invested in the farm business.

Returns were also up on the back of higher throughput and carcass weights, and a 4% fall in feed costs.

With specialist pig businesses outperforming all other sectors, the National Pig Association has urged caution when viewing the figures.

Chief executive Zoe Davies said China's ASF woes meant the sector's income performance was artificially inflated.

Future caution advised

"As ASF continues to spread towards Germany, we are extremely cautious about future prices," said Dr Davies.

An outbreak in Germany will see exports to China blocked and its output returned to the EU market, which will increase supply and pressure prices. The UK's valuable cull sow market in Germany may well collapse.

Meanwhile at home, domestic demand is still a struggle. "These figures suggest a period of making hay while the sun shines, but continuing to invest and ensure pig businesses are resilient and competitive for the future," she said.

Other sectors

For other sectors, the weather was a key driver for change during 2019 compared with year-earlier results.

For grazing livestock farms, better weather during the 2019 growing season had helped bolster incomes on grazing livestock farms through reduced feed costs.

But arable farms have reported falls in income with the value of higher yields offset by lower prices and a hike in machinery costs.

Lowland cattle and sheep

Average income on lowland cattle and sheep farms is expected to have increased by 51% to £19,000. Defra suggested the additional margin was mainly due to lower feed costs.

Almost perfect summer grass-growing conditions combined with lower concentrate prices to cut feed and forage costs by about one-fifth.

In addition, total output for cattle increased by about 3%, helped by slightly heavier carcass weights. The improved incomes were achieved despite lower prices for most of the period covered.

Less-Favoured Area (LFA) livestock

Defra has predicted a 40% increase in average incomes for LFA livestock to £22,000, driven by lower feed costs and an increase in sheep output.

The same factors pushed up LFA cattle output with feed costs reckoned to be 20% down.

Cereals

Specialist cereal crop growers saw the biggest drop in incomes across the farm sectors. Defra’s estimate suggested that average income on cereal farms dropped by 15% to £57,000 in 2019-20.

The main factor was the weather which saw bumper yields and increased crop areas planted compared with 2018. These plentiful supplies and a successful harvest pointed to a 4% price drop.

At the same time, input costs are expected to have risen by 2%, with higher fertiliser and machinery prices the big drivers.

General cropping

Average incomes on general cropping farms are expected to show a fall of about 7% to £99,000 in 2019-20. Peas, beans, sugar beet and potatoes all saw increased yields compared with the drought-stricken harvest of 2018.

But, like cereals, the effect of the rises, coupled with increased areas for some crops, are expected to be offset by lower prices.

The exception to this is oilseed rape, where prices are predicted to remain firm, but the area and yield decreases, reflected losses to cabbage stem flea beetle and pigeon grazing.

Dairy

In the dairy sector, Defra estimated incomes to have remained static at about £80,000.

A fall in input costs was offset by a similar reduction in output, with prices for the period March 2019 to January 2020 about 1% lower than the previous year.

JOURNAL : Farmers Weekly

The coronavirus outbreak has prompted governments to ban large gatherings in a number of European countries, including France and Italy, with Germany and Romania about to do the same.

The UK government could soon move from “containment” to “delay”, the second phase of its four-part plan to tackle the spread of the disease.

Proposed measures to delay the virus’ spread would include social distancing, people showing symptoms of the disease being asked to self-isolate and a ban on mass gatherings of people.

See also: Eustice holds further talks with retailers on coronavirus

In the UK, five people have died from the coronavirus and the number of confirmed cases stood at 321 on Tuesday (10 March).

(function(d,s,id){var js,fjs=d.getElementsByTagName(s)[0];if(d.getElementById(id))return;js=d.createElement(s);js.id=id;js.src='[*https://embed.ex.co/sdk.js*](https://embed.ex.co/sdk.js)';fjs.parentNode.insertBefore(js,fjs);}(document,'script','playbuzz-sdk'));

In the ***agricultural*** industry, large gatherings of people are planned over the coming weeks, including conferences, machinery sales and the start of the ***agricultural*** showing season. On a daily basis, livestock farmers are also in regular close contact with each other at auction marts across the country.

Farming rally

Hundreds of farmers are also expected to travel from across the country to London on 25 March to take part in a rally to urge the government to safeguard the industry’s world-leading standards in future trade deals.

An NFU spokesman told Farmers Weekly the union still planned to hold the rally on 25 March, but it was keeping the situation under review.

The spokesman said: “We are currently not aware of any issues on British farms as a result of the coronavirus. The NFU will be following all government guidance for businesses and we will encourage our members to do the same.”

Last week, the last day (1 March) of the Paris ***Agriculture*** Show was cancelled amid the spread of Covid-19 in line with a French government order to ban indoor gatherings of more than 5,000 people.

JOURNAL : Farmers Weekly

Prime cattle supplies are likely to tighten throughout 2020, with fewer cattle available and greater proportions of male cattle being slaughtered at a lower age.

Analysts say this could point to firmer prices but warn that demand for beef remains “sensitive” to consumer opinion and international trade agreements.

Latest figures from Quality Meat Scotland (QMS) show that calf registrations in Scotland were 552,700 head in 2019, the same as in 2018, but 2.5% lower than in 2017.

See also: App reveals sires worth £120 more in gross margin

Analysis also shows that while the age profile of female cattle under 30 months of age on farm is unchanged, male cattle are typically being sold younger.

Combined with the fact that prime cattle slaughtered this year will largely be drawn from animals born in 2018, and those numbers born were lower than 2017, it all points to a slightly tighter supply of prime cattle.

Stuart Ashworth, director of economic services at QMS, said: “Economic theory tells us that tighter supplies support prices, but the caveat to that is demand must remain firm domestically and internationally, and access to international markets must be open with minimal constraints.”

Native breeds

The calf registration ***data*** also highlights the continuing trend towards native breed sires, which is about 28% of all registrations, up from 20% a decade ago.

In Scotland, the Aberdeen Angus breed now accounts for 19% of all Scottish registrations up from 14% 10 years ago.

Dairy-sired calves

Another noticeable trend is a 3.5% fall in the number of dairy-sired male calves between 2018 and 2019.

“This reflects the growth in the use of sexed semen to produce replacement dairy stock, leaving scope to increase the use of beef sires on a greater number of dairy cows,” said Mr Ashworth.

Nationwide trend

This trend has also been seen in England and Wales, where there was an 11% drop in dairy-sired male calves between 2018 and 2019, while female dairy calf registrations remained unchanged, said Mr Ashworth.

AHDB analysis of the December 2019 census also highlights sizeable drops in the number of male cattle under two years of age, because of greater use of sexed semen.

It suggests that sexed semen accounts for almost one in three dairy inseminations.

AHDB is forecasting that the prime slaughter kill will be 2% lower in 2020 at 1.96 million head, compared to 2.01 million in 2019.

Ireland

Census figures from Ireland show similar patterns.

The number of cattle aged 1-2 years on Irish farms fell 2.7% between December 2018 to December 2019, and the number of male cattle in this age group fell 4%.

JOURNAL : Farmers Weekly

The close-up dry period is a critical period in the last three weeks before calving.

It is essential to the success of the next lactation and rations should change to prepare the animal for lactation.

Forages low in energy are a must as it is essential cows don’t put on or lose weight.

See also: How to assess if your dry cow ration is working effectively

Together with independent nutritionist Mark Price, we take a look at five options for dry cows.

Dry cow diet facts

Target calcium level in a dry cow diet is 30g a head a day.

The average calcium content of grass silage is 8-10g/kg DM meaning if a cow eats 12kg of forage DM matter a day that’s 120g of calcium

Excessive calcium will stop a cow from mobilising it from her bones when she needs it at calving

Be aware, a heavily fertilised grass high in potassium creates an alkaline blood and reduces calcium mobilisation.

1. Goldilocks diet

What it is?

The Goldilocks diet is low in energy and high in low-quality forage, typically straw, and fed for the entire dry period.

The term "Goldilocks" is derived from the fact cows are provided with just the right amount of nutrition. This means the cow’s energy requirements will be met, but not exceeded when they are fed the diet ad lib.

How does it work?

By feeding the cow just right amount of energy, there is a lower rate of fat mobilisation. This is because cows’ tissues become more insulin sensitive, and insulin is a hormone that reduces fat mobilisation.

Many Goldilocks diets are also dietary cation anion balance (DCAB) diets. This means they contain a balance of minerals that acidify the blood, which promotes calcium mobilisation from the bones (see point 2).

Vital elements of the ration/inclusion rates

Typically, the diet will contain:

More than 50% forage.

Low levels of grass silage (ideally no more than 3kg a head a day).

2-3.5kg a head of dry straw (high quality, low energy and chopped short).

Crude protein is 13.5-15.5%.

At least 1,200g of metabolisable protein.

Neutral detergent fibre is 40-50%.

Micronutrients are dependent on factors such as milk yield and raw material bioavailability.

Potassium as low as possible.

Magnesium to potassium ratio is 1:4.

Pros

Good at keeping the rumen full and because less grass silage is used, the risk of milk fever is reduced because the energy density of the ration is kept low.

It can be fed to one group throughout the entire dry cow period.

Cons

You must be able to chop high-quality straw down to 2cm and ensure cows eat it.

It is not the cheapest diet as the straw brings no nutritional benefit.

What type of herd is it suited to?

This diet is suited to mid- to high-yielding herds (7,000-12,000 litres) because it is effective at controlling milk fever and ketosis, both of which are present in higher yielding herds.

2. DCAB diet (semi-DCAB and High-DCAB)

What it is?

The DCAB system is probably the most common modern dry cow feeding approach to help prevent milk fever. It involves balancing the minerals naturally present in the feeds to create the most favourable, slightly acidic conditions in the blood.

The difference between a high-DCAB and a semi-DCAB is the level of acidification – a high-DCAB (full) diet causes the blood to be more acidic.

A semi-DCAB (partial DCAB) contains less anionic salts meaning the blood is less acidic. Magnesium chloride is the main anionic salt used in both diets.

A high-DCAB diet involves the use of a commercial mineral pack (supplement) containing a balance of anionic salts and additional calcium. This works well under careful management, but high calcium can make milk fever worse if the supplement is not fed accurately every day.

How does it work?

It acidifies the blood which allows calcium to be mobilised from the bones.

To acidify the blood, you need to offset the inputs of positively charged cationic salts such as potash and sodium, which make the blood less acid, with acidifying, negatively-charged anions like chloride and sulphate.

This essentially causes the cow to get mild, metabolic (not rumen) acidosis which triggers the metabolism of calcium from the bone reserves to redress the balance and prevent milk fever.

Vital elements of the ration/inclusion rates

The rations of a high-DCAB and semi-DCAB diet are similar except for the mineral pack.

The diet includes:

2-4kg a head of straw (no higher than 6kg a head).

Ideally, low levels of grass silage (typically no higher than 10kg a head) to keep potassium levels low.

Typically, 5kg/head a day of hay/haylage (not essential).

Maize silage.

2kg a head a day of concentrates.

Mineral pack – the pack will depend on whether it is a full or semi-DCAB diet and also the base ration of the diet. The semi-DCAB mineral pack will contain less anionic salt.

Pros and cons

High-DCAB diet can be more expensive.

Can be hard to manage and needs to be accurate. Blood acidity will need monitoring by testing the pH of the urine.

A semi-DCAB diet is slightly cheaper because of the mineral pack contains less anionic salts. However, the semi-DCAB diet is less effective in minimising milk fever in high risk animals such as high-yielders.

What type of herd is it suited to?

High-DCAB to high yielding herds and semi-DCAB to high- (10,000 litres plus) and medium- (7,000-9,000 litres) yielding cows.

3. Calcium binders

What it is?

Calcium binders are granular compound clay pellets that bind excessive calcium in the diet (for example, if a high amount of silage is being fed.) They have been found to decrease the incidence of milk fever and are often used where high amounts of grass silage is fed in the dry cow diet.

How do they work?

Some of the products are based on sodium aluminium silicate, which is a synthetic zeolite clay that binds calcium. This causes the cow to mobilise calcium from her bones when she needs it.  Binders are often sold as a compound dry cow nut.

Vital elements of the ration/inclusion rates

20kg ahead a day of grass silage.

2kg a head a day of straw.

2kg a head a day of concentrates.

Roughly about 500g of zeolite (calcium Binder) although many complete formulations include the zeolite and the concentrates.

Pros

Feeding a calcium binder is one of the most robust and reliable ways of stopping milk fever.

It allows farmers to feed high amounts of grass silage which can be high in calcium.

Cons

Expensive.

Only prevents milk fever and not other metabolic diseases such as ketosis.

Needs precise management of the zeolite – it cannot be fed at all post calving.

Some farmers can be so reliant on the binders, the ration often receives less attention.

What type of herd is it suited to?

Small herds/all year round (AYR) small calving groups or herds that may struggle to source and chop straw, and where grass silage is the main source of feed. It also suits farmers that graze dry cows.

4. Standing hay for grazing herds

What it is?

This is where a field is left to grow for two months and then strip grazed. It provides cows with a high fibre, low-energy diet.

How does it work?

Instead of incurring the cost of baling long, stemmy grass for silage or hay, cows harvest it themselves by strip grazing it. The paddock can also double up as a calving area.

Vital elements of the ration/inclusion rates

Cows typically eat 8-10kg of DM a head a day.

For very low yielders, no supplementation will be required.

High yielding cows will need to be supplemented with dry cow rolls or nuts.

Pros

It is the cheapest diet – the cost of grazing standing hay is only 7p/kg of DM and for the total ration cost, you are talking pence not pounds – half the price of other diets.

Works well for farmers managing dry cows outdoors or calving outdoors.

Cons

Weather can reduce the DM intake and affect the hygiene of the cow and calf.

If calving outside, ensuring good colostrum intake in the calf can be trickier to manage.

Potentially there’s a higher risk of metabolic diseases in higher yielding cows if they are not receiving the correct dry matter intake.

What type of herd is it suited to?

Smaller cows and low-yielding cows (below 7,000 litres). It also works better logistically for an autumn calving herd.

5. Simple forage and dry cow nut

What it is?

A forage-based ration such as haylage supplemented with a dry cow nut is the simplest dry cow ration available.

How does it work?

This diet is reliant on forage. The dry cow nut is used to address any protein and energy needs with minerals often fed in addition. The diets are often semi-DCAB which helps acidify the blood slightly and causes mobilisation of calcium from the bones.

Vital elements of the ration/inclusion rates

25-30kg a head a day fresh weight of forage.

Dry cow nuts should be 25% protein, 18% starch and an ME of 12.5% and fed at a rate of 2-3kg a cow a day.

Overall ration ME of 10.5ME.

Pros

Simple diet and be very effective.

Works well with small groups.

Can be flexible.

Cons

If you do have issues, it can be hard to adjust.

Reliant on forage.

What type of herd is it suited to?

Lower yielders and cows housed in smaller groups where feeding multiple diets would be hard. i.e. if there are only a few cows in each group.

JOURNAL : Farmers Weekly

A new rapid test is set to help farmers save money on their fungicide bill, by detecting septoria in wheat crops before symptoms are visible.

Septoria is considered to be the biggest threat to wheat crops in the UK, causing yield losses in excess of 30%. This is because the disease reduces the ability of the wheat plant to produce energy.

However, it has a long latent period where it grows inside the leaf for weeks (20-plus days) before becoming visible on the surface as yellow blotches and black dots.

See also: 3 high-tech gadgets for monitoring crop diseases

This makes it difficult to target fungicides, as infection can be lurking undetected. To help farmers, Microgenetics has developed a rapid test that takes just six hours from the start of the process.

The company claims it is very sensitive to even early infections of septoria, where only a small amount of fungal matter is present.

Andrew Davies, Microgenetics managing director, said farmers/agronomists can send samples using a standard next-day mail service and receive results as soon as 24 hours after posting.

He believes it will enable growers to save on fungicide costs by opting for cheaper products where the risk is low. Conversely, where the disease is detected, farmers can target it with a beefed-up spray programme.

After proving the technology, this year the company is looking for farmers and other partners to take part in a testing pilot, where they will receive their next-day results free of charge.

JOURNAL : Farmers Weekly

The Food Standards Agency (FSA) has announced plans to tighten controls on raw milk production in England and Wales.

Raw milk is unpasteurised and therefore carries a greater risk of containing harmful micro-organisms such as salmonella, campylobacter, E coli and listeria, according to the FSA.

It said greater scrutiny and tougher controls of the raw milk sector are needed because of a significant increase in both producer numbers and customer illness.

See also: So you want to sell milk direct from farm

Up to 2014 there were roughly 100 farmers producing raw milk.

But this grew by more than 70% to 171 by 2018, as an online market developed and demand increased.

However, the rapid expansion saw a parallel increase in customer illness. Between 2015 and 2017, there were five outbreaks of illness linked to raw milk compared with no outbreaks during the previous 12 years, the FSA said.

Within these outbreaks, there was a total of 103 reported cases, with some people requiring hospital treatment.

The FSA responded by carrying out a consultation in early 2019. This was conducted in conjunction with the Raw Milk Producers Association (RMPA), which has advised on the new controls that will come into force on 1 April 2020.

Tali Eichner, RMPA membership secretary, said she was pleased to have been engaged in constructive dialogue with the FSA throughout the process.

“The approach proposed by the FSA enables the producer to assess the risks in their own system and set controls appropriate to their individual situation,” Ms Eichner said.

Hazard assessments

She explained that producers will be expected to carry out full hazard analysis and critical control point (HACCP) assessments that identify risks to the product safety and the measures implemented to prevent contamination.

These measures will be assessed during routine inspections, which will also include more in-depth audits of the farm.

Dairy hygiene inspectors already look at the milk-producing facility. But their visits will scrutinise things more widely, including pest control, feed storage and veterinary records, across the whole unit, said Ms Eichner.

Milk sampling will also look beyond the standard hygiene controls to test for specific pathogens.

Ahead of the stricter regime, the FSA has produced a 37-page document that sets out what will be required of producers.

The guidance, which must be read and adhered to from 1 April 2020 states:

Anyone planning to sell raw drinking milk must first register as a food business with the FSA.

Farms already registered must notify the FSA of an intention to start selling raw drinking milk.

Raw milk producers face an initial check and milk sampling by dairy hygiene inspectors.

Inspections will be on a six-monthly basis thereafter.

Farms are legally required to devise and implement a safety system that includes an assessment of risks of their product.

The system must also identify controls to prevent the risks from affecting their product safety.

Producers are expected to adopt recommended periodic testing for specified pathogens and indicators of poor hygiene and disease that can be found in milk.

Local authorities will be informed of proposed raw milk production by the FSA. However, producers must also contact the local authority, which may want to carry out its own inspection of the filling and bottling process.

Michael Wight, head of food safety policy at the FSA, said: “Food businesses must follow the measures set out in this guidance in order to reduce the health risk to consumers from this product.

“The FSA will continue to monitor any health incidents associated with raw drinking milk to see if these measures are sufficient.”

Further information

Guidance for raw milk producers (PDF)

It should be read in conjunction with the Food Hygiene Regulations (Wales) 2006 and the Food Safety and Hygiene Regulations (England) 2013.

In England and Wales, contact the FSA on [*approvals@food.gov.uk*](mailto:approvals@food.gov.uk)

In Northern Ireland, email [*executive.support@food.gov.uk*](mailto:executive.support@food.gov.uk)

The sale of raw milk is banned in Scotland

JOURNAL : Farmers Weekly

Red diesel prices have slid by 2p/litre after Saudi Arabia announced it would step up crude oil production and lower prices.

The national average diesel price fell to 48.5p/litre this morning, down from 50.5p/litre last Wednesday (4 March).

The price is based on a Farmers Weekly UK-wide survey for a 5,000-litre delivery within 20 miles of the depot on 28-day payment terms.

See also: Fury over chancellor’s plans to scrap red diesel duty rate

Some fuel retailers reported to Farmers Weekly that farmers have stepped up their buying to capitalise on the low prices, with reports of deliveries now scheduled for the end of the week in some regions.

Additional interest is also being generated by reports that chancellor Rishi Sunak may remove the red diesel duty rate for the ***agricultural*** and manufacturing industry in his Budget statement on Wednesday (11 March).

Why has the price fallen?

Prices now stand at multi-year lows after Saudi Arabia announced an aggressive expansion in crude oil production at discounted prices despite forecasts of global demand falling as the effects of the coronavirus causes manufacturing and trade to slow.

This caused oil prices to crash by 30% as markets opened this morning, with traders saying it was the biggest one-day fall since the 1991 Gulf War.

Brent crude, the international marker, was trading at $31.25/barrel at its lowest point after opening at $45.27.

The Saudi strategy is understood to have been caused by the country seeking to punish Russia for failing to agree to a cut in global production at the end of last week.

Wider implications

The move is likely to put pressure on a number of ***agricultural*** commodities with by-products that are made into energy such as wheat, maize and soya, warned Rabobank commodity analyst Michael Magdovitz.

“These are still food-related, but they have biodiesel components,” he said.

Traders will also be closely studying forecasts for feed demand, which could be under threat because of the logistical difficulties in getting crops into China, as many areas are still operating under quarantine restrictions, he added.

The May-20 UK wheat futures market was down from £149.55/t at its close on Friday to £147.25/t in intraday trading, while May-20 European rapeseed futures had fallen by 10/t this morning to stand at 367.75/t.

JOURNAL : Farmers Weekly

Beef and lamb sales fell in both volume and value over the past three months, but pigmeat spending was up, according to Kantar WorldPanel (KWP) figures.

The market analyst said total spending on beef was down by 3% in the three months to 26 January 2020, compared with the same period a year earlier.

This was primarily driven by a 2% decline in the amount purchased, but average prices were also down by 1%.

Both the volume purchased per buyer and market penetration fell.

See also: Doorstep milk round revived by dairy farm selling direct

AHDB Beef and Lamb analyst Bethan Wilkins said the figures suggested consumer demand for beef continued to struggle.

Lamb sales also fell by 3% year-on-year during this period, KWP figures show. This was due to a 6% drop in the amount purchased, which was only partially offset by a 3% rise in average prices.

People who did buy lamb purchased similar amounts to last year, so buyers may have been deterred by the rise in retail prices, said Ms Wilkins.

However, retail spending on pigmeat showed a slight increase of 1% compared with the same three months last year.

“This was driven by a 5% increase in average prices, partly due to a reduction in promotional support [shopper discounts and offers] for both primary pork and bacon,” said Ms Wilkins.

British pig prices were 17% higher than year-earlier levels in January, and the price of imported pigmeat was also up by 17% in December. This may well be pressuring retail margins, encouraging some price increases, she said.The amount of pigmeat purchased declined by 4%, mainly due to consumers purchasing less a head.

The main casualty was primary pork cuts, with fewer people buying pork and the amount bought a head dropping off.

The 1% rise in values was down to increased spending on processed pigmeat, while overall market penetration was maintained due to some growth in the ready-to-cook market, Ms Wilkins said.

Retailer performance

The decline in red meat volumes comes as KWP figures suggest an overall increase in supermarket sales figures.

In the past 12 weeks, year-on-year supermarket sales grew by 0.7% - the fastest rate since November 2018.

However, some supermarkets performed better than others. Sainsbury’s was the only one of the traditional large grocers to increase year-on-year sales, with spend up by 0.3%, said KWP’s Fraser McKevitt.

Among the rest of the big four, sales at Tesco and Asda dipped by 0.8% and 1.2%, respectively, while Morrisons' sales were 2.0% lower than the same period last year.

The traditional big hitters saw their market shares further eroded by competition, with Lidl leading the charge.

Lidl is Britain’s fastest-growing grocer for the first time since November 2017, with sales up by 11.4%, Mr McKevitt said.

Lidl has benefited from its rapid store expansion programme, with its 800 stores serving an extra 900,000 shoppers over the 12-week period.

Its market share has risen accordingly, with sales up from 5.2% last year to 5.8% in 2020.

Meanwhile, Aldi’s sales were up by 5.7%, with its share of the market now standing at 7.9%.

JOURNAL : Farmers Weekly

Selecting a building design with no roof is allowing expanding dairy farms to save money on new infrastructure.

Topless cubicle housing and milking parlours cost less and, contrary to perception, there is no trade-off in the comfort and welfare of cows and staff, say farmers who have gone down this route.

But there are issues that must be considered when a building has no roof.

Simon Hennessy, of Grasstec’s Farmyard Design Department, says the additional rainwater ***collected*** from roofless cubicles can increase slurry requirements by up to 80%.

See also: Video: Roofless sheep unit helps Anglesey farmer preserve spring grass

However, the cost advantage of not installing a roof is a saving of about 55,000 (£46,743) per 100 cows accommodated, he calculates.

Below, we consider the pros and cons with two dairy farmers who have chosen roofless facilities.

See also: How to avoid the 9 most common dairy cow housing pitfalls

Case study: Rory Christie’s roofless cubicle shed

At £600 a cow place, topless cubicles have provided Rory Christie with a lower capital solution for housing his large-scale, spring calving herd.

Mr Christie, who farms with his brother, Gregor, in south-west Scotland, had been running 600 cows in four separate herds until he streamlined the system to create a single herd, milking 1,200 cows.

With milk production on the Port William holding run on a lower capital system, he trialed different ways of managing the cows for the winter dry period.

Farm facts

Spring calving

Milking 1,000 Friesians cross Jerseys through a 44-point rotary parlour

Yielded 3,500 litres last year on once-a-day milking, at 5.41% butterfat and 4.33% protein

Sells milk to the Milk Suppliers Association (MSA), a co-op supplying the Caledonian Creamery in Stranraer owned by Lactalis

They previously had cows at different locations, on fodder beet and silage bales, rough ground and sacrificed land, but it was becoming logistically very difficult and they were concerned about the potential run-off.

He sought potential solutions during a visit to New Zealand.

He didn’t find any answers but received a photograph of roofless cubicles when he returned and later discovered similar housing in Wales.

Impressed by what he saw, he built his own roofless cubicles, initially installing 500 places and expanding to 1,000.

Cost and benefits

The building and associated slurry storage facilities cost £600 a cow place, but the decision to go roofless was not down to cost alone.

“The cows are much healthier and cleaner because they are outdoors in clean air,” says Mr Christie.

“They grow hairy coats. It is the equivalent of a farmer putting on warm clothes and waterproofs to go outside if the weather is bad – they are kitted out well for being outdoors.”

Location and considerations

The cubicles are in a sheltered position. They were built on a site once occupied by a 10,000-space pig unit and are protected from the prevailing wind by surrounding buildings.

The stalls have rubber mats and these are brushed daily with a Plant-mec motorised brush.

“We floodwash and scrape the passages every day, just like a normal cubicle setup,’’ he explains.

His farm is well suited to the structure – the annual average rainfall is just 1m (39in).

“It is a good solution for spring block calving herds because cows are predominately dry when they are on it.’’

The herd is Friesian cross Jersey – a robust, 500kg cow.

“They are very resilient animals. They are bred specifically for a system like ours.”

The success of the system is driven by body condition scoring (BCS) and Mr Christie manages this very closely.

“We use the New Zealand scoring system. I like them to be at BCS 5 when they are dry,” he says.

After calving in February, the cows perform well off grass as they are already acclimatised to the outdoors.

Overcoming challenges

The downside is there is a higher volume of dirty water generated because the building is not protected from rainwater.

To overcome this, there is a 5m gallon slurry store that provides sufficient capacity to hold slurry and dirty water produced over 12 months.

As a safety net, the cubicle layout and feed area were designed in such a way that they can be roofed at a later stage if required.

But Mr Christie sees no reason to adapt the shed yet.

Case study: Johnjo Roberts and Mat Venables roofless rotary

Investing in 70-point rotary parlour without a roof helped business partners Johnjo Roberts and Mat Venables stick to a tight budget when they established a new dairy unit on Anglesey.

At £460,000 inclusive of all associated costs, the parlour was their biggest expense, but they made a saving of £40,000 by installing a model with no roof or walls.

Cow numbers were their priority when they set the budget to establish a new dairy unit at Bryn Celli Ddu, a 250ha rented farm on the Plas Newydd Estate.

Farm facts

Yielding 4,400 litres at 4.66% butterfat and 3.7% protein

Milk sold to Arla

“Capital is limited when you are setting up a new dairy. We wanted to stock the farm fully from the start, so cow numbers were a priority,” explains Mr Roberts.

The pair were already heavily invested as this was the second farm they converted to dairy; they had already established a spring calving herd as a joint venture two years earlier.

They were confident their decision to install a roofless parlour was the right one after visiting another spring block calving dairy farm in north Wales that had been milking in a rotary with no roof for 10 years.

“We had the benefit of being able to visit the farm and speak to the farmers.

"It is easier to be the second to try something than the first,” Mr Roberts adds.

Location and considerations

At 36in, the farm’s average annual rainfall is not high and shelter is not an issue because the Waikato parlour is not completely devoid of a roof.

There is an overhang above the area where the milkers operate and this provides some shelter.

“We milked in the rotary through the Beast from the East and we had no more problems than we had with our fully covered 46:92 herringbone,” says Mr Roberts.

In fact, herdsman Gethin Jones, who has worked in the business since the parlour was installed in 2016, insists there are no downsides to a roofless design.

“When the weather is a bit wet, we get kitted up well, and when the sun is shining, everyone is smiling because we are out in the daylight.’’

The parlour is operated by three milkers in the spring and two at other times of the year.

Benefits

Mr Jones says heifers acclimatise quickly to being milked because they are not entering a dark building.

In fact, throughput averages 400-450 cows/hour.

Not having walls is an advantage for cleanliness, he reckons.

“The parlour keeps itself very clean, there is hardly any build-up of muck and when we get a bit of rain, it gets a good wash.

"It is kept very clean because there are no walls, that is a big positive.”

Overcoming challenges

When the weather is at its most challenging, in December and January, the herd of New Zealand Friesian cross Jerseys is dry.

Calving gets under way at the beginning of February and only limited numbers are milked in that month.

Roofless livestock facilities can elicit negative comments on social media and the sources of those comments can be surprising, Mr Roberts admits.

“Occasionally, a photograph of the parlour will appear on social media with negative comments, sometimes from other dairy farmers, who suggest it must be miserable to work in. That is definitely not the case.

“It is a nice environment to milk in. Why spend more money on infrastructure than you need to?”

JOURNAL : Farmers Weekly

Farm-built cultivators and drills are a staple of the Farmers Weekly Inventions Competition, and 2020 was no exception.

See also: Video: On test – 20 top workshop tools recommended by farmers

George McWilliam’s cover crop drill

Aberdeenshire farmer George McWilliam built a cover crop drill for just £400 over the course of a few afternoons last spring.

The outfit is based on an old 5.5m Kongskilde Triple K cultivator, which he bagged for just £150 at a local ***collective*** sale.

To this, he fitted a recycled Accord distributor head (£50) and fabricated his own spreader plates to run along the back of the cultivator.

New pipework finished the job and an Amazone front hopper – already on the farm – holds and meters the seed.

Mr McWilliam drills the crops directly into barley stubble in August and has so far sown 40ha, with decent, uniform results.

The cover crop will then be ploughed in prior to spring barley sowing this year.

Compared with previous systems, the new drill pulls fewer stones to the surface, and is quick and cheap to run. It could also be used to sow grass seed, he says.

Rob Gash’s drill packer scrapers

Wet conditions have been bunging up drills across the country, but Rob Gash has come up with a neat way of keeping packer rollers relatively clean.

His cable scrapers fit to new brackets welded on the farm’s Horsch Pronto drill, flicking soil off the tyres and avoiding any build-up of material against the main frame.

The brackets have several hole options to vary the distance of the cable from the tyres.

Total cost was £200, and assembly took just a day.

Geoff Beck’s plough pan breaker

Rock-hard furrow bottoms could be a thing of the past with Geoff Beck’s bolt-on plough attachment.

The leg is designed to break up soil compacted by the tractor’s wheels, using a curved cultivator tine to throw the soil ahead of the mouldboards.

Mr Beck says he typically runs it 7.5-10cm below the plough’s points, so roughly 35cm when ploughing at 25cm.

The kit has hole-and-pin height and width adjustment and it can be pulled out completely if not needed.

Stevie Houston’s grassland drill

County Antrim farmer Stevie Houston built a grassland drill for rejuvenating tired swards, repairing poached pasture and sowing new grass lays.

The high rainfall in Northern Ireland means Mr Houston’s 200-strong autumn-calving herd can quickly destroy parts of a field, so he started looking around on Facebook and Gumtree for a seed drill and grass harrow to help alleviate the compaction.

His combination centres around a second-hand KRM air drill, which he managed to get for half the asking price, as well as two grass harrows and a brand-new Fleming Agri 3m spiker.

In order to covert the grain drill to sow grass, Mr Houston blocked off half the seed rollers to lower the rate. He says this has worked perfectly.

He has also removed the bout markers and tramline kit and believes the simple ground-driven wheel is all that is needed.

All in, the build cost about £3,000, and this included the purchase of the new spiker. Once all the parts were delivered, it took a couple of days to knock up.

Paul O'Connell’s combi drill bag lifter

Paul O'Connell from County Laois, Ireland, made a hydraulic bag lifter for his Amazone Combi drill, so he doesn’t need a separate tractor and loader for topping up with seed.

The device has a simple central mast with one pivot point and a single long-stroke hydraulic ram to do the lifting.

Cleverly, Mr O'Connell set up the geometry in such a way that the bag can be lifted from the side and it comes up perfectly in line with the top of the hopper.

It is capable of lifting bags from the ground or off a trailer, and has telescopic adjustment to get the placement right.

When it’s not in use, the arm can be neatly folded to the side of the machine.

Edward Heath’s Weaving drill conversion

To improve the performance of his 4m Weaving Tine drill on min-tilled ground with chopped straw, Essex farmer Edward Heath extended the frame and spread the coulters over an extra two rows.

As his drill is an early model, the coulters were originally spread over three rows and they tended to clog up when there were large quantities of straw.

However, by distributing them over five rows, he now has ample clearance for trashy conditions.

Mr Heath says the modification was relatively straightforward and involved cutting off the following harrow and pre-em markers, adding the additional rows of diagonally mounted box section and then reattaching the harrow and markers.

Finally, he added some seed pipe joiners and extensions to span the extra distance to the coulters.

He considered adding a second pivot point for folding mechanism, but having tested it in its standard form, decided it was already strong enough.

JOURNAL : Farmers Weekly

Scottish Basic Payment Scheme (BPS) payments must remain “largely unchanged” until 2024, says NFU Scotland (NFUS), avoiding the kind of cuts already scheduled to hit farmers south of the border from next year.

The call forms part of a raft of post-Brexit policy demands for Scotland during the 2021-24 “transition”, which also include scrapping the crop diversification (three-crop) rule and the permanent grassland requirements of the existing CAP.

See also: Scottish farmers offered £40m to tackle climate change

NFUS believes funding increases of up to £100m more than the current £500m “pot” will also be needed, especially with action to mitigate climate change being central to any future farming policy.

Despite the call for more money, there were signs that Scottish farmers could be pushing at an open door, with Holyrood’s rural economy secretary Fergus Ewing saying there is “common ground” to work on.

Although the union wants the BPS left generally untouched, it has called for improvements to farm mapping requirements, the farm inspection regime and penalty processes.

NFU Scotland proposals summarised

The BPS should continue largely unchanged to 2024, but must include improvements to farm mapping requirements, the farm inspection regime and penalty processes.

The crop diversification (three-crop) rule and permanent grassland requirements of the existing CAP must be removed from current greening rules.

A full review of ecological focus areas must be undertaken.

Both of Scotland’s existing coupled support schemes - the Scottish Suckler Beef Support Scheme and the Scottish Upland Sheep Support Scheme - must be amended to improve delivery and reduce compliance risks.

The Less Favoured Areas Support Scheme must be retained in its current form until 2024, but rebased on 2019 ***data***, while maintaining the £65m budget.

The Beef Efficiency Scheme must be replaced with an effective Beef Improvement Programme that delivers productivity and environmental outcomes.

The Agri-Environment Climate Scheme must take a non-prescriptive approach, led by farmers and based on rewarding outcomes rather than only covering income foregone or additional costs.

Slower pace

Launching NFUS’ latest post-Brexit policy document, Stability – The Platform for Change, union president Andrew McCornick suggested the changes in Scotland should happen at a slower pace than in England.

“Let’s not pin ourselves to something hard and fast we need flexibility,” he said, adding that the proposals were “ambitious”, but deliverable.

To achieve the sector’s aims, pilot schemes on farms to help deliver Scotland’s climate change targets need to be bolstered, he said. For example, the ***Agricultural*** Transformation Programme (ATP) announced last month need an increase in the £40m already pledged by the Scottish government.

The union also says a ring-fenced financial framework must be established for Scotland, with at least the same amount of funding as now under both pillars of the CAP.

Although it does not want to go into detail, when the £40m for ATP is taken into account, NFUS thinks a further £60m is needed to deliver its and the Scottish government’s aims.

What happens next

NFUS will use its Steps for Change policy document, published in March 2018, in negotiations with the Scottish government on future ***agriculture*** policy, including financial stability, environmental measures and productivity.

The ***Agriculture*** (Retained EU Law and ***Data***) (Scotland) Bill is currently going through the Scottish parliament and will contain the main policies for farming after Brexit.

Updates to existing climate change legislation are expected to be published by the Scottish government next month and could contain arrangements to increase funding for the farming sector.

Future proof

Launching the document at the Scottish parliament on Tuesday (2 March), Mr McCornick said the proposals for a 2021-24 transition and a post-2024 policy would “future-proof our sector”.

“Both the short- and longer-term proposals recognise Scottish ***agriculture***’s fundamental role in emissions reductions and carbon sequestration, while retaining our ability to profitably produce food to the highest of standards.

“Farmers and crofters must be incentivised to take up fundamental measures focusing on soils, input costs and emissions reduction. It is essential that such actions are taken up by a much wider swathe of Scottish ***agriculture*** and that all doing so are appropriately supported.”

Common ground

Mr Ewing said the Scottish government would consider the NFUS proposals.

“We will particularly look at the proposals around penalties and inspections, as these are two areas our simplification taskforce has already highlighted, and I have committed to making rapid progress on,” he said.

“These proposals show that there is common ground between the Scottish government and NFUS to do all we can to provide stability for farmers and crofters in the critical years ahead.”

JOURNAL : Farmers Weekly

Farmers in Scotland have been granted a derogation from the three-crop rule following prolonged cold, wet weather.

The decision follows lobbying by NFU Scotland, which has consistently opposed the need for the EU rule, describing it as a blunt instrument with little benefit.

See also: No three-crop rule derogation for farmers in England

Bad weather has also prompted a derogation for farmers in the Republic of Ireland. But farmers in England must still abide by the three-crop stipulation.

Designed to encourage crop diversification, the rule requires farmers to have a minimum of two or three crops in the ground during the months of May and June.

NFU Scotland combinable crops chairman Willie Thomson said cold and wet conditions had meant a narrow window of opportunity to plant and establish crops for 2020.

“Meeting the three-crop rule for many farmers has been almost impossible,” he said.

“The derogation from the three-crop requirement will make a difference to growers who have been unable to get on to waterlogged ground.

“But it is already looking for some parts of the country that fallow may be a more economic option than planting.”

Significant cost

NFU Scotland argues that the rule does not fit the profile of Scottish ***agriculture*** and offers little environmental gain but adds significant cost for many farmers.

It says the rule also has a public cost in terms of inspections and compliance complexities.

The union has proposed the removal of the crop diversification and permanent grassland requirements from farm support greening rules from 2021.

It says there is no monoculture issue in Scotland and the abundance of permanent grassland at a national level renders the requirements completely unfit for purpose.

Mr Thomson said: “Required ‘green’ outcomes – notably on climate change and biodiversity – need to work within ***agricultural*** systems.”

But the three-crop included prescriptive dates that compromised food production while doing little or nothing in terms of environmental benefits.

JOURNAL : Farmers Weekly

Self-employed workers will have quicker and easier access to benefit support during the coronavirus pandemic.

As part of the government’s response to tackling the virus, chancellor Rishi Sunak announced people ineligible for statutory sick pay, such as the self-employed, will be able to claim Employment and Support Allowance (ESA) from day one of illness, rather than day eight.

ESA is paid to those who are too sick to work, provided they meet certain conditions. It is worth £73.10/week, or £57.90 for under-25s.

See also: Coronavirus: How employers can get help with statutory sick pay

The government is also temporarily removing the minimum income floor from universal credit.

The minimum income floor takes into account how much a worker would normally expect to earn in a month, when calculating entitlement to universal credit.

Not having the floor means being able to claim for time people spend off work due to sickness, which Rob Hitch, of Dodd and Co Accountants, called a helpful measure.

“It should be noted, however, that the government states the minimum floor will be suspended ‘for the duration of the outbreak’, so this is very much a temporary measure,” said Mr Hitch.

“Universal credit is a means-tested benefit, so if you hold non-business or personal home assets, such as premium bonds, ISAs or let property, these will bar you from a claim if they exceed £16,000, and at present this still applies.”

The chancellor also said instead of attending a job centre, applications could be made on the phone or online instead.

Farmers must review their responsibilities towards their farmworkers and ensure appropriate measures are put in place to protect them, said Mr Hitch.

“Farming is one of those industries that cannot operate remotely,” he said. “Staff availability, which is already an issue for many farms, may become even more of a problem in the coming weeks and months.”

Support for businesses paying tax

All businesses and self-employed people in financial distress, and with outstanding tax liabilities, may be eligible to receive support with their tax affairs through HMRC’s Time To Pay service.

These arrangements are agreed on a case-by-case basis and are tailored to individual circumstances and liabilities.

If you are concerned about being able to pay your tax due to Covid-19, call HMRC’s dedicated helpline on 0800 0159 559.

JOURNAL : Farmers Weekly

Four leading shooting organisations have joined forces to fight Wild Justice’s latest judicial review against Defra on the legality of releasing game birds over designated sites.

The British Association for Shooting and Conservation (BASC), Countryside Alliance, Game Farmers’ Association and National Gamekeepers’ Organisation have jointly applied to become interested parties in the proceedings.

The campaign group claims that releasing birds, even at considerable distance, could damage a European Protected Site (EPS) and that no game bird releasing should be allowed unless an assessment has shown there will be no impact on the area.

See also: Defra to review law on release of game birds in sensitive areas

But a spokesperson for the shooting organisations said this case had “direct consequences” for thousands of their members and supporters; many of whom were also responsible for the care and management of these sites.

“It is essential that the shooting community involves itself in the proceedings at the earliest possible stage so that we can present a robust, evidence-based case to the court,” the spokesperson said.

“No matter the cost, our voice needs to be heard during the proceedings. And time is of the essence. Many people involved in shooting have already begun preparations for next season which carry significant financial burden.

“The countryside does not operate to the same calendar as the judicial system and it is essential that point is delivered loud and clear to the court.”

Livelihoods ‘at risk’

The organisations warned that livelihoods and the health of the countryside would be put at risk if the judges making the decisions got this wrong.

“In their attempt to attack shooting, Wild Justice are putting at risk the responsible management, use and enjoyment of the countryside by farmers, land managers and the public at large, as well as endangering the very wildlife and environment which they claim to be interested in protecting,” they added.

Wild Justice, founded by TV presenter and wildlife campaigner Chris Packham, raised the legal challenge against the government’s policy on the release of game birds last summer.

The group argued that Defra had failed to assess the impacts on sites of conservation interest of releasing 50 million non-native game birds, specifically common pheasant and red-legged partridge, into the countryside.

Defra has launched a review and says it cannot comment on the legal action while proceedings are active.

JOURNAL : Farmers Weekly

Extremely slow farmer buying is keeping nitrogen prices in check. February saw little, if any, movement and current levels are just £2-£3/t above late January prices for UK-manufactured ammonium nitrate (AN).

This puts it onto farm for March delivery at £227-£230/t on normal payment terms.

Imported material is in a wider range, with  some offers from those holding more stock than they would like.

However, strong sales by Egypt and large purchases by the US have put upwards pressure on the global urea market, say traders.

See also: New nematicide Red Tractor rules for farmers explained

For UK buyers, the recent weakening of sterling has not helped, although at £245-£250/t in March, it is still good value against AN.

While urea is readily available, importers are wary of committing to new cargoes because of uncertainty over farmer demand.

AN prices on continental Europe have risen recently. Traders suggest this and the firmer urea market could push the UK AN market up a bit in April but this is weather dependent.

Phosphate and potash prices are steady.

Fertiliser update (£/t delivered March 2020)

UK 34.5% N (Oct)

Imported AN

Granular urea 46% N

Potash MOP

Phosphate DAP

Phosphate TSP

£227-£230

£210-£223

£245-£250

£245-£250

£290-£303

£248-£250

All illustrated prices are based on full loads for cash payment on 28-day terms.

JOURNAL : Farmers Weekly

Selling at a market is a popular diversification for farmers who are already creating products and enjoy working directly with the public.

A fairly inexpensive option, it’s a good social opportunity and can help advertise and build up an existing farm shop or online or mail order business.

Farmers Weekly asked the Farm Retail Association (FRA) what rules, legislation and tips people considering becoming a stallholder need to know.

See also: So you want to sell food and drink to the public?

How many farmers’ markets are there?

There are about 650 farmers’ markets in the UK, according to the last count, which was in 2018.

Their number is still growing and more producers are always welcome.

The FRA has recently relaunched a Real Farmers Market Certification, and a declaration form is available free of charge for association members. This is a paper-based self-certification scheme for markets that includes random checks.

Markets are usually monthly, with the larger ones held at the weekend and the smaller ones more likely to take place during the week.

When considering which markets to attend, think not only about size, timing and mix of stalls but also about practicalities such as hours, access, parking and other facilities.

What are the rules about selling products?

The most important rule for certified farmers’ markets is that the stallholder must have produced the food they are selling.

Producers adding value to primary local produce by baking, for example, are encouraged to use local ingredients such as jams and butter, meats, fruit and vegetables, rather than going to wholesalers.

Individual market operators or managers usually have the final say about what can and can’t be sold at their market.

Most have a distance rule allowing produce from a 30- to 50-mile radius, although sometimes this is defined by county boundaries.

In London and other urban areas, farmers’ markets may allow produce from up to 100 miles away.

Markets usually try to balance the range of produce offered to ensure a “full basket” shop and stall types so there is not too much direct competition between stallholders.

If you produce something different to what is already on offer at a market, you may be more likely to get a stall.

How do I know it's right for me?

First you should be sure that your produce appeals to farmers’ market customers (see panel “What sells well?”).

Visit markets and talk to other stallholders to learn more about how it works and what to expect.

One benefit of markets is that they don’t require investment in premises and are a relatively cheap way of retailing.

They are a good platform for promoting a farm shop, internet or mail order business, but can be time consuming.

Business cards, fliers and recipes given out to market attendees can help promote your business and attract customers.

Who do I need to notify about selling food?

As soon as you start to sell food, Environmental Health officers and Trading Standards officers need to be involved. They can be contacted through the local authority.

The former deal with hygiene and good practice regarding production, while Trading Standards covers weights, measures and labelling.

Talk to both before you go to your first market.

What about legislation?

Food safety, health and safety, trades descriptions and weights and measures are the main areas.

Because of allergens and intolerances, ingredients need to be listed in the food labelling, and food hygiene is paramount.

The government provides allergen guidance for food businesses.

The Food Standards Agency is a great source of information, as is the local authority’s environmental department.

The requirements vary depending on the type of produce you are selling.

For example, in the case of fruit and vegetables, some produce must be sold by weight, others can be sold by count.

If you sell by weight, the price a kilogram must be displayed on the pack or prominently on your stand.

The labelling and traceability requirements are rigorous for meat, and in particular for beef, but any food which is ready for immediate consumption at the point of sale is of concern to environmental health officers (EHOs).

Raw and cooked foods need to be stored and handled separately, as does money, and some form of hand cleaning facilities must be available other than toilet washbasins.

Within the Food Safety Act, fitness to work rules cover personal hygiene and communicable diseases, including infections such as gastroenteritis.

If you offer free samples, the same hygiene rules apply as if you were selling them.

If you are preparing food at home, your kitchen must meet certain minimum standards and will need EHO inspection and approval.

Some food types need batch numbers, best-before dates, and detailed record keeping for full traceability.

There are minimum required temperatures for meats, ready-to-eat and cooked foods – your EHO will advise you.

Some foods that normally need refrigeration may be displayed for up to four hours in ambient temperatures but cannot then be returned to a chilled condition.

If unsold, they must be thrown away.

Investing in a chilled cabinet may seem expensive (second-hand ones are available) but presentation will be better and your stock-control easier.

Many farmers' markets offer a power supply to run them.

Alternatively, many stallholders sell from insulated polystyrene boxes; regular monitoring of temperatures is essential.

Goods must, by law, be priced, with the price displayed on the pack or prominently on the stall.

If prices are not immediately clear, some customers will just walk away.

All food businesses must have a Hazard Analysis and Critical Control Point (HACCP) plan.

This is a food safety management system that identifies what could go wrong in your processes, how to prevent it and how to address it.

Do I need any training?

It depends what you are selling, but a basic food hygiene certificate (about six hours of online training) is good practice and your EHO may insist on it for handling ready-to-eat food products.

If you are adding value, or offering certain ready-to-eat foods, an advanced food hygiene certificate will be a good idea. This can be completed over a number of days at a local college or through a training provider.

What sells well?

Try to provide something different and don't compete with the supermarkets.

If you are considering making cheese, for example, don't make a run-of-the-mill cheddar.

Carefully assess what’s already on offer and selling well at your chosen markets.

Pricing is important – it must reflect costs of production and not be too cheap, but it must also not be too expensive, especially if a similar product is already available.

Customers care about quality and provenance more than ever before – they want to know where their food comes from and they support local.

Many stallholders are specialists as they are one- or two-person businesses and do not have the time to provide a wide variety of quality products.

Do I need to spend a lot of money on my stall?

No, but the appearance and attractiveness of your stall is very important.

Remember that this is not like a shop where people will browse – they are on the move and you have got to get them to stop and look.

A good display with information about the farm and the produce (with photographs) will all help.

The stall must look inviting and you must be prepared to engage with customers and draw them to you - at a farmers' market, customers buy from the person behind the stall.

A white coat or coloured apron helps to give a professional image.

Tie hair back and ensure hands and nails are clean.

If it is in a good position, try to book the same stall each time so customers can easily find you again.

Attend as many markets as you can – it’s important to build loyalty.

Be prepared for a 9am to 10am market start, but be ready an hour before that – regular customers will be.

Monthly markets trade for four to six hours, and weekly markets for two to four hours.

Should I pre-pack my produce?

Some people think this detracts from the appeal of fresh produce, but it can save a lot of time on the day, especially when the market’s busy.

You can pre-price, and pre-packing allows customers to choose their produce easily and to handle it without problems.

It also avoids the hygiene issue of handling both fresh food and money.

How much does a stall cost?

Anything from £10 for a small community-run market run to £75 for a larger city market.

What insurance do I need?

Product and public liability – at least £5m for each category – is recommended.

Stallholder insurance costs range from £52 to £110 a year.

If you have staff, you'll need employer's liability cover too.

Case study: Frocester Fayre Farm

Farm facts:

101ha

Mixed livestock and arable

Family-run farm in Gloucestershire on ***agricultural*** holdings act tenancy

Sells produce at Stroud, Cheltenham and Bristol markets

Also has a farm shop

Four full-time and one part-time staff

Products: pork, beef, lamb, sausages and burgers as well as ready-to-eat meat pies, sausage rolls and pasties.

Nikki Pinker’s tenanted farm used to be a dairy unit until it was struck by bovine tuberculosis in the late 1990s.

The decision to sell the herd, combined with an offer from her uncle to butcher pigs for free, led to the milking parlour being turned into a shop and registered cutting room.

Stroud Market started in July 1999 and was seeking stallholders, so the Frocester team decided to sign up, initially using portable coolers before investing in a proper chiller.

At one point they were attending three or four different markets a week, but they’ve now settled on two a week.

The Frocester team regularly attends Stroud (£40 a stall), Cheltenham (£35 a stall) and Bristol (£30 a stall).

“It’s a nice social place to go,” Mrs Pinker says. “You get to meet people interested in food and we’re able to go to our customers, as we’re a bit off the beaten track.

“The most difficult thing is making a profit out of it because you don’t make as much as people think and it is difficult when you’re employing staff.”

As tenant farmers, she finds they are slightly limited with what they can do and cannot expand any further, so utilising markets is a good option.

The markets attract tourists, some of whom come back year after year, and the Frocester stalls also have extremely loyal local customers.

Nikki’s tips

Make sure you’re up-to-date with health regulations.

Get environmental health officer on your side from the start. Go to them rather than making them come to you, ask them questions and run ideas past them, and you'll find they are more amenable to you.

It’s helpful to have someone who knows about social media on your team so you can advertise yourself.

You can’t be scared to talk to people.

JOURNAL : Farmers Weekly

A global tightening of pig supplies as a result of African swine fever culling in China has elevated pig prices 15-20% across the board since last spring.

National average store and weaner pig prices were up on the year 18-20% and 14%, respectively, in February, according to AHDB Pork figures.

***Data*** from average sales of young pigs exchanged between marketing groups reveals an average of £57.99 a head for store pigs (30kg) and £42.20 for weaners (7kg).

See also: UK pig prices edge up after post-Christmas lull

Hereford

Hereford market’s pig values were firm in February and started March on a very strong footing last week (5 March).

A lower entry than normal of 140 pigs included a quality consignment of 30 white store pigs that made £44 a head, with some plainer coloured stores at £19 a head.

Auctioneer Andrew Edwards said weaner and store pigs were up 20% on the year, and, barring a post-Christmas lull, there had been a good trade on all sections since November.

Quality white porkers ranged from £70-£126 a head and cull sows and boars were a very strong trade with better quality cull sows making £130-£202 and cull boars at £120-£125.

Rough-coated, coloured, outdoor pigs were, as ever, harder to sell and really only wanted for niche markets, Mr Edwards added.

He said coronavirus had not yet affected the pig trade, although weaners were a slightly more selective trade of late; he suggested this could be weather-related.

“Prices could go either way. There is a possibility that home meat trade could improve as the public might appreciate UK reared livestock more, rather than importing meat.

“There aren’t many pig markets around anymore, which is partly why we’ve had buyers from as far as Dorset, Kent and Yorkshire. It’s a good way of getting young people interested in farming and is an entry enterprise.”

Market Drayton

An entry of 63 store and weaner pigs topped with weaners at £42 and the best end of the weaners selling between £25 and £35, with others at £15 to £22.

Ben Baggott, auctioneer at Barbers, said that 12-18kg weaners had generally been making about £30-£35, but that the pig market was, as ever, “boom and bust and difficult to call”.

He said weaners could be £50 one week and £25 the next, although prices in general were dearer than a year ago.

JOURNAL : Farmers Weekly

The average farm manager earns £49,523 including any bonuses and profit share payments.

In addition to this, they receive an estimated £8,368 in non-cash benefits such as housing, vehicle use and utility payments.

The figures come from the Institute of ***Agricultural*** Management’s (IAgrM) survey, carried out every other year.

On the face of it, the results show a £2,700 drop in salary compared with the previous survey’s average of £52,268.

See also: Farmers Weekly awards - farm manager finalists 2019

High number of young managers skews results

However, the results are skewed by a large rise in the number of younger farm managers completing the most recent survey, which, in great part, explains the apparent drop in average salary.

At 120, the level of respondents was the highest ever, and 45% of the sample were under 40 years old, compared with just 26% in 2018.

In the 2020 results, only 5% of farm managers are over 60, compared with 16% in 2018.

“It simply introduces the question of what the average age profile of farm managers is, compared with the average age of farm managers completing this salary survey. The answer to this question we do not yet have,” says the report.

Fair comparison shows just 2.1% increase over two years

To compare this year’s survey more closely with 2018 levels, the figures were reworked to exclude all managers at either end of the age profile in both 2018 and 2020.

This showed the average manager's salary, including profit share/bonus, increased by 2.1% – from £51,671 in 2018 to £52,769 in 2020.

Splitting the results by age bands shows that cash earnings for those aged 50-59 average £58,823 gross, compared with £45,078 for those aged 30-39.

Higher earnings at top

For the first time, the survey showed farm managers in the UK earning in excess of £90,000, and 3% getting more than £100,000/year.

However, there was a drop in the number receiving non-cash benefits. Where such benefits were paid, their value fell 40% from £14,000 to an average of £8,368.

The number of managers getting no non-cash benefits has tripled since the last survey, and such perks might become a thing of the past, say the authors.

Holidays

More than half (55%) get 21-25 days holiday annually, while 23% get 26-30 days and 7% more than 31 days.

Other findings include:

Almost one-third earn income from elsewhere, with half of these earning outside the farm through rental income. Consultancy was the next largest non-farm income source.

Members of IAgrM (37% of respondents) earn £4,379 more than non-members, although the reason for this is not clear.

More than half of all managers are degree holders, with almost all the others having achieved a diploma.

Two in every three farm managers have also undertaken post-education farm management and leadership training.

Half of farm managers now also have diversified enterprises under their management.

Approximately half of farm managers are employed by a private individual.

In line with previous surveys, three-quarters of farm managers reside in central, southern and eastern England

Almost all farm managers have responsibility for the day-to-day organisation of the business and decisions relating to the farm system, while only 60% have financial control of the business.

About 60% of farm managers receive a fixed salary, with the remainder receiving a bonus and/or a share of profits.

Those who contribute to a pension put in 5.7% of their salary, while employers contribute an average of 5.6%.

There was a drop in the percentage owning their own house, at 64%, compared with 70% in 2018, likely reflecting the far larger proportion of younger managers responding to this year’s survey.

Women and ethnic minorities under-represented

As in other years, the results show the tiny proportion of women in farm management – just 2%.

“While this survey does not capture the information, we all know ethnic minorities are also woefully under-represented,” says the report. “***Agriculture*** is a stereotypical industry trapped in the 1960s”.

[*https://infogram.com/farm-manager-earnings-2019-1h7v4p85ye086k0*](https://infogram.com/farm-manager-earnings-2019-1h7v4p85ye086k0)

Farm Managers in 2020 findings: key salary, bonus and benefits

2014

2016

2018

2020

Number in sample

77

84

69

120

Gross annual pre-tax salary

47,879

49,052

48,760

46,527

Additional share of profits/bonus

5,251

3,186

3,508

3,016

Total gross annual salary plus profit share/bonus

53,130

52,238

52,268

49,523

Estimate of non-cash benefits

12,603

12,530

14,053

8,368

Source: IAgrM

The Farm managers in 2020, their jobs and their pay survey was compiled by:

Richard Crane – head of the ***agriculture*** and food investigation team within the School of ***Agriculture***, Policy and Development at the University of Reading

Graham Redman – a partner of The Andersons Centre and a director of Agro Business Consultants

Victoria Bywater – director of IAgrM.

IAgrM members can get a free copy of the full survey results via the "member resources" section of the IAgrM website.

Non-members can obtain a copy for £25 by emailing IAgrM at [*enquiries@iagrm.co.uk*](mailto:enquiries@iagrm.co.uk)

JOURNAL : Farmers Weekly

Increasing calcium in pre-calving diets can improve postpartum uterine health and fertility, a recent study has revealed.

The study, which took place at the University of Illinois, examined feeding dry cows differing amounts of calcium or no calcium.

See also: How to feed dry cows to prevent negative protein balance

How the study worked

A group of 76 Holsteins was split into three and fed:

A negative dietary cation-anion difference (DCAD) diet with calcium added at 2% of dry matter (DM)

A negative DCAD diet with no added calcium (0.4% of DM)

And a positive DCAD control with a standard calcium range (0.4% of DM).

The cows were fed these diets 28 days before calving until 30 days after calving, when the animals moved on to a common diet until pregnancy checks at 72 days in milk.

Cow health and fertility checks were carried out after calving. These included taking ultrasound measurements four days post-calving to identify follicular growth to determine days to first ovulation.

Blood tests were carried out, along with metricheck scores to evaluate vaginal discharge for the presence of purulent material – indicating uterine disease. Uterine swabs were also taken to identify infection.

What the results showed

Cows on the negative DCAD diets with higher inclusion of calcium (2%) had improved reproductive performance.

Cows fed the high-calcium diet took 16.3 days to ovulate after calving, while the low-calcium cows took 17.93 days against the control at 18.93 days.

Cows fed the high-calcium diet were found to have disease-fighting antioxidants, blood tests revealed.

They also had an increased number of glands in the uterine lining. These keep the uterus clean and excrete hormones which start ovulation, improving reproductive performance.

Cows fed the added calcium also had a lower metricheck score and a healthier uterine environment.

Professor Phil Cardoso, from the university's department of animal sciences, says other studies show shorter ovulation leads to improved conception rates.

Cows on the higher calcium diet probably had a healthier uterine environment due to enhanced immune response to parturition and an alleviation of oxidative stress.

He recommends farmers use a negative DCAD strategy with a higher concentration of calcium in the diet (1.5-2% of DM).

This is because cows that were fed negative DCAD diets suffered from increased calcium excretion and, therefore, performed very poorly without extra calcium.

In the study, calcium carbonate – otherwise known as limestone – was used.

 “But if there are better sources available, I encourage farmers to discuss them with their nutritionists and veterinarians as they may need to be used in a smaller amount,” said Prof Cardoso.

Take-away messages

Consult with a nutritionist or veterinary specialist before adding calcium to the diet

Know the correct concentration of calcium – ideally 1.5-2.0% of DM

Too much calcium could lead to milk fever

JOURNAL : Farmers Weekly

A T0 fungicide should be used this season on winter wheat crops that are already showing early signs of rust or mildew to prevent disease festering all season.

However, for most other crops this spring, growth will be so fast that a T0 will make little meaningful contribution to disease control.

A later drilling date combined with mild winter conditions means both yellow and brown rust are likely to be an issue for growers in the East this season.

See also: Advice on draining and restructuring waterlogged soils

Rust and mildew

Any signs of rust should be tackled early with a T0 spray, says Adas research scientist Philip Bounds.

He says a review by Adas 10 years ago revealed a correlation between a later sowing date and yellow rust levels, especially when there were less than five -5C frosts over the winter, making it a real risk this season.

“For brown rust, the worst seasons are when it comes in early, so for varieties with less resistance and later sowings there is a need to control it,” he says. “If crops have it, hit it early.”

Mildew will also be a problem if its not kept under control early, but both rust and mildew should be controlled if growers plan to use something for septoria at T0, such as chlorothalonil or folpet.

T1 timing

Out of rust risk areas, the majority of crops will have been drilled later than usual, and are therefore unlikely to need a T0, says Mr Bounds.

Crops that were not drilled until December or January will rush through their growth stages, however, this will make identifying the correct T1 spray timing very difficult, he says.

“On late-sown resistant varieties we rarely see a response from T0 for septoria, but it can be used as a management tool if the T1 spray is unlikely to be applied at the right time,” he says.

Keeping crops clean at the T1 timing will also be key to getting the most out of thin crops this season, says Bayer agronomist Gareth Bubb.

“Leaf three is going to be contributing more to yield this year than it would usually, so keeping disease out will be critical,” he says.

Field-by-field assessment

Mr Bubb adds that with a wide range of sowing dates and varieties in the ground this season, spray programmes will have to be decided on a field-by-field basis.

He suggests there will be two schools of thought this season on how to manage disease.

For some, the crops that are in the ground will be very high value, so growers are likely to want to protect the yield.

Meanwhile, others will be reluctant to spend out on a really robust programme if yields are already looking compromised.

“A programme should always be driven by septoria, so focusing too much on other diseases, such as rust, could let septoria in.

“Look at what covers all of the bases,” he says.

He adds that if growers are thinking of giving up on a crop, it should be winter barley crops, which have wet roots.

“For wheat, try to keep it greener for longer.”

Case study: Jack Hopkins, Herefordshire

Assistant farm manager Jack Hopkins plans to use a T0 on his early-drilled crops this season, as he expects there to be disease in the crops after the wet and mild winter.

He plans to use up some chlorothalonil at T0 if conditions are good enough to travel, as he expects there to be a higher disease level in the crops right from the start.

“Where crops are not so good, the skill this season will be deciding how to treat them,” he says.

Mr Hopkins will look at the yield potential of his winter wheat crops at Lower Hope Farm, Herefordshire, and work backwards, cutting his programme to match lower plant numbers.

“We will be judging the potential of the crop and not just throwing inputs at it.”

JOURNAL : Farmers Weekly

Farm leaders are demanding continued protection from cheap foreign imports, with tariffs maintained at current levels to avoid an influx of food produced to lower standards.

This followed a recent Department for International Trade consultation into its plans for a simplified tariff schedule to apply to imports once the Brexit transition ends at the end of the year.

In particular, the government is seeking to “catalyse free trade across the world” to generate greater wealth among nations.

See also: Relying on imports for our food is strategic folly

But responding to the consultation – which was only open for a month – the Ulster Farmers Union (UFU) said it is vital tariffs are set “at a level that prevents the UK from being flooded with imported food produced to much lower standards when compared to those our farmers are expected to meet”.

Recognising that many in government favour a cheap food policy, the UFU says food is already very affordable.

“The average UK family spends 10% of its income on food and drink – a decline from 30% in the 1950s," said UFU president Ivor Ferguson. "In fact, in the UK, the proportion of household incomes spent on food is the third lowest in the world, behind only the US and Singapore.”

High standards

These concerns are shared by NFU Scotland president Andrew McCornick, who says it is “absolutely crucial that we keep tariffs at the current level”.

“Our industry is proud of the high standards it operates to, but these impose very significant additional costs,” he said. “With WTO rules not allowing trade to be blocked to ensure a level playing field, it is only through the applied tariffs that any protection can be offered to our industry.”

Mr McCornick added that any tariff reduction or removal should only be done as part of trade negotiations and in return for reciprocal concessions.

He suggested that the publication of a temporary tariff schedule by the UK government last year, as part of “no-deal Brexit” preparations, had caused potential trade partners to halt negotiations, because they knew they would get what they wanted without giving ground.

What the government is seeking

The Department of International Trade says it wants to simplify the UK’s tariff policy and remove tariffs on certain key inputs to production. It suggests:

Removing all “nuisance tariffs” (less than 2.5%)

Introducing tariff “banding”, so tariffs are rounded down. For example, a tariff of 12.8% would become 10%,  while a tariff of 48% would become 45%

***Agricultural*** tariffs would be expressed as a single percentage, whereas currently some contain a fixed monetary element. For example, boneless cuts of beef have a tariff of 12.8% plus 303/100kg, while live chickens are levied at 52 per 1,000 birds.

However, the UFU sees a danger in a single percentage approach. “The ***agricultural*** process can be very volatile and a fall in prices would reduce the protection of local producers,” it says.

“This could subsequently lead to an import surge at a time of already low prices, further compounding the market problem.”

JOURNAL : Farmers Weekly

Defra has said it will amend laws to give tenant farmers more flexibility on how they run their business and when they retire, under new plans to modernise legislation and boost productivity.

The government has published the response to its consultation on ***agricultural*** tenancy law in England and confirmed it will amend the ***Agricultural*** Holdings Act (AHA) to make it fit for purpose in the 21st century.

See also: Radical shake-up of ***agricultural*** tenancies proposed

Amendments include repealing the minimum succession retirement age of 65 to provide tenants with the flexibility to decide when it is right for them to retire and hand over the farm to the next generation.

A new dispute process will also be introduced to enable AHA tenants to ask to vary restrictions in their tenancy agreements and make it easier for them to apply for the Environmental Land Management scheme.

Radical shake-up

Plans were put forward in April 2019 for a radical shake-up of ***agricultural*** tenancy legislation in England and Wales, with a key aim being to improve productivity growth by making it easier for people to enter and exit the industry.

Two 12-week government consultations were launched and farmers were urged to have their say on the proposals.

The consultations build on the work of the Tenancy Reform Industry Group (TRIG) to reinvigorate the tenanted sector.

TFA response

The Tenant Farmers Association (TFA) welcomed the new provisions and said it supported all of the changes set out in the ***Agriculture*** Bill, but added that there were gaps which must be filled urgently.

It said in a statement: “While we welcome the new provisions which will allow a tenant the ability to object to a refusal from the landlord for consent to enter into a scheme introduced under the financial assistance provisions of the Bill, or to carry out works in accordance with a statutory obligation, currently this only applies to tenancies regulated by the 1986 AHA.

“These provisions must be extended to tenancies regulated by the 1995 AHA.”

It said this left many tenants vulnerable to being disenfranchised from the new financial assistance arrangements.

Nearly half of the land in the tenanted sector is let under the 1995 Act provisions.

The association said it would be a “significant failure” if the Bill did not provide the same level of protection to tenants under the 1995 Act.

Modernise laws

Farm minister Victoria Prentis said tackling barriers to productivity for tenant farmers was “vital” for unlocking the potential of the whole industry.

“It is high time that we modernise outdated legislation so that it is fit for today’s farmers and their families,” she added.

“I am pleased that we have already been able to incorporate some of these proposals into our landmark ***Agriculture*** Bill and look forward to working closely with industry to continue supporting this vibrant sector.”

Defra has amended the ***Agriculture*** Bill to take in the most popular points of the tenancy reform consultation. The Bill is currently at the report stage in the House of Commons and could still be amended before it is passed.

JOURNAL : Farmers Weekly

Most farmers would back themselves to spot a dodgy tractor a mile off, but a burgeoning ***agricultural*** business is offering an impartial inspection service that goes a bit further than lifting the bonnet and giving it a quick run down the farm track.

Ryan Fletcher's new venture, Elite Associates, involves a thorough tractor inspection to produce a dossier for the buyer that outlines its exact condition.

The negotiations remain the buyer's responsibility – Mr Fletcher purely arms them with a bit more information – and nor does he offer a warranty.

See also: Ultimate guide to buying a tractor 2019

The idea for the business came from his work in various service roles with Agco, CNH and John Deere over the past decade, where he regularly watched buyers part with thousands of pounds for machinery they had never seen.

Mr Fletcher’s new business will work closely with well-established automotive company Elite Inspections, which already offers pre-purchase inspections (PPI) on supercars and motorhomes.

Emotional attachment

Although Mr Fletcher is aware that his service won't appeal to everyone, one of the main benefits is his ability to make an impartial decision, with no emotional attachment, on the suitability of the machine.

Searching for a specific machine online can be the ultimate thief of time. For most buyers, the second stage involves viewing the tractor in the flesh, but Mr Fletcher says farmers’ keenness to get a deal over the line often means they turn a blind eye to potential problems.

“By employing someone who doesn’t have an involvement in the purchase, the inspection can become more matter-of-fact,” he says.

“Sometimes condition and faults can be overlooked, fuelled by the desire to own a vehicle you’ll be spending a lot of time in. My job is to provide an honest, factual report on the condition and spec of the machine and check it is as advertised.”

Inspections can take place on any tractor, regardless of age and warranty cover. However, the reality is that lower-value vehicles carry less risk to the buyer, so it's more difficult to justify the expense of an inspection.

What does the inspection involve?

Mr Fletcher will arrange to see the machine, usually within three days of being notified.

“Inspections usually take around three hours, but I will be with the machine until the job is done. The logbook and service history are both required and if they aren’t available, we’ll insist that copies are sent after the visit, or go to the dealer to get them.”

These are studied to make sure they are legitimate and that there's nothing of concern.

HPI checks are also carried out. Tractors, like most vehicles, will transfer with any outstanding finance so it becomes the new owner’s problem once the sale is completed.

Mr Fletcher says he is surprised at how rarely this is checked, given the amount of finance taken out on new tractors.

Everything is digitally documented, with pictures and close-up shots of specific defects – a typical report may contain more than 250 photos.

A visual check looks in-depth at the usual weak spots. These vary, but common issues include worn mudguard pivots and broken grease nipples, which Mr Fletcher says highlight a “telltale sign of a maintenance – or lack of, in some cases”.

Damaged engine catches and elongated holes around pins, especially on front linkages, are often revealed, while little things such as drawbar condition and the inclusion of weights, drawbar and link balls will all contribute to extra expense after the sale if not clarified.

Tyres are checked for bulges and cracks, and the date of manufacture is noted down. This is particularly handy for spotting if rubbers are older than the machine, which could indicate that it has had a hard life.

Pressure tests

Carrying out a pressure test on the hydraulic system will give a good idea as to the health of the pump.

“This is a job that most farmers won’t do when looking at a second-hand machine and it does add a big value to our service,” Mr Fletcher says.

Spools can be checked to make sure the flow reflects the size of pump and this is a quick way to establish if the pump advertised is actually the unit on the machine.

It is also possible to up the pressure and check how the flow reacts – if it falls away rapidly then a failing pump is the likely culprit.

The tractor’s air and hydraulic trailer brakes are also subject to a pressure test and the results compared with the manufacturer’s guidelines.

“Another potentially missed area is how the front linkage receives its oil flow,” Mr Fletcher says.

“If the feed has been tapped into one of the rear spools rather than being fed by a dedicated supply, it won’t be possible to use both front and rear valves at the same time. For those running triple mowers, this could be a deal breaker.”

On request there is the option of a dyno to test power output at the pto. Mr Fletcher also carries refractometers and battery testers to every inspection.

Even if the machine’s warranty is still intact, there are key areas this may not cover, such a lights and stabilising arms, or any damage caused by the owner or operator.

Farmers Weekly looked around a John Deere 7260R with Mr Fletcher and he pointed out some exposed wires at the back of the engine that had lost their protective conduit.

This left the wires exposed to the searing heat of the engine and meant they could already be damaged internally and could potentially present a fire risk.

What does it cost?

Mr Fletcher says: “Although it’s an upfront fee, this service shouldn’t cost the buyer money as any defects found should influence further negotiations for a better price or repairs to be sorted pre-delivery.

In most cases, I anticipate a far bigger saving than the price of an inspection.”

The service is being pitched in the region of £850 for a tractor with a value of £50,000. Each inspection is tailored to the customer’s requirements and this is reflected in the price.

While there is no warranty offered on the tractor by Mr Fletcher, he has insurance to cover any claims if his reporting is found to be inaccurate.

While it might sound expensive, it takes only a few minor defects to have the inspection fee almost paid for, he says. It’s also worth factoring in the potential costs in fuel, accommodation and time if you carry out a viewing yourself.

Verbal feedback takes place immediately after the inspection, with a detailed report and accompanying images usually sent over within 48 hours of the visit. It is then up to the buyer to make the decision.

The business is in the early stages but there are big plans for the future, with inspections of combines and cultivators both possibilities.

JOURNAL : Farmers Weekly

Livestock rustlers have struck in Monmouthshire and stolen a flock of 47 lambs.

The animals were taken from a farm in Llandenny sometime between Tuesday 3 March and Wednesday 4 March.

The thieves cut open the farm gates and rounded up the lambs, according to Gwent Police’s rural crime team.

See also: What to do if you’re a victim of sheep rustling

Officers believe the animals were removed from the farm in a lorry.

It is the second large-scale livestock rustling incident to have happened in the county over the past few weeks.

In February, 140 lambs were stolen from farmland in Rogiet Moors, near Caldicot.

But most were later recovered in a field near the M4 Prince of Wales Bridge.

Anyone who may have witnessed the latest incident, or who has information about either theft, is asked to contact Gwent Police on 101, quoting reference number 200080648.

Alternatively, call Crimestoppers anonymously on 0800 555111.

According to rural insurer NFU Mutual, livestock worth more than £3m was stolen from UK farms in 2019.

Top tips to prevent livestock rustling

Preventing rustling is not as easy as putting a padlock on a building or fitting a security system to a tractor.

However, there are a number of steps farmers can take to reduce the risk, and technology is now providing effective ways of tracing stolen livestock.

To deter livestock thieves, NFU Mutual advises farmers to:

Ensure stock is clearly marked and records are up to date

When possible, graze livestock in fields away from roads

Check stock regularly and vary times of feeding/check-ups

Consider a high-tech marking system such as TecTracer, which puts thousands of coded microdot markers into a sheep’s fleece

Join a Farm or Rural Watch scheme to share information about rural crime in your area

Ask neighbours to report any suspicious sightings to the police, or to give information 100% anonymously to the Rural Crime Hotline on 0800 783 0137, [*www.ruralcrimehotline.co.uk*](http://www.ruralcrimehotline.co.uk)

Dial 999 immediately if an incident is taking place – do not approach criminals.

JOURNAL : Farmers Weekly

Sugar beet growers can still achieve effective control of costly weeds in crops without the herbicide desmedipham, although care should be taken as there is a higher risk of crop damage due to the greater reliance on mixing straights.

Post-emergence herbicide desmedipham has been the cornerstone of beet weed programmes for many years, offering control of key broad-leaved weeds such as cleavers, knotgrass and fat hen, especially in cooler and drier weather.

However, this spring is the last season that sugar beet growers can use products containing desmedipham, which cannot be used after 1 July.

See also: Beet growers set to benefit from herbicide-tolerant varieties

Effectively it means the loss of valuable formulations such as Bayer’s Bentanal range, like the four-way mix Betanal maxxPro (desmedipham + phenmedipham + ethofumesate + lenacil) and UPL's Betasana Trio (esmedipham + phenmedipham + ethofumesate).

It’s also the last season for pre-emergence herbicide chloridazon, but it has a later final use date of 30 July.

As sales of desmedipham-containing products were not possible after 1 January, some growers may find themselves short of product and this spring will have to take a different approach to that of the past few years.

Looking at the alternatives, Darryl Shailes, research and development manager at agronomy group Hutchinsons, says there are fortunately plenty of approved options still available, "but we will have to be more precise with advice and applications".

These include ethofumesate, lenacil, metamitron, phenmedipham, triflusufluron-methyl, clopyralid, quinmerac and dimethenamid-p.

Crop damage risk

Pam Chambers, national influencer at agrochemical firm UPL, adds that growers will, therefore, become more reliant on straights, which can bring greater risk of crop damage.

That means particular care should be given to temperature and crop conditions when spraying.

“There were some issues with herbicides in 2018 where the beet crop was generally drilled a month late, but then growth was very rapid and temperatures were very warm at spraying,” she says.

Ensuring crops are stress free when applying herbicides is, therefore, vital. Growers should avoid spraying during extreme temperatures such as frosts or hot conditions.

Optimising crop ***nutrient*** status and checking soil pH is also important, otherwise this can lead to plant stress and consequently herbicide damage.

Greater monitoring between sprays

To achieve good control, Mr Shailes says growers and agronomists need good knowledge of the remaining approved actives and to increase their crop monitoring between sprays.

“Growers are likely to be using more frequent applications of less effective products, with reduced spray intervals, so it’s essential they or their agronomist get into the field more frequently to monitor their crops.”

The identification of weed species, soil type and weather conditions will also be essential when choosing what active to apply and when.

“It will be important to mix and match products to fit the specific weed spectrum as the product used will highly depend on the type of weed, soil conditions and weather,” he adds.

For example, the residual metamitron is useful for tackling knotgrass and fat hen to build up residual and control cotyledon weeds.

Looking at conditions, he highlights that phenmedipham works better in warmer, more humid conditions, so where desmedipham is in short supply this season, it's best to save it for cooler, drier conditions up to the last usage date and use phenmedipham when warmer and more humid, says Mr Shailes.

Mrs Chambers believes adjuvants can also play an important role in helping weed control and also increasing the efficacy of herbicide formulations.

However, careful consideration on the use of these products should be taken as they can also increase leaf damage if applied in the wrong conditions.

Cultural control methods

Cultural control methods provide another alternative to weed control in sugar beet crops, as the crop’s wide-row spacing creates ample room for a mechanical hoe to pass.

Improved technologies, such as GPS systems and camera guidance, further enable the potential success of this weed control method.

“Cultural methods should always be used where practical, and some growers may use a combination of mechanical weeding with conventional chemistry to enhance effectiveness,” says Mrs Chambers.

JOURNAL : Farmers Weekly

Another month has slipped by and we are still battling with the elements.

I think the farm is now so wet that it might break free from England and join the Isle of Wight, or preferably the Channel Islands, where I gather there has been less wet weather and no coronavirus.

Since the turn of the new year, it feels like we, as an industry, have been increasingly bombarded with how ***agriculture*** has got to change.

How we have to challenge ourselves to be more environmentally friendly, be custodians of the land and change the way we produce food.

See also: 3 ways a beef farmer is adapting to improve profitability

We even had some idiot come out and say actually we don’t need farmers at all in the UK.

We are going to change as an industry and as the old, slightly annoying saying goes; “In order for things to stay the same, something has to change.“

Machinery is another industry with some serious questions to answer. The cost of a new tractor has risen by 20% in the past six years, but as farmers, are we earning 20% more from that machine?

So this got me thinking about the "other side" of ***agriculture***, what I call the commercial ***agricultural*** world.

For example, feed companies, medicine companies, supplements, seed, spray, fertiliser and machinery manufacturers and all those other sectors that rely on farmers. Are they ready for change?

A lot of companies are thriving on the inefficiency of farming, but the clock is ticking for them. Take the feed industry, for example.

In my former life as a feed rep, there were 13 competitors operating in my little patch in mid-Devon.

Yes, 13 of us all running around trying to take the business off one another and persuade farmers why certain products are a better fit for their farm or needs.

As farmers get bigger and grow into more professional outfits, there just isn’t room for that. Surely consolidation is the order of the day if they want a sustainable future.

Keep up

Machinery is another industry with some serious questions to answer. The cost of a new tractor has risen by 20% in the past six years, but as farmers, are we earning 20% more from that machine? Debatable.

It is about time that the agri-commercial world gets with the times and start developing a constructive path for farmers to work with them.

They need to look at where farming is going after subsidies and have a long, hard look at themselves.

As a farm, we see and deal with all sorts of companies, but we also see some that have an attitude of everyone for themselves, which is not going to get them very far in the future.

I was staggered by the comment about whether the UK needs farmers or not, especially coming from government.

What a way to kick an industry while it’s suffering from flooding and dire circumstances. But watch this space, because change is coming.

Let's hope everyone can keep up.

JOURNAL : Farmers Weekly

Police investigating a crash in which a mother and young child were hurt are appealing for a tractor driver to come forward.

It happened at about 7.25pm on Wednesday (26 February). A Volvo C30 car and a tractor towing a trailer collided on Northallerton Road, Leeming, North Yorkshire.

See also: Road rules reminder: Trailer safety, tractor speed and licences

Both the driver of the Volvo and her 18-month-old child were treated in hospital for injuries they suffered in the crash.

Police are appealing for the driver of the tractor to come forward and for anyone who may have witnessed the collision or either vehicle in the area at this time to contact them.

Anyone with information should call North Yorkshire Police on 101, and ask for Emma Bainbridge, or email [*emma.bainbridge@northyorkshire.pnn.police.uk*](mailto:emma.bainbridge@northyorkshire.pnn.police.uk)

JOURNAL : Farmers Weekly

A gang of organised criminals is being hunted by police over high-value thefts of GPS kit on farms in West Sussex.

Thieves have raided three farms and one tractor dealership in the county and made off with kit worth an estimated £131,000.

All the thefts took place within a 15-mile radius over a seven-day period since 24 February.

See also: Ultimate guide to farm security kit

In total, 25 tractors have been broken into – most with a single-use key – but some have had their locks drilled out.

Ten GPS receivers, 29 screens and one multi-use screen have been stolen.

The thieves also caused serious damage, with numerous cuts to tractor cabling and wiring.

Farmers say the loss of earnings and time to repair the tractors, including labour, will cost them an extra £70,000.

Police rural taskforce needed

West Sussex NFU chairman Mark Chandler, from Moor Farm, Petworth, was one of the farmers targeted.

He told Farmers Weekly: “This is a really concerning spate of thefts, probably carried out by a gang that is then moving the kit abroad.

“Our neighbours and friends are also getting done over and we are wondering what’s next?

“We have been calling for a rural crime police taskforce in West Sussex for three years now – and nothing is happening.

“The cost of the thefts to us is nearly £250,000. If that happened on the high street, police would be throwing all sorts of resource at it.

"But because it’s rural crime, it goes to the PCSOs and they just don’t have the time.”

Sussex Police and crime commissioner Katie Bourne agrees there should be a rural crime taskforce for the county.

But the decision rests with chief constable, Giles York, QPM, who announced on Wednesday 4 March that he would be stepping down.

“We need trained police officers who are specialised in tackling rural crime,” said Mr Chandler.

“We currently have six rural PCSOs, who have been employed since last year.

"They are trying to visit as many farms as they can, but they are totally overwhelmed.

“In West Sussex, 349 police officers are now getting recruited. We need 35 of these in a rural crime team.”

Manufacturers 'must raise game'

Farmer Dominic Gardner had £30,000 worth of GPS kit nicked from Lee Farm, Patching, Worthing.

He said: “The thieves just walked in and took the receivers from the top of the cabs by cutting them off.

“They took the screens out of the cabs, which made the tractors immovable. They also took a specialist screen for a trailed sprayer.

“The police need to raise the game, but so do the manufacturers.

"A lot of this equipment you can operate without a password or code.

"If they changed this, it would stop the kit being so attractive to thieves.”

Police response

A Sussex Police spokesman said: “We are investigating four incidents in which specialist GPS equipment valued at more than £130,000 altogether, has been stolen from 25 tractors in farming communities in West Sussex since 24 February.

“Our rural crime officers have been in contact with the victims, in Patching, Easebourne, Bosham and Church Norton near Selsey, and an investigation into each of the incidents is ongoing.

“They are working with colleagues across the force, and nationally, to deal with this issue, which has been seen in other areas of the country although not so far in other areas of Sussex.”

Anyone with information about these incidents is asked to contact Sussex Police on 101, quoting serial 451 of 24/02.

JOURNAL : Farmers Weekly

Long gone are the glory days when the vast majority of tractors used on UK farms were built in UK factories.

Today, only CNH Industrial’s New Holland plant in Essex survives as a major tractor assembly centre, with JCB’s Fastrac production line near Cheadle, Staffordshire, being the only other source of UK-built tractors.

Further afield, Austria, France, Germany and Italy have managed to retain tractor production on a large scale, as have Japan and the United States – the latter being the source for the majority of the highest horsepower models used in Britain.

See also: Combines: where are they made?

For simpler, lower-powered models with thin profit margins, lower-cost locations are increasingly being exploited.

Turkey has huge manufacturing capacity – its tractor market, in unit terms, is one of the biggest in the world.

Likewise the scale of India’s market and improving production technologies make it a relatively new source of tractors for the West.

Although tractor sales growth in China has stalled over the past two years, the trend towards better-equipped machines – and big investments there by Western manufacturers – have strengthened the country's potential for export sales.

And in the sub-100hp and compact tractor sector, South Korea is already a strong player in the global production network.

In many cases, the manufacturers make the engines, transmissions and cabs that go into the finished products, or source major components from independent suppliers such as Carraro, Cummins, Dana, Deutz, FPT Industrial, Perkins and ZF, and local cab suppliers.

Check the map below to see which manufacturers are based in which countries - we've divided them into components and tractor assembly, cabs, engines and axles/transmissions.

See more detail on the manufacturers below the map.

Armatrac

Tractors supplied under the Armatrac export brand of Turkish manufacturer Erkunt Traktör Sanayi are assembled in the town of Sincan, on the outskirts of the Turkish capital Ankara.

The business, owned by Indian group Mahindra since 2017, sources transmissions from Carraro Group, which has plants in Italy, India and China, and engines from Deutz in Cologne, Germany, and Perkins in Peterborough.

Belarus

An integrated complex of factories producing engines, transmissions and cabs feeds the assembly lines of Minsk Tractor Works (MTZ), which turns out Belarus tractors in the east European country of the same name.

Branson

Branson is the export brand of Kukje Machinery Company and the tractors are built in Okcheon-gun, a city in central South Korea.

Kukje has been owned by fellow South Korean manufacturer Tong Yang Moolsan (TYM) since 2016.

Case-IH

All top-end Case-IH tractors are built in the United States.

The Magnum is assembled in Racine, Wisconsin, on the west bank of Lake Michigan, using CNH powershift and stepless transmissions also built there, and front axles from Dana’s Spicer range.

Steiger and Quadtrac artics come from Fargo, North Dakota, 600 miles to the north-west.

These feature powershift units from Univance in Japan and a ZF CVT from the Eccom range built in Passau, south-east Germany, and the town of Steyr in Austria.

All three ranges are powered by Cursor engines from FPT Industrial’s Bourbon-Lancy plant in central France.

European factories produce other Case models, mostly using cabs from the CNH plant in Croix, near Lille, northern France.

The factory in St Valentin, northern Austria, assembles all Luxxum (formerly Farmall Pro), Vestrum, Maxxum, Puma and Optum tractors for the UK, using transmissions from CNH’s Antwerp facility in Belgium and FPT engines from Turin, north-west Italy.

CNH’s Jesi plant near the Italian east coast port of Ancona is home to most of the smaller tractors in the Case range, including the Quantum orchard models and the Farmall C.

But production of simpler Farmall A tractors is shared by Jesi (85A to 115A) and CNH’s Türk Traktör joint venture in Ankara, Turkey, which also produces the FPT S8000 engine that powers them.

All F5C and NEF power units used in other models are sourced from FPT’s Turin factory.

Claas

The Le Mans factory in France, acquired with the Renault ***Agriculture*** operations in 2003, remains the principal home of Claas tractor production.

The one exception is the flagship Xerion built at the Harsewinkel headquarters plant of Claas, with its Eccom CVT sourced from ZF.

Power comes from Mercedes-Benz branded off-highway versions of Daimler OM engines prepared by MTU, a division of Rolls-Royce Power Systems, in Friedrichshafen, north-west Germany.

All Arion and Axion tractors use powershift transaxles from the Gima joint venture with Agco in Beauvais, northern France.

CMatic stepless units for the Arion 500 come from Claas Industrietechnik in Paderborn, Germany, and for the larger models from ZF Friedrichshafen’s German and Austrian plants.

Front axles, meanwhile, are sourced from Carraro and Dana factories in Italy.

FPT Industrial ships engines from Italy for the Arion 400 and Axion 800 and 900, while John Deere’s Saran plant in France supplies diesel power for the Arion 500 and 600 tractors.

Cab frames are outsourced but “dressed” in the Le Mans factory, while cabs for the Xerion are produced alongside the tractors in Harsewinkel.

Claas outsources its smaller, more specialist tractors – the Nexos orchard and Elios farm models are built by the Agritalia unit of Carraro Group in Rovigo, north-east Italy, while the Atos 200 and 300 come from SDF Group’s Treviglio factory further west.

Deutz-Fahr

All Deutz-Fahr tractors in the 6, 7 and 9 Series – from 126hp to 336hp – are built in a new factory at Lauingen, 80 miles north-west of Munich in southern Germany.

Diesel engines arrive from the Cologne plant of independent engine manufacturer Deutz.

Powershift and CVT transmissions for tractors from the 6 Series RCShift models upwards are shipped from ZF.

The Powershift models have transmissions built in SDF Group’s Treviglio factory in northern Italy. Front axles are built there, too.

Treviglio also makes the majority of smaller Deutz-Fahr tractors, including the Agrokid compacts, 5 Series Ecoline and TTV, and the 5G Series.

But the new 5D Keyline “economy” models are sourced from SDF’s newly upgraded Bandirma plant in north-west Turkey.

Apart from the 110-126hp Deutz-powered 5 Series tractors, all the Treviglio-built products have SDF Farmotion engines assembled in the group plant in India.

Fendt

Production of Fendt tractors is concentrated in the Bavarian town of Marktoberdorf, southern Germany, along with the Vario stepless transmissions that go into them.

Cabs are shipped in from Asbach-Bäumenheim, 70 miles north of the main factory.

Cabs and transmissions for the Fendt 900 MT Vario twin-track tractor are sent to Agco’s Jackson, Minnesota, plant in the US.

This also builds Challenger versions for the North American market, but the bigger 1100 MT has a locally-built cab and a powershift transmission from Caterpillar’s factory in Peoria, Illinois.

Front axles from Dana’s Spicer range produced in Italy include the central housing and independent wishbone suspension units on the new 900 and 1000 Vario models.

Fendt’s engine sourcing is quite diverse – the tracked machines and the 200/300 Vario tractors use Agco Power engines from Finland.

The 500 to current 900 Vario models have Deutz power; and the new Fendt 900 and 1000 Vario tractors have diesels from the newly formed MAN Engines unit of MAN Truck & Bus in Nuremberg, southern Germany.

Iseki

The Iseki TG6 Series tractors and other models in the Japanese manufacturer’s range are built in Matsuyama on the southern Japanese island of Shikoku.

JCB

The production lines for JCB’s two ranges of Fastrac tractors are located alongside its wheeled loader operations near Cheadle in Staffordshire.

Agco Power engines, and transmissions from Fendt's Marktoberdorf factory, are installed as part of the modular powertrain.

Axles for the Fastrac 4000 are built by JCB Transmissions in Wrexham, north Wales, and purpose-built axles for the Fastrac 8000 are shipped from Dana’s Graziano facility in Italy.

Both series have a bespoke chassis fabricated by GKN Wheels & Structures in Telford, Shropshire, while driver accommodation is produced by JCB Cab Systems in a new factory near Uttoxeter, Staffordshire.

John Deere

For the most part, John Deere’s tractor production is shared across two locations – one in Germany and one in the US.

All tractors in the 7R, 8R and articulated 9R series emerge from Deere’s Waterloo, Iowa, headquarters plant.

Most use diesels from Deere’s engine plant nearby, but the top-horsepower 9R and its derivatives are powered by a 14.9-litre motor from the Jamestown factory of Cummins in Lakewood, New York.

In Europe, JD’s Mannheim facility in south-west Germany assembles all the 5R-, 6M- and 6R-series tractors up to the biggest 6250R model, with cabs shipped in from Bruchsal, 30 miles south of Mannheim, and engines from Saran, near Orleans in France.

Historically, the larger 6-series tractors (170hp-250hp) were also built in Waterloo for the US market, but this arrangement is coming to an end, which means Mannheim will now build all 6R models for global sale.

Towards the lower end of the range, the 5M tractors are sourced from a John Deere factory in Augusta, Georgia, while the 5E comes from Deere’s Hadapsar factory near Pune, south-east of Mumbai, India.

The 5G-series orchard and vineyard tractors are produced by Carraro Group’s Agritalia plant in Rovigo, Italy.

Kioti

Tractors carrying the Kioti export brand of Daedong Industries are assembled along with engines up to 73hp at Dalseong-gun near Daegu, in the south-east of South Korea.

From 100hp up, engines are sourced from the relatively new Doosan Infracore compact diesel operation at the port city of Incheon to the north-west of the tractor plant.

Kubota

The M4002 and M5001 series tractors are built in Tsukuba near Tokyo and the M-GX series at Sakai, near Osaka, using in-house engines, transmissions and cabs.

For the larger M7003 Series tractors, Kubota set up an assembly-only plant in Dunkirk on the northern French coast, using engines from Japan and transmissions from ZF.

Landini

Components are manufactured and assembled at three Argo Tractors plants in northern Italy, where powershift and CVT transaxles and front axles for all models up to 140hp are built in-house.

The 2 Series compacts, Rex 3 orchard and Trekker crawler tractors are all assembled at the San Martino in Rio factory near Modena, along with cab versions of the Rex 4 fruit tractors.

Platform versions of the Rex 4 are built in a dedicated plant in nearby Luzzara.

Both are within 14 miles of the cab and headquarters factories in Fabbrico, where the rest of the Landini product range is built.

This includes the flagship 7 Series, which uses powershift and CVT transmissions from ZF.

Engines for the Landini 2 Series are shipped from Yanmar’s Biwa factory, north-east of Osaka in Japan, and for the Rex 3F from Kohler Power in Reggio Emilia, 20 minutes up the road from San Martino in Rio.

Engines for all Landini models up to 130hp are from Deutz in Germany, while FPT’s Turin factory supplies diesels for the larger 114-225hp models.

Massey Ferguson

As one of the core plants producing Massey Ferguson tractors for global markets, the factory in Beauvais, northern France, turns out five series from the 5700 Dyna-4 to the 8700 S Dyna-VT.

Cab production is in a dedicated plant nearby, while Dyna-4 and Dyna-6 powershift transmissions for all models are manufactured and assembled in the Gima joint venture with Claas that forms part of the main factory complex.

Stepless transmissions are brought in from Agco’s Marktoberdorf factory in Germany, and all engines from Agco Power in Finland.

At the lower end of the range, the MF 4700 and MF 5700 “global platform” tractors are built at Agco’s Changzhou factory near Shanghai, China.

MF 3700 orchard tractors are outsourced to SDF Group, and the MF 1500 and 1700 compacts are supplied by Iseki in Japan.

McCormick

All models in the McCormick range are built in the Argo Tractors factories in and around Fabbrico in the Reggio Emilia region of northern Italy.

The VT-Drive stepless transmissions for the X8 and X7 models are built in ZF’s German and Austrian plants, along with the X7’s P6-Drive powershift transaxles.

Argo’s own powershift transmissions go into the 70-140hp X4M to X6.4 models – plus the X6.4’s VT-Drive stepless option – while orchard and vineyard tractors are built in the Luzzara and San Martino in Rio factories nearby.

These also manufacture transmission and axle components.

Cabs for all McCormick tractors come from Argo’s own facility in Fabbrico. Engines from 114-310hp are courtesy of FPT, while all smaller models get Deutz power (other than the Yanmar-powered X2 compacts).

New Holland

With the exception of two low-end ranges, all New Holland tractors for the UK are assembled in one of three plants.

Basildon in Essex is the site of Britain’s only large-scale tractor production facility, where it builds T6, T7 and T7 HD models for world markets.

It uses transaxles manufactured in a CNH plant in Antwerp, Belgium, fully-dressed Horizon cabs from Croix near Lille in northern France, and FPT Industrial engines from Turin, north-west Italy.

High-horsepower manufacturing goes stateside, with the T8 models built around CNH powershift and stepless transmissions in Racine, north of Chicago.

The T9 artics are from the Fargo plant in North Dakota, using powershift transmissions from Univance in Japan and Auto Command stepless transmissions from the Eccom range of ZF.

CNH company FPT Industrial ships Cursor engines from its Bourbon-Lancy plant in central France for these tractors.

The Jesi factory near the Italian port of Ancona produces the T4 specialist fruit and vineyard tractors, the TD5 and T5 families and the transmissions that go into them, while engines are from FPT in Turin.

Cab production is more diverse – for the T4 F/N/V and T5 Utility and Electro Command, glazed frames from Cab Plus in Jesi are “dressed” in the tractor plant.

However, for the T5 Auto-Command, frames welded up in Croix head across to the St Valentin plant in Austria for dressing.

Cabs for TD5 models are shipped from Yaris Kabin in Turkey, where CNH’s Türk Traktör joint venture builds New Holland T4 and T4S models powered by FPT S8000 engines.

LS Mtron’s Wanju-gun factory in South Korea supplies latest-generation Boomer compact tractors.

Same

While the new Same Dorado Natural range of 65-97hp tractors are built in SDF Group’s Bandirma factory in Turkey, the rest of the range comes from the headquarters plant in Treviglio, northern Italy.

Cabs, transmissions, front axles and engines are also produced there, but the smaller capacity Farmotion diesels are shipped from SDF’s Indian factory.

Solis

Tractors carrying the Solis export brand of India’s International Tractors Limited (ITL) are manufactured in Hoshiarpur, Punjab, alongside transmissions and engines. Smaller compact models are sourced through a partnership with Yanmar of Japan.

Tafe

An integrated manufacturing and assembly plant for transmissions, engines and finished products in Chennai, southern India, produces Tafe tractors for manufacturer Tractors and Farm Equipment.

TYM

The tractors from Tong Yang Moolsan (TYM) of South Korea are produced at the company’s Jeonbuk factory in the city of Iksan.

Doosan and Daedong engines from South Korea, Deutz motors from Germany and UK-built Perkins engines are used in the various models.

Valtra

All of the Finnish marque’s mainstream products, comprising the A, N and T series, are built at the Suolahti factory in the south of the country, with the exception of the flagship S4 series produced in Massey Ferguson's Beauvais plant.

The integrated Suolahti facility includes production and assembly of complete powershift and CVT transmissions for the N and T models.

As part of the Agco “global platform” family, the Valtra A series tractors use 12x12 mechanical transaxles from the Changzhou factory in China and HiTech 4 powershift transmissions from Gima in Beauvais.

Engines are also built locally, at the Linnavuori factory to the south-west of the tractor plant, while cabs for the Suolahti-built models are assembled in Yliharma, to the north-west.

Orchard and other specialist A series models were previously sourced from Turkish partner Hattat, but the newly introduced F series tractors come from  Carraro’s Agritalia operation.

Versatile

The Winnipeg headquarters factory of Buhler Industries in Manitoba, Canada, builds the big four-wheel-drive and Delta Track articulated tractors, using powershift transmissions from Caterpillar’s Peoria plant in the US and Cummins X15 engines from Jamestown, New York.

Zetor

All tractors in the Zetor range have traditionally been built in the company’s Brno factory in the Czech Republic, along with engines and transmissions.

While that remains true for the Proxima and Forterra, the Major and top-end Crystal models also built there now have Deutz engines from Germany. The 43-49hp Perkins-engined Utilix and 68hp Deutz-powered Hortus are sourced from TYM of South Korea.

JOURNAL : Farmers Weekly

Many arable farmers are not taking a rigorous enough approach to grain trading to protect themselves from losing money in volatile grain markets, say experts.

James Bolesworth, director of independent grain trading advice firm CRM Agricommodities, says that UK farmers are great at insuring themselves against yield losses in the field through the use of fungicides and fertiliser.

However, many lag behind their global counterparts in deploying a proactive strategy and using all available tools to avoid missing out on a price rally after selling, or a price drop before selling, he says.

See also: Arable finances: What to consider after tough winter

Price swings increasing

This is despite on-farm yields showing lower year-on-year deviation than grain prices, which have shown increasing volatility in the UK since 2004-05, when the US bioethanol boom contributed to a global grain shortage.

Average ex-farm wheat prices saw a 35% swing between their highest and lowest level in 2019, while on-farm yields typically move by a maximum of 20%, so growers should try to de-risk both to maximise their chances of making money, he says.

And while it is impossible to always sell at the peak, he recommends the following framework for farmers wanting to revisit their trading strategy:

Step 1: Understand the minimum selling price at which the crop is profitable

Until a grower is certain they have covered their cost of production and made a margin, they will not know if the price is right for them to trade at.

Step 2: Consider the constraints on your business that affect trading decisions

This will involve taking stock of:

Cashflow requirements. Those with large monthly outgoings may not be able to hold back as much of their crop until late in the season.

Storage constraints. Growers constrained by storage may be physically forced to sell more at harvest and will have less to market later on.

Market opinion. Those with crops still to sell and a low attitude to risk may wish to sell even while prices are rising but others will be willing to wait.

A combined assessment of these factors will form the basis of a grower’s trading strategy – the decisions they make on when and how they trade their grain.

This will normally be through a combination of forward contracts, where a fixed price is agreed for a crop prior to harvest, and spot sales, where grain is traded based on the price for immediate movement.

Step 3: Familiarise yourself with volatility management tools

While trading throughout the season is in itself volatility management, as growers will normally average out the highs and lows of the market, there is more that can be done to lock in at a favourable price and be more versatile, says Mr Bolesworth.

One tool that he says is underused by UK farmers is the options market.

An option is a product that can be purchased through a broker.

It acts as insurance against a price rising or falling over a fixed period of time.

They can sometimes also be bought from a grain merchant but may cost more than buying them direct as the merchant will need a margin for managing the position, he says.

There are two types of option – call options and put options.

Call options insure against a price increasing and can therefore be useful to a grower who needs to sell their grain quickly as they will still benefit from the rising market.

Put options insure against a price falling and can be useful to protect someone who has the storage or cashflow to not sell at harvest as they believe the market will rise.

Losses are limited to the cost of the option premium if the market does not rise or fall accordingly, says Mr Bolesworth.

This is akin to insuring your car and not getting a payout because you haven’t crashed it, or applying a fungicide and then having a period of dry weather.

Trading in these products is only speculative if it is not linked to a physical transaction, and they are also used by city traders to make bets on the market rising or falling.

How it works

Purchasing put or call options gives the purchaser the right to buy or sell on a futures market of their choice at a certain price for a certain duration.

Grain is traded by farmers on futures markets around the world, including the London-based Ice Futures Europe, formally known as LIFFE, the Euronext in Paris and the Chicago Board of Trade, known as CBOT.

As ex-farm prices and futures prices track each other, a grower can use the futures market to insure a physical transaction of real grain on a spot market.

The price that you fix at is referred to as the strike price.

The cost of insuring that price is referred to as the premium.

At any time until the product expires, the buyer can “exercise” or re-sell the option and they will be paid the difference between the strike price and the futures market price on the day.

If they chose not to exercise their option before the expiry date, any payout owing to them will be automatically paid at expiry.

It is recommended that any grower who chooses to use these products closely monitors the grain markets or takes professional advice while they have active products, as they will need to decide whether to exercise their options.

However, they will already know any losses are limited to the cost of the premium, said Mr Bolesworth.

Case study: Wormell Farms

Dan Wormell, of PR Wormell Farms near Colchester, has managed risk by avoiding price falls by selling early and using options to insure against missing out on the market rising.

The 600ha farm has three flat stores, but he took the decision to lease out two of them in 2015 for rental income rather than use them for crop storage, meaning all crops had to be sold for harvest movement.

Mr Wormell worked with CRM Agricommodities to come up with a strategy that allowed the business to benefit from the diversified income without suffering from not being able to trade grain throughout the season.

Forward selling

They now forward sell up to 70% of the crop before harvest, with the rest being sold spot at harvest, but this year’s challenging weather means they have committed a lower-than-average amount so far.

He is hoping to continue trading into May and June, when spring crops have emerged, although the variability of spring wheat yield means caution will be needed.

He says: “We may lose out on a percentage in the harvest spot-price dip, but by the end of September we have sold 100% of our harvest and we have taken all downside price risk out of the marketing of the grain.

He then uses options to insure against an upswing in the market after the grain has been sold.

Get educated

“When I buy an option, I am paying an insurance premium to hedge the physical sale in case of the market rallying,” says Mr Wormell.

“You look at farmers across the world and they are using these financial tools to assist their businesses,” he says.

He says farmers should take a gain a thorough understanding of all the strategies available to their businesses.

“If they are not right for you, that’s fine, but understand them and know they are there,” he says.

“Marketing it is one of the most important things you can do – there is nothing professional about just selling grain when a merchant rings up.”

JOURNAL : Farmers Weekly

Two men have been arrested over the theft of two tractors in the Staffordshire Moorlands.

Police were called to reports that the farm machinery was stolen from two locations in the Kingsley area on Saturday (29 February).

One of the missing tractors was found on at 11.20pm on Tuesday night (3 March) on the A53 road near Leek.

See also: Ultimate guide to farm security kit

But the investigation is ongoing and officers from Staffordshire Police are still searching for the second set of stolen machinery, a red Case tractor and green silage trailer.

Two men, a 42-year-old and a 33-year-old, both from Cheadle, Greater Manchester, were arrested on suspicion of theft and remain in custody at this time.

A force spokesperson said: “The information provided by members of the community has led to the recovery of one of the valuable vehicles.

“Anyone with information is again asked to message Staffordshire Police on Facebook or Twitter, quoting incident number 821 of March 3, call 101, or contact Crimestoppers anonymously on 0800 555 111.”

Meanwhile, farmers in West Sussex are being warned to stay vigilant after £131,000 worth of GPS equipment was taken following raids on 26 tractors across four farms.

[*https://twitter.com/chandlerfarming/status/1234792351027126273*](https://twitter.com/chandlerfarming/status/1234792351027126273)

JOURNAL : Farmers Weekly

Dairy product exports have outstripped imports for the first time since records began, according to the AHDB.

Figures released by HMRC show that the UK dairy trade balance – exports minus imports – was positive, in volume terms, at 95,000 tonnes during 2019.

It is the first overall UK trade volume surplus since records started in 1997, said AHDB Dairy analyst Katherine Jack.

See also: Study reveals what a farm manager is worth

Trade balance volume

Of the product types, the largest shift in trade balances was seen in skim milk powder (SMP). The category recorded a positive balance of 55,000t in 2019 – almost double the 30,000t surplus of a year earlier.

Ms Jack said that the marked improvement in the trade balance for skim milk was a direct result of a shift in trade patterns across the Irish border.

“In 2019, exports of skim milk to Ireland increased by 20,000t while imports to the republic fell by nearly 59,000t,” she explained.

The overall powder trade surplus also increased, with the figure for whole milk powder (WMP) up by 5,000t to a record 45,000t for the year.

“For buttermilk, there was a small increase in exports, but the main reason for the improved trade balance was a significant drop in imports of 103,000 tonnes,” Ms Jack said.

“[Reduced] shipments from France, Belgium and Germany accounted for most of the drop,” she added.

The shift in the cream trade balance from a deficit of 6,000t in 2018 to a surplus of 5,000t last year was due to both higher exports and lower imports.

A year of strong milk production and high butterfat levels supported this, said Ms Jack.

Cheese, yoghurt and butter still traded at a deficit.

The deficit was reduced for butter – down from -22,000t in 2018 to -9,000t last year – as imports fell and exports rose.

For cheese the deficit fell from -332,000t to -327,000t in 2019 as imports declined.

Trade balance value

In value terms, there was still a yawning dairy trade deficit in 2019 of more than £1bn (-£1.09bn).

However, the deficit was significantly smaller in 2019 compared with a year earlier, Ms Jack pointed out.

The overall deficit at £1.09bn was £167m down on the previous 12 months, as export values increased and import values shrank.

Butter and cream were the strongest performers.

Cream almost reversed a deficit of -£13m in 2018 to record a trade value surplus of £12m in 2019.

Butter products saw the most notable change, with a reduced trade value deficit of -£87m in 2018 down to -£31m last year.

“This is partly because we imported less butter in 2019, but also because lower prices meant the volume deficit was worth less overall,” Ms Jack said.

JOURNAL : Farmers Weekly

Silage and haylage from Forage Aid has arrived on two Yorkshire Dales farms still suffering the effects of flooding last July and more recently.

Doug Barningham lost 120 sheep and 300 silage bales at Home Farm, Arkengarthdale, Richmond, last summer.

In addition, there was huge damage to the yard and the land.

In just three hours 340mm of rain fell, turning a stream into a powerful torrent which dumped 10,000t of stone on the field nearest the yard and far more in the yard itself.

Boulders carried by the stream stacked up against a building, forcing the water through the yard, taking with it stone walls and washing away the single track road that runs past the farm.

See also: Flood hit livestock farmers face long road to recovery

CCTV caught the torrent carrying bales past its doors and Mr Barningham’s daughter’s horse swimming as the water rose close to the top of the breeze block walls.

Incredibly, the horse managed to clamber out of the building, but his son’s car was lost in the floods.

Mr Barningham is waiting for a payment from the government’s Flood Recovery Fund, although the maximum grant of £25,000 will go nowhere near covering the damage.

Forage Aid has supplied more than 200 bales of silage and haylage to Home Farm.

“We’ve had tremendous help from Forage Aid and from many local farmers and the young farmers,” he said.

“Everyone’s been so helpful, it’s helped us get through a really tough period.”

Where to go for help

Farminghelp.co.uk

Forage Aid – 07967 219 991, email: [*info@forageaid.org.uk*](mailto:info@forageaid.org.uk)

Farming Community Network – 03000 111 999

Royal ***Agricultural*** Benevolent Institute – 0808 281 9490

The Addington Fund – 01926 620 135

Rsabi (Scotland) – 0300 111 4166

JCB sent two Fastracs and Ripon Farm Services provided trailers to help the clean-up.

Mr Barningham also faced huge costs, including waste charges to dispose of the wrecked silage bales.

Forage Aid stepped in to help with this, too, as it has done on other farms, removing about 700 bales in total and delivering them to an AD plant further north.

His sheep carcasses were found as far as five miles downstream and the costs for the carcass disposal fell to Mr Barningham to pay.

This year, the recovery will continue, with a lot of walling work planned.

A load was also delivered to Ron Bailey, who farms a few miles away at Fremington Mill Farm, Fremington.

The Forage Aid help had been absolutely fantastic, said Mr Bailey.

More donations needed

Forage Aid is growing all the time, thanks to the support and goodwill of the wider farming community.

However, it is currently working hand to mouth, said founder Andrew Ward.

It has delivered more than 500 loads to hundreds of farmers since 2013.

“We’re still looking for silage, another load or two would help,” he said.

The organisation is part of the farming help group, supported by the Prince’s Countryside Fund.

Mr Ward founded it in 2013, when snowstorms left farmers in Wales and north-west England without feed.

Almost 400 loads went to more than 120 farmers in its first three years of operation, worth about £725,000.

Helping with the impact of the summer floods last year and those in early November, it has moved another 30 loads worth £48,000 and there are five more to schedule.

About 85 hauliers, many of them owner-drivers, have given their time and trucks free  of charge to make the deliveries.

JOURNAL : Farmers Weekly

The Farmers Weekly 2020 Farm Inventions Competition featured some smartly made farm equipment, such as a powered gravel cart, home-built flat-bed trailer and a nifty two-way log splitter.

Robert Wright’s ground-driven gravel cart (complex category highly commended)

Ground-driven implements are pretty common in wet areas such as mid-Ulster, so when a local drainage contractor asked Robert Wright to build a driven gravel cart for an employee with health issues, he got straight to work.

See also: How to tackle rust by galvanising farm kit

His first job was to work out the diameter of the large flotation wheels needed on the trailer.

A scrap axle from an 18t Volvo lorry then determined the width of the machine and allowed Mr Wright to make the modifications needed to the rims for it to be as narrow as possible for road transport.

The complicated process of making it ground driven originally had the gearbox for the trailer drive at the front of the machine, directly in line from the pto drive on the tractor.

But Mr Wright was cautious, as when going down the road at 50kph, it wouldn’t take much for the gears to walk and the whole setup to go bang.

He then switched the gearbox to the rear, where it was set in its own sub-chassis within the trailer’s larger chassis. It was far enough away from the rear axle differential for two universal joints to be used as connectors and allow for any alignment tweaks.

Crucially, these were still strong enough to transmit the drive to the axle.

The gearbox was turned around so reverse gear was used to match the rotation of the tractor and provide drive to the rear axle.

At the other end of the gearbox, where the clutch would be, a modified sprocket was added to take the chain drive from here and link it via three other sprockets to the front of the machine. This setup was needed to get around the 10t gravel hopper.

By doing this, getting the timing spot on between the tractor’s ground drive and the rotation of the gravel cart’s wheels was made easier, as there were multiple adjustment points along the drive line. Mr Wright settled on a 1% variance over a 50m distance.

Once at this stage Mr Wright needed a way to disengage the drive for road transport. He used the gear selector on the transmission to change the drive from reverse to neutral. That meant drive still came from the tractor, as the pto remained connected, but nothing was transferred through the gearbox to the trailer’s axle.

He employed a 12V linear actuator with a 50mm stroke and a force of 150kg, which is equivalent to a person trying to engage a gear without the clutch. He hooked it up to a rocker switch in the cab and it takes about three seconds to change gear, while a warning light denotes the gear position.

It’s best done at slow speeds, as any gears that aren’t aligned quite right can move to allow the lever to engage. The complicated build took about six months to complete and has meant that a driver in poor health can operate the gravel cart without having to get off the seat.

It cost £6,000-£7,000 to complete.

Andrew Burt’s tilt-bed trailer (complex category highly commended)

Having searched for and failed to find a rattle-free tilt-bed trailer, Andrew Burt decided to make one himself.

The tandem-axle design uses high-quality German-built running gear, heavy-duty pivots and folding aluminium rear ramps that don’t rattle around and jam up.

He also incorporated a slight beavertail into the deck that allows the rams to be kept short, making them easier to handle. Twin tilt rams hooked up to electric controls mean there is no manual pumping required, either.

Mr Burt designed the trailer to have a 3,500kg gross weight and had the complete chassis galvanised to prolong its life. He did all of the work himself, but had some of the more complex components laser cut. Apparently, it is almost silent during towing.

Ieuan Evans’ shed roof cleaner

Ieuan Evans has come up with an ingenious answer to mossy shed roofs.

His brilliantly simple scraper solves the age-old challenge of cleaning dangerously fragile roofs that may have built up several decades’ worth of green matter.

Central to the assembly is an axle and wheel combination from an old ride-on pedal tractor. The blown plastic wheels are lightweight and chunky, allowing them to ride over delicate sky lights and traverse the uneven profiles of roofing sheets.

To the running gear, Mr Evans welded recycled steel reinforcing bar carrying four thin-edged, U-shaped scrapers. There were made from semi-circular cable ducting scavenged from old electric posts and run in the channels of the corrugated roof, dragging the moss down to the gutter ready to be cleared.

The whole lot is connected to a long T-bar handle, which allows the operator – from the safety of a lifting platform – to run the cleaner up the roof on its wheels, before flipping it over (with the wheels in the air) to scrape back down.

Of course, anyone that decides to build a similar version should use caution when working on roofs that may contain asbestos.

Graham Jackson’s stationary engine

An engine from a scrapped John Deere combine has been given a new lease of life by Graham Jackson, based in Little Eccleston, Lancashire, as a means of powering the farm’s Master grain dryer.

He had previously used a spare tractor for the job, but decided it was drinking too much fuel and, with the engine thrashing away at high revs and in dusty conditions all day, it was at risk of seizing.

Instead, Mr Jackson sourced an old four-cylinder, 90hp oil-burner and mounted it to a solid RSJ base frame.

Both the original diesel tank and rotating air pre-cleaner were salvaged; with the latter particularly useful in keeping the radiator clean and cool while drying dusty barley.

To avoid the complications of a gearbox, drive is simply engaged by a hydraulic ram that tensions a set of upgraded Kevlar belts.

Mr Jackson also bought a £400 auto shut-off kit from the US that kills the engine if oil pressure and coolant temperature exceed set levels.

It runs impressively smoothly at 1,500rpm too – so much so that it doesn’t need bolting to the ground. It’ll also run all day on less than 136 litres of fuel.

The build cost left a handful of change from £3,000.

David Devine’s log splitter

This nifty two-way log splitter is the work of County Londonderry farmer David Devine.

It has a double-edged splitter and uses two rams – one pulling and one pushing – to give even splitting power in both directions. These are controlled by one half of a Ford 10-series double spool block with adjustable detent.

Mr Devine has also incorporated a hydraulic log lifter on the side of the table, which can be left up to give a larger working area. This has a separate ram that is controlled by the other half of the spool block.

Apparently, it more than doubles splitting time, as the long ram stroke means it’s often possible to split two logs at once.

Edward Ward’s road grader

As he needed to keep more than seven miles of tracks in good order, Lincolnshire farmer Edward Ward took a redundant set of Massey Ferguson discs and converted them into a track leveller.

The build took about a day to complete and began with removing the disc gangs. He kept the hydraulic drawbar pitch, as it is handy for levelling up the U-shaped blade when working on different tractors and uneven ground.

The wheels were also retained from the discs to lift and lower the blade into action. So far, it has covered about two miles of farm tracks, levelling humps in the middle of tracks as well as grading out piles of tipped stone.

The costs included welding rods and the time it took to build.

Ieuan Thomas’ electric scooter

It’s torture for most young people growing up on farms to look at machinery, but not be allowed to drive it. This is why 15-year-old Ieuan Thomas decided to build a scooter so he could help out with general tasks.

Most of the parts came from scrap lying around the farm, and power is provided by a couple of 12V batteries that run an old motor his grandfather had used on a previous project.

It has an electromagnetic brake system that slows the motor down once the drive is stopped.

The front wheels are from an old mobility scooter that was being chucked out by a local shop and the seat was pinched from Mr Thomas' grandfather’s old 2008 Ford Focus, that failed its MOT.

All in, the build cost about £20 and took two weeks to build in his spare time. It has proved very useful transporting everything from feed bags to bales around the yard.

James Park’s track grader

Living at the end of a long farm track sounds idyllic, but the combination of heavy farm traffic and wet Lancashire weather meant James Park was regularly dodging potholes on his route home.

Previously, he would fill in the potholes with a shovel, which was not only hard work, it took up valuable hours, so last year he decided to speed the job up by building a tractor-mounted leveller from scrap angle iron.

The clever design uses the iron cross members welded at 10deg angles to shave off the high spots and fill in the low areas. The high sides also mean material isn’t lost onto already graded areas.

Mr Park can also adjust the link arms so he can grade a camber onto the track, and it is used on average four times a year.

The 2.7m-wide frame is made from weighty offcuts of metal pylons and can be pushed or pulled by the farm’s Massey Ferguson 6716S.

There was little cost to the project and it took about three days on and off to knock together.

Lloyd and Pete Mortimore’s wrap compressor

Since adopting big-bale forage, organic beef farmers Lloyd and Pete Mortimore needed to come up with a way of neatly managing their used wrap.

The solution was to build a DIY compressing bay at their Dartmoor farm, which uses an intermediate bulk container (IBC) full of water to squash the material, making it easier to store and cheaper to dispose of.

On the top on the IBC, the pair have fashioned a simple rolling table with a guide that keeps the wrap clean and allows it to be formed into neat, uniform pellets.

These are then stacked on a pallet in the bulker and when this is full, the IBC is placed on top to compress them. More wraps are added and compressed until no more can be accommodated.

In total, about 300 wraps can be fitted onto a pallet, at which point it’s removed from the bunker and the load is secured using more used wrap.

It’s then easy to take to a recycling centre, where they are given a discounted rate for bringing in clean, sorted material.

Phil Metcalfe’s suspended grain conveyor

After a quote for a full-length transverse grain conveyor was considered too expensive, Yorkshire farmer Phillip Metcalfe decided to have a go at building his own.

The base of the project was a second-hand conveyor that received a full refurb before installation. Two steel tracks at either end keep it suspended and move it up and down the grain store via wire rope pulleys, operated from the ground.

Most of the steel tracking had a previous life on the farm before being repurposed.

A large red hopper receives the grain from an overhead chain and flight conveyer, which has a number of outlets fitted with swivelling spouts to help transfer the grain. The main conveyor is bottomless, so allows for a level fill and better air movement due as it is not pushed with a loader.

Fan pedestals are also put in the crop to help the air flow.

Once a bay is full, a light is illuminated by a level sensor to alert the grain store operative to move the conveyor forward about 50cm for it to continue filling the bay.

New parts included the steel for the red hopper and the nylon wheels used for the track runners. The winding mechanism to move the conveyor was all fabricated from existing parts.

A new motor for the conveyor was installed by an electrician and the final cost was approximately 15% of the initial quote and was built last year in the farm’s workshop.

Chris Barker’s novel trailer catch

Fed up of filling his boots with grain every time he unlatched his trailer’s tailgate, Yorkshire farmer Chris Barker developed a low-cost solution that keeps a safe distance between the grain and his boots.

The design focuses on a length of baler twine that is tied to the top of the trailer’s tailgate. One end is threaded through the lower catch and then hooked back onto the longer end that runs down the length of the trailer.

When the string is pulled, it tugs on the catch, lifting it off the bar and releasing the gate. Mr Barker says it avoids countless boot empties a day and the colour of the twine is optional. And the cost is "Yorkshire’s favourite price", he says.

Peter McLaughlin's people carrier and post knocker

North Ayrshire farmer Peter McLaughlin converted an old Canycom tracked dumper into a people carrier capable of carting four people to remote areas.

The low-ground-pressure machine has a 1,400x600mm storage area that has a 1,000kg payload and helps to deliver personnel and tools to hard-to-reach jobs.

Mr McLaughlin also fitted a crane and a Wrag post driver to a 5t Morooka tracked dumper. It has the capacity to carry lots of fencing kit and is driven by the hydraulic levers at the rear of the machine.

The post driver can swivel 180deg to help the operator get the right distances and angles to knock the posts into the ground.

JOURNAL : Farmers Weekly

Calves reared in a specific youngstock unit are growing 100g/day faster during the 20-120-day phase in early trial work.

The High Health Unit (HHU) prototype has been trialled for two years on a calf rearing unit at Long Lane Farm, near Frome in Somerset, where it was first designed by the late Tim Walwin, a calf rearer with over 50 years’ experience.

See also: What’s In Your Livestock Shed? visits £130,000 cubicle shed

Growth rate ***data*** shows calves achieve an average daily liveweight gain of 1.15kg a day, between the age of 20 and 120 days in the HHU.

This is 100g a day higher, than in conventional general-purpose livestock sheds on the same farm across the yard, at a 0.5% morality rate.

Shed facts

Dimensions: Each pen is 5x3m = 15m

Stocking rate: Each pod can stock 10 calves up to 85kg (1.5sq m a calf) or seven calves up to 140kg (2.14sq m a calf)

Materials: Made from steel frame, insulated non-drip roof and pens segregated with recycled plastic stock board. Seven-rail galvanised steer gate at front.

Erection: Takes a telehandler and four hours to erect a 10-pod system

Extras: Each unit comes with three walls and a gate at the front. Pellet hoppers and push-nose drinkers can be bought as optional extras.

Retail: A 10-pod system costs approximately £26,500 (+VAT), depending on specification, farm requirements and delivery charges.

Watch the video and read the rest of the report below.

Development

After five initial prototypes and two minor redesigns during the trial period, the design is now commercially available.

Recent improvements include, a rear flap to control air flow at the back of the shed during cold weather and recycled plastic stock board being used as segregation boards in between each pod due to its strength and lightweight qualities.

Design principles

Gabby Emery of Buitelaar’s Tech Team, explains that to ensure airflow is achieved systems should start with a minimum of two pods and not have more than ten in a line.

The sheds can be erected anywhere relatively sheltered and away from other farm buildings to allow air to circulate into the pens.

Farms must have a solid concrete base to secure the front of the unit by screwing it into the floor, but it can stand on hardcore or concrete, she explains.

“The key design feature is the low roof because young calves don’t generate the same heat and stack effect that older cattle do,” says Ms Emery.

“The gradient of the roof helps draw fresh air in, which doesn’t happen in multi-purpose livestock sheds with high roofs.”

A telehandler is required for construction, but the idea is farms erect units themselves, she adds.

Key design features

Airflow

The roof is pitched at a 45deg angle, sloping upwards from the rear. This helps draw fresh air in to replace stale air.

The shed is completely open in normal conditions at the front and rear of the shed. The rear back boards are 1.24m high, meaning no drafts at calf level.

Segregation

Side boards separating pods are also 1.24m high meaning different pens are segregated and calves from different batches can’t touch and transfer pathogens via direct contact.

Insulated roof

A non-drip insulation material is housed inside the sloping roof. This helps stabilise temperatures, keeping it warm in winter and cool in the summer.

Easily cleaned

All surfaces are stainless steel or plastic, meaning the units can be easily cleaned and disinfected between batches.

Grouping

Calves are grouped in the units upon entry at three weeks of age. Grouping calves has been shown in scientific trials to result in better growth rates due to competition for feed.

It also increases animals’ socialisation skills, which helps them integrate into new groups when regrouped at pasture or in feedlots.

Push-nose drinkers

While an additional cost over a simple bucket, the push-nose drinkers are recommended.

Automatically refilling when calves need to drink, they save on labour, spillages, reduce the risk of disease transfer through water and are easily cleaned out compared to buckets.

Rearing system

The units take in calves from dairy units at three weeks old, on a 42-day milk plan feeding 25kg of milk powder a calf. Calves are fed a 16-17% crude protein calf rearer pellet on an ad-lib basis.

Over 500 calves have been through the system, with a week rest period between each batch and 3.5 batches are grown in a year.

Calves are weaned at around 90kg after six-to-seven weeks in the unit at ten weeks old, averaging 0.9kg/day at weaning and 1.1kg thereafter.

Calves are bedded up daily with barley straw.

Health protocols are planned by vets at Synergy Farm Health. All calves enter the unit after receiving 10% of body weight in colostrum in the first three-to-four hours of life at the dairy farms where they are born.

All calves are vaccinated with a four-in-one vaccine covering parainfluenza 3, bovine respiratory syncytial and bovine viral diarrhoea viruses, as well as Mannheamia haemolytica serotype A1, with a follow-up booster given two weeks later.

After weaning calves are given a live marker vaccine for infectious bovine rhinotracheitis.

Approximately one third of calves through the unit have been dairy bulls which are kept entire, a third have been a mix of Angus-cross and a third blue-cross steers and heifers.

Calves are sold on to finishing farms for grazing or intensive finishing at 150kg.

JOURNAL : Farmers Weekly

Bovine TB compensation for Welsh farmers has jumped 15% in a year, according to new figures.

Compensation in 2018-19 for farmers hit by the disease was £18.24m, with £15.9m paid in 2017-18. Over the past five years, compensation to Welsh farmers totals just under £74m.

The figures came in response to a written assembly question submitted by Welsh Conservative Andrew RT Davies.

See also: Counting the cost of bovine TB in Wales

The Farmers’ Union of Wales (FUW) said the rise reflected the unsustainable increase in the number of valuable cattle slaughtered due to the disease.

It said in a statement: “The current level of compensation takes no account of the consequential losses caused by current regulations and these consequential losses can be significant.

“We know that issues, including loss of stock; problems with cashflow, costs of housing and feeding additional stock; loss of business control; and uncertainty over the future inevitably affect the emotional wellbeing of farming families and have a long-term effect on the cattle sector in Wales.”

The FUW added that the past three decades of “ineffective policy” had restricted the ways in which farmers can manage the wildlife source of TB infection.

Mr Davies, the shadow rural affairs minister, said the figures were further evidence of the Welsh government’s failure to listen to the farming community and implement an effective strategy to eradicate bovine TB.

He added: “Compensation payouts are spiralling, and the costs of administering the wider scheme are also going upwards.

“As Welsh Conservatives, we have long called for a comprehensive, scientifically led programme of TB eradication, as it’s clearly not sustainable to preside over such an ever-increasing compensation bill.”

Farmers Weekly has contacted the Welsh government for a comment.

JOURNAL : Farmers Weekly

A £2.5m flood relief fund has been opened to help Welsh farm businesses recover from damage and disruption caused by storms Ciara, Dennis and Jorge.

The Business Flood Relief Grant provides funding for small and medium enterprises facing the immediate costs of recovery.

A maximum of £2,500 is available per business to ensure that they remain solvent through disrupted trading periods.

Initially there was some doubt over whether farm businesses could apply.

See also: Herefordshire farmer reveals flooding devastation

But they have been given the green light to apply following talks between NFU Cymru and the Welsh Government.

“We are now able to confirm that farm businesses are eligible and should provide their CRN reference in the application," an NFU Cymru spokesman said.

Only small and medium enterprise businesses (SMEs) are eligible, which means those with fewer than 250 employees and a turnover lower than £44m.

The fund is administered by Business Wales and will support those with the immediate costs of recovery not covered by insurance, the union spokesman added.

The Business Flood Relief Fund is open to applications from 11 March 2020 to 20 August 2020, subject to funds remaining available.

Who can apply?

The grant can only be claimed by businesses that meet the following criteria:

The business must be an SME based in Wales

The business needs to demonstrate that it has suffered severe disruption as a result of storm Ciara and/or storm Dennis and/or storm Jorge

It must have been directly affected by the weather event – ie, flood damage to the property,equipment, and/or stock

Alternatively, it must have been indirectly affected by the weather event ie, the business has had no – or highly restricted – access to premises, equipment and/or stock as a result of flooding; restricted access for customers, suppliers and/or staff; suffered loss of trade and have issues with regards to wages for employees.

What does it cover?

Funding can only be used to cover costs that cannot be recovered from insurance, and only one application is allowed for each business.

Costs incurred could include:

Clean-up of equipment – generators, dehumidifiers, lighting, brushes, power sprayers etc

Building and stock security

Costs associated with getting IT and electricity up and running

Temporary accommodation costs

Specialist advice to help you work out what to do, such as legal advice

Anything to help you get open and trading again

Grants can be paid against items that have already been purchased (after the date of the flood), and/or items which the business has not yet bought.

All applications will be considered on an individual basis and payment of the grant is at the absolute discretion of the Welsh Government.

How to apply

Businesses will need to provide details of estimated affected costs to their business and evidence of business address. They must also provide photographic evidence of the damage

Online: Businesses can apply for the grant using a Business Wales application form.

By phone: Contact the Business Wales Helpline on 03000 6 03000.

Email queries to: [*floodrelieffund@businesswales.org.uk*](mailto:floodrelieffund@businesswales.org.uk)

JOURNAL : Farmers Weekly

Farmers, growers and land managers in Wales are being offered the opportunity to dispose of unwanted pesticides for free.

Welsh Water has relaunched PestSmart, its free and confidential pesticide disposal scheme, which aims to safeguard raw water quality before it reaches treatment works.

The “no questions asked” scheme offers land managers the chance to get rid of out-of-date, unwanted or unlicensed chemicals safely.

See also: The rules for legal storage of pesticides on farm

The scheme is available throughout Wales, not just Welsh Water’s operating area. It is completely confidential and available for a limited time on a first-come, first-served basis.

Ian Christie, managing director of water services at Welsh Water, said: “Our routine raw water monitoring programme has detected increasing traces of pesticides in areas where we have never seen them before.

“While these levels are too low to pose a risk to those drinking the water, they are enough to risk breaching rigorous drinking water standards, so we want to work with farmers, growers and land managers to take action to address this issue together.”

The project has received funding through the Welsh government Rural Communities – Rural Development Programme 2014-2020, which is funded by the European ***Agricultural*** Fund for Rural Development and the Welsh government.

Protect water

Welsh rural affairs minister Lesley Griffiths, said: “This is a great initiative by D r Cymru and I encourage all farmers, growers and land managers to register for the free pesticide disposal scheme.

“Minimising the impact of pesticides on the environment is an essential part of responding to the ecological crisis, protecting Wales’s watercourses for future generations. “

To register, visit [*www.dwrcymru.com/disposalscheme*](http://www.dwrcymru.com/disposalscheme) or call 01443 452716 by no later than 5pm on Tuesday 31 March 2020.

Your details will be securely transferred to Welsh Water’s appointed hazardous waste contractor which will contact you for further details before ***collecting*** your unwanted pesticides and herbicides on a pre-arranged date.

JOURNAL : Farmers Weekly

Almost half of all farmers in the south-east and east of England have already invested in non-farming activities such as building lets and agro-tourism, as they seek to diversify their income sources.

The latest Farm Practices Survey, carried out by Defra in October each year, attracted more than 2,700 responses from farmers, providing a snapshot of how they run their business.

See also: Find all our diversification advice in one place

The latest survey across all farm types and all regions of England include a detailed section on how farmers are changing their businesses, such as diversifying into non-farming activities, investing in renewable energy or changing their cropping patterns.

The survey found almost one-third of farmers have already invested in things such as tourism and letting building, with another 15% expecting to do so in the next three years.

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But there were strong regional differences, with 49% of farms in the South East and 47% of farms in the East having already diversified their income streams, compared with just 22% in the North West and West Midlands.

This reflects the greater opportunities for farmers in areas of higher population density and household income.

Renewables

Investing in renewable energy is another popular development, especially among pig and poultry farmers. However, the importance of continued taxpayer support is apparent, with 51% of all farmers saying they would invest in renewable energy if it were grant aided.

“In terms of changes farms were planning to make in the next three years, farmers were most likely to widen the variety of crops or enterprises, with 26% of farms selecting this option,” says the report.

This is in contrast to the 11% who were inclined to become more specialised in their farming activities.

Not surprisingly, cereal growers were the most inclined to extend the variety of crops grown, with 39% planning to do so. This compared with just 9% of upland grazing farms that plan to add an enterprise in the next three years.

Precision farming

Precision farming remains a minority activity on both livestock and arable farms, with most farmers citing "lack of relevance" or "lack of cost-effectiveness" as the main reasons for not adopting it.

But of those who have, more than three-quarters said it was to increase productivity, while over half said it helped improve accuracy and reduce input costs.

The most common forms of precision farming technology include measuring livestock growth rates – especially common on pig and poultry farms – and using breeding indices or estimated breeding values.

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Using agri-tech to reduce environmental effects such as soil loss or greenhouse gas emissions was a relatively minor motivation, with just 38% of farmers who use any precision farming tools citing this as a reason.

“But this ranged from 22% of lowland grazing livestock farms to 60% of cereal farms” says the report.

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It was a similar story for using precision farming to improve soil conditions, with 66% of farms in the arable-dominated east of England giving this as a reason, compared with just 35% in the livestock-dominated South West.

Asked why they did not use precision farming techniques, 63% said they were not relevant to their farms, while 48% said they were too expensive.

Sources of advice

The farming press remains the number one source of advice for farmers, whether it be about productivity, the environment or regulation.

"Friends and family" rank second, with organisations like the NFU or AHDB third.

Around 30% of farmers also pay for an adviser.

Government advisers are little used for advice on productivity, but more so on environmental and regulatory matters.

JOURNAL : Farmers Weekly

The latest instalment in our long-running What’s in Your Shed? series features 27-year-old Cumbrian livestock farmer and contractor Edward Beard.

He reveals the best and worst of his largely Case-branded machinery fleet, with tractors ranging in age from a long-in-the tooth K-reg 1455 to a brand-new Puma 165.

How did you get started?

I grew up in Cockermouth, but my grandad really got me into farming. I was offered the tenancy of a 40ha farm, plus fell rights, when I was 18 and straight out of college.

I started with 250 sheep and eight Galloway cows, along with an old Case 895 tractor and McHale wrapper.

It was a steep learning curve and it took me several years to start making any money.

Somehow, I scraped together the cash for a Case 5150 and began taking on more land, to the point where I now have 180ha, 800 sheep and 65 Blue Grey suckler cows.

Alongside the farm, I offer contracting services, including mowing, tedding and baling.

But the thing that keeps me busiest is fencing – I did 12km last year, a lot of which was done by hand for the National Trust and River Trust.

See also: Take a trip around the UK with our What's in Your Shed map

Farm facts: Edward Beard, EJ Beard, Buttermere, Cockermouth

Farm size 180ha rented

Cropping 80ha silage/hay, 100ha rough grazing

Soil type Mixed, from bedrock to heavy clay

Stock: 800 Herdwick, Swaledale and Cheviot ewes, 65 Blue Grey suckler cows

Contracting Mowing, tedding, baling, groundworks and fencing

Staff Edward Beard, plus up to three others at peak times

How brand loyal are you?

As you can probably tell by the picture, I like Case tractors. I dreamt of having a 5150 – which I now own – and a 1056, which I’m still keen to find.

That said, the new tractors don’t excite me quite as much and I occasionally mull over the idea of getting an old Fendt.

Favourite dealer?

CT Hayton at Wigton is my go-to for tractors – the Puma and Farmall came new from there and the JXU and Maxxum were second-hand.

Their service is good and, more importantly, the man in the parts department knows exactly what he’s talking about.

For most other stuff, I tend to use David Johnson ***Agricultural*** Engineers at Broughton-in-Furness. They’ll source pretty much anything, can be contacted at any time of day and I love how brutally honest and straight they are.

They’ve also just moved to a smart new premises and must have one of the biggest workshops in Cumbria.

Favourite and least favourite pieces of kit?

My undisputed favourite is the Case 5150, but we’ll come to that later. Apart from that, it’s my new 9t Takeuchi digger kitted up with a Wrag post knocker.

I paid £22,500 for it two months ago – it has 7,000 hours on the clock – and it has revolutionised the fencing job.

It’s far more stable than a five-tonner and has the reach we need to get into awkward places – it’s already been in some fairly gnarly locations on the fells.

Least favourite is the McHale Fusion 2 baler wrapper, though it’s because of the way I run it, rather than its performance.

There are too many buttons to think about while concentrating on changing gear in my old tractors, particularly because most of the work is on hills.

That said, I wouldn’t change it and the weight in the bales is amazing – I usually make 5,000, but expect to add another 1,000 this year.

Kit list

Tractors All Case: Puma 165, Farmall 115HD, Maxxum 140, 5150, 1455, 895, 4230. Siromer scraper tractor

Balers McHale Fusion 2, Lely 235, New Holland 376

Other forage kit Lely front and rear mower, Krone 680 twin-rotor rake, 2x Claas tedders (six- and eight-rotor), Tanco linkage-mounted wrapper, McHale trailer wrapper

Muckspreader Bunning Lowlander

Other 6t and 10t dump trailers, Marshall livestock float, low loader trailer, 9t Takeuchi digger

Latest purchase?

A brand-new Puma 165, which arrived just before Christmas. I also picked up a second-hand Walter Watson Spiral Blade Aerator for £4,800.

It was recommended by several farmers for alleviating soil compaction caused by sheep.

It is far heavier-duty than other aerators I have tried before – 6t fully laden – so should penetrate the ground a bit better.

Oldest machine still at work?

The K-reg (1992) Case 1455. I was at a farm sale looking for a scraper tractor and got a bit carried away. It was on 7,500 hours and I paid £22,000 for it.

I could have sold it for £28,000 last year, but chickened out at the last minute.

Last year, it ran the Fusion and hauled trailers – it’s ideal for the job, as it has so much power and torque.

It’s also pretty heavy, which is important because the Fusion can weigh 8t with two bales on the back.

However, the 35kph top speed is a bit slow and I’m getting more reluctant to use it in case I blow up the engine.

How long do you keep your machines?

As long as possible – I wouldn’t buy any of the kit when it is finished here. I usually chuck it in a ***collective*** sale when it’s no longer useful.

The reality is that, until the past couple of years, I haven’t been able to afford any really decent machinery. But I’m now in a position where I can be a bit more selective about what I buy.

Next on your wish list?

Hopefully I can add to the Case tractor ***collection*** with a baby brother to the 1455, so either a 956 or 1056. It will be an investment, as I can’t see them dropping in value.

I’d also like a new film-on-film Fusion 3 baler wrapper and maybe a new tedder.

Ideally, I’d like to upgrade the trailers as well – I’m keen to get everything on commercial axles with a Tilly Pass certificate, particularly given the steep hills, narrow roads and abundance of tourist traffic around here.

Biggest machinery mistake?

I once reversed the 21ft livestock box into a parked car, pulling off the back wing and shoving it into a dyke.

It wasn’t really my fault, though – I’d met a local service bus on a single-track road and had to back up, but the car was parked on double yellow lines at a passing point with no sign of the owner.

Most expensive repair bill?

The Maxxum 140’s back-end. The handbrake had been sticking and, while I was on a dual carriageway near Penrith, the disc shattered. It destroyed the crown wheel and pinion, casing and the brakes.

The bill was £7,000, but the dealer offered to knock the cost off the price of a new Puma, which was all the incentive I needed to expand my tractor fleet.

Best invention?

I don’t invent stuff, but the best idea I’ve seen is Agricision’s low-cost lightbar guidance system.

I saw it at Lamma and bought one for £600 – a small price to pay for accurate fertiliser spreading and field mapping.

What couldn’t you live without in the workshop?

I recently upgraded some of my Makita tools to Milwaukee and I’m seriously impressed. The 3/4in impact driver is a beast for rattling off wheel nuts, so I’m already eyeing up the 1/2in-drive version.

Favourite and least favourite jobs?

Favourite: Mowing, as it is fast and satisfying to see the work you’ve done.

Least favourite: Wrapping bales, which is monotonous.

The reason I bought the Fusion 2 is that my main part-time employee got himself a demanding girlfriend who wouldn’t let him work late, so I needed to make the baling and wrapping a one-man job.

What’s your everyday transport?

I recently bought an Isuzu D-Max Blade on 18,000 miles. It replaced a Rodeo and seemed like a good deal – £18,000 for built-in satnav, leather seats and 3.5t towing capacity.

My runaround is a little Y-reg, 90,000-mile Suzuki Jimny. I’ve had it a year and not yet managed to get it stuck.

It can clock up to 80 miles a day during lambing and I’ve stuck a load liner in the boot for the dogs, along with a spare battery for emergencies.

Best tractor you’ve had?

Without question the 5150, which arrived on 7,000 hours as my main tractor in exchange for £11,000.

I had the head gasket done as soon as it arrived five years ago, but have had no problems since then, despite their reputation for iffy electrics.

It’s now on 10,200 hours and still goes on the rake in the summer. I’ll never part with it – it was the tractor that got me started.

Worst tractor you’ve had?

An International 454 that I had for scraper duties. It had lived on easy start and the tractor was OK once it started. But it eventually drank all the oil from the sump and blew up.

Biggest machinery bargain?

The ex-demo Puma, mainly because it saved me paying the Maxxum’s transmission bill and I’ve got it on 0% finance and three years' warranty.

JOURNAL : Farmers Weekly

Farmers could have a key role to play in helping reduce flood risks faced by UK communities – but only if the government puts its money where its mouth is, say industry experts.

As the UK continues to grapple with the effect of widespread flooding, it is clear that a new national strategy is needed to help businesses and communities cope with increasingly frequent extreme weather events.

See also: Managing contract farming agreements in difficult seasons

Farm leaders say this should include a mix of natural flood management measures – including changing the way land is managed so it can absorb more water – and engineered solutions, such as storing floodwater on farmland away from villages, towns and cities.

The NFU set out its proposals for the government to improve flood mitigation in a flooding manifesto in 2017. Although the document was well received, few, if any, of its recommendations have been implemented.

“Nothing has changed and I think that is the main frustration for farmers across the country,” says NFU national flood risk adviser Mhari Barnes.

“Defra and the Environment Agency said they agreed with many of our proposals, but nothing has happened.”

Natural measures

Farmers are willing to adopt natural farm management measures – such as “leaky dams” of fallen trees and branches that slow the flow of water, silt and sediment downstream – but they need assurances about the ongoing maintenance and liability of such schemes.

“If you put in leaky dams, and they work and are doing well, that's fine,” says Ms Barnes. “But if the timber rots and it is transported downstream, where it blocks a culvert leading, to increased flooding, the liability is with the landowner. That is a massive issue.”

More landowners would adopt natural flood management measures if water management legislation was changed to ensure they are safeguarded in such an eventuality – especially as such schemes benefit communities downstream, rather than the farmer implementing them.

The government should adopt a longer-term outlook in relation to water and flood management – and support it with adequate investment - Ian Moody

Long-term outlook

Ian Moody, technical manager at the Association of Drainage Authorities (ADA), agrees that the government should adopt a longer-term outlook in relation to water and flood management – and support it with adequate investment.

“The government needs to sit up and take notice,” he says. This winter has been wet throughout – and has included a number of extreme weather events. This means already saturated catchments are flooding because water has nowhere to go.

“We are going to see more of this in the future,” says Mr Moody.

Alongside natural flood management measures, the ADA favours hard flood defences around towns and cities where necessary, and convergence work within those channels, including targeted dredging and the clearing of vegetation.

Making room

Mr Moody believes the UK could learn from the Netherlands, where a major scheme called Room for the River has improved flood management.

The scheme worked by relocating dykes, lowering the floodplain and increasing the depth of side channels (see: "Case study – Dutch scheme makes Room for the River").

The UK government's forthcoming Environmental Land Management scheme might encourage farmers to undertake flood risk mitigation on a small scale. But bigger thinking is needed to reduce flooding following the sort of extreme weather seen this winter.

“Large-scale flood water storage on farmland could be an option, but it is about getting the incentives right,” says Mr Moody.

This means controlled storage, with the farmer compensated in right way, and without taking land out of production for large parts of the year.

Case study – Dutch flood improvement scheme

A water management project in the Netherlands is managing flood risk by allowing Dutch rivers to expand naturally during periods of high flows.

The Netherlands is one of the most densely populated countries in the world, and more than half of it is below sea level.

Flood protection is therefore a very high priority for the Dutch government, which started planning the Room for the River programme in 2007.

The 2.3bn programme has seen natural floodplains restored in places where it is least harmful to protect areas that need to be defended.

Floodplains are lowered and broadened with river diversions and temporary water storage areas created.

At Lent, on the river Waal, a water-holding dyke was moved 350m inland. An ancillary channel was dredged in the floodplain to help drain the river during extremely high water.

This in turn has created better flood protection for the area behind the dyke.

Flood mitigation measures

Washlands like this should be accompanied by broader flood mitigation measures – rather than a sole focus on ***agriculture***, believes Country Land and Business Association director general Sarah Hendry, who was formerly Defra director for floods and water.

“We need the government to recognise that a range of things are contributing to flood risk – including infrastructure, roads and the way that more of our landscape is being concreted over in built-up areas,” she explains.

Proper sewerage systems that can better cope with heavy rainfall would be a good start, Ms Hendry suggests. “I worry sometimes that there is a tendency to scapegoat people who manage the land rather than looking at the whole picture.”

Adequate compensation for farmers who store water is a must, she adds. The government has a tendency to focus on what happens to people's homes – underestimating the value of farmland and its value in mitigating flood risk and to wider society.

For their part, farmers should consider working together to manage flood risk in the same catchment. “One farmer or landowner working on their own cannot do as much. We need to be working in clusters or groups and work on solutions at a landscape scale.”

Case study – Philip Wynn, of Aubourn Farming, Lincolnshire

The government is under increasing pressure to properly compensate farmers where ***agricultural*** land is flooded to protect nearby homes and businesses.

Long-standing washland arrangements should be reviewed, because climate change and population growth means farmland is being deliberately flooded much more frequently and for much longer than originally envisaged.

Land farmed by Mr Wynn includes the Witham Washlands, which extend to some 700ha south-west of Lincoln.

Under an agreement originally made in the 1980s, the washlands are to be flooded in perpetuity when required to protect the city.

“We are being flooded for weeks at a time rather than days – and much more often – and it takes a long time for the soil structure to recover,” says Mr Wynn

The washlands have been on alert for flooding six times since last June. “The whole scheme needs a complete review.”

Investment

Overall, though, says Ms Hendry, the hard truth is that flooding will happen with increased frequency and can't prevented completely. In short, it is here to stay and we need to learn to live with it, mitigating its worst effects where possible.

“We perhaps need to have a more open and honest debate. If we want to carry on living and working in the same places, we have to recognise that flooding happens. That means a lot more investment in being able to recover and clean up afterwards.”

The Environment Agency will publish a new floods strategy later this year.

It will set out plans to prepare for and adapt to the risks created by climate change – including the impact on individuals and communities – and structural damage to property and infrastructure.

Defra secretary George Eustice told the recent NFU conference that the government had invested £2.6bn to better protect the country from flooding over the past five years and was planning a further £4bn over the next five years, including "nature-based solutions" such as natural dams and tree planting.

Case study – Irrigation lakes help protect communities

Herefordshire soft fruit grower Anthony Snell has invested thousands of pounds in seven irrigation lakes to store excess water – and reduce the flood risk to local communities.

“The local River Wye has seriously affected farmers and local residents, with the biggest flood in over 100 years – up to 6m in places,” he says.

The irrigation lakes use 139,000cu m of water each season, while helping to protect local properties from flooding.

Mr Snell says his newest lake cost about £50,000 to build and about £40,000 in planning fees, because the council insisted he undertake a number of newt surveys and flood risk assessments.

“The planning application was slow and costly – it is a lot of money.”

The government and local authorities should support farmers who want to put in irrigation lakes, he adds.

“They have many advantages – preventing flooding by capturing excess winter water and reducing the need to abstract water for irrigation in the summer.”

JOURNAL : Farmers Weekly

The GB milking herd contracted by almost 50,000 head in 2019, according to British Cattle Movement Service (BCMS) figures.

At 1 January 2020, the herd stood at 1.72m head – down by 49,600 or 3% on the same date last year. Most of this fall was accounted for in the number of cows aged 2-4 years, which dropped by 42,500 head over the 12 months.

AHDB Dairy lead analyst Patty Clayton said the decline was rooted in events that took place in 2016-2018.

The removal of quotas in March 2015 caused a sudden increase in supply, she explained.

See also: Average dairy herd size drops – but milk keeps flowing

Supplies on the EU market also rose after Brussels imposed sanctions on Russia over its involvement in the Ukraine conflict.

Moscow retaliated with a tit-for-tat ban on farm produce. That meant exports worth £1.8bn – or one third of all EU cheese and a fifth of its butter – were returned to the European market.

As a result milk prices spiralled down by 25-30% to a seven-year low and dairy producers were hit hard.

A further factor in this year's decline is the switch to sexed semen which began in 2016-17.

Farmers opted to put more cows to male beef breeds while using their better milking animals to rear female replacements.

"That has seen a reduction in the number of replacements bred overall and a smaller but more efficient milking herd," Ms Clayton said.

While the lower number of calves on the ground starting in 2016 works its way up through the age brackets, other age groups have not declined to the same degree.

The number of cows aged 4-6 years was up in January 2020 by 10,500 head compared with year earlier figures.

While the number of youngstock – 0-2 years – dropped by 5,700 head on the year, animals aged 0-6 months increased by 1,800 head, slowing the overall decline in youngstock numbers.

The slowing rate of decline in youngstock numbers suggested some future stabilisation of the GB milking herd size, Ms Clayton said.

Milk production

In March the AHDB is due to publish its 2020 outlook for UK milk production which will set out how the changing herd size might affect output.

But Ms Clayton painted a relatively stable picture for production ahead.

The summer drought in 2018 saw a rise in milk yields as dairy farmers switched from forage to more potent concentrates to fuel production, she said.

The past year has seen the reverse, with a greater reliance on forage in 2019’s excellent grass growing weather which should mean yields return to a more normal level.

Globally, she said milk production was almost static with 1% growth forecast against a predicted rise in demand of 2%.

JOURNAL : Farmers Weekly

The increased risk of mildew in this year's wheat crops means growers may need to adopt a targeted treatment in the coming weeks, if they are to avoid the potential yield losses of up to 20% in susceptible varieties.

Powdery mildew is not a disease on every wheat grower’s radar when formulating fungicide programmes in a typical spring.

However, the very wet growing season has pushed drilling dates back, thus increasing the risk.

Powdery mildew in wheat is a visual disease and often its alarming appearance doesn’t always translate into significant damage.

However, there is increased concern among experts and agronomists about its potential effects this season, because many growers have a higher proportion of their wheat drilled between November and the end of February.

See also: What new phosphate fertiliser guidelines mean for growers

Niab cereal disease expert Bill Clark says that in these late-drilled wheats powdery mildew is much more of a concern, although scientifically it isn’t fully understood.

Mildew in wheat

Powdery mildew in wheat and rye is caused by Blumeria graminis f.sp. tritici. It favours mild winters and warm, humid and rain-free weather

Visual symptoms appear as white, fluffy pustules on leaves, stems and ears

Dense, stressed, late-sown or rapidly growing crops and susceptible varieties are highest risk

Excessive nitrogen application can encourage the disease

Early attacks can reduce tiller numbers

In susceptible varieties, yield losses can hit 20% and early control is key

“We think it is down to slow early growth and plant stress. As these late-drilled wheats are usually stressed, they tend to pick up more mildew, so this year it could be a bigger problem,” he explains.

Varietal resistance

Intense rainfall seen through winter and spring has been a good suppressor of mildew infection, washing spores off leaves.

Wet spores also tend to germinate poorly, reducing the risk of spread.

However, this is now being offset by mild temperatures and when drier spring weather arrives, the moderate levels of mildew reported in crops could quickly explode.

Adding to this risk is the fact that varietal resistance scores for mildew have been falling, with the average score on the 2019-20 Recommended List lower than it was five years ago.

A handful of varieties have scores between 3 and 5 (see "Winter wheat varieties with low mildew resistance (2019-20)).

Mr Clark says those growing very weak varieties such as Leeds (3) will be aware of the risk, but the mid-range varieties may lull people into a false sense of security in terms of controlling mildew.

“Late drilling changes the resistance ratings and I think you just have to treat what you see this season.

“You could have a variety with a score of 5 and it might easily be as susceptible as a 4 when drilled late,” he explains.

Risk assessment

Mr Clark highlights that the mildew threat could be compounded by growers’ attitude to disease risk this year, with potential disease pressure being talked down by some due to the later drill dates.

This is certainly the case for septoria, as later sowing is proven to be a useful cultural strategy to reduce levels of infection heading into the spring.

Lower septoria pressure, twinned with lower yield potential, may see growers tuning down or leaving out the T0 spray altogether and opting for a cheap and cheerful fungicide mix at T1.

Where applied, chlorothalonil will inevitably be growers' go-to T0 option this spring, as they have plenty of the multisite fungicide in their stores because it is its final season of use. However, Mr Clark warns that it offers no activity on mildew.

“I’ve also heard talk of just a cheap azole and chlorothalonil being used at T1 and that isn’t going to suppress mildew enough either,” he warns.

Fungicide choices

When planning a strategy for mildew, Mr Clark explains that of the fungicide options available, only prothioconazole from the azole group and all SDHI actives provide useful protection.

Therefore, using prothioconazole-based products will help keep mildew out of crops where the disease isn’t already established.

Where other azoles such as epoxiconazole are favoured, an SDHI component to mixes will be required for any level of mildew protection at T1.

“If people are using reasonable fungicide programmes early on, including prothioconazole or SDHI mixes, then it really shouldn’t take hold,” he explains.

While this might be adequate in some situations, Mr Clark sees a case for a specific mildewicide if pressure is high.

“I think these late-drilled crops will go through their growth stages very quickly this year, so holding off on a T0 and using a decent SDHI/azole mix at T1 may well be enough.

“But if it really is getting away from you, then growers will have to consider a specific mildewicide like Cyflamid or Talius at T0 or add one to the T1 spray,” he adds.

Active ingredients

Amistar Opti - chlorothalonil + azoxystrobin

Cyflamid - cyflufenamid

Talius - proquinazid

Keeping tillers

In Kent, CCC Agronomy adviser James Rimmer says about half his winter wheat acreage is in the late-drilled category this year, so he doesn’t see septoria being the major issue it can be.

Instead, his focus is on mildew and rusts and he will be aiming to keep on top of both diseases early on to protect crop biomass and prevent plants from losing tillers.

With an eye on keeping costs down in crops with less potential, he says keeping mildew out early using a preventative approach will be the most cost-effective route in the long run.

This will involve using a specific mildewicide at T0 in situations where a variety is weak against mildew and the disease is likely to develop.

“Specific mildewicides are reasonably expensive, but when used early, they stop you having to come back later and chase it. I’ve found that if you take it out early, you rarely have to come in again with a bespoke mildewicide,” notes Mr Rimmer.

Mildewicide options

There are a handful of protectant mildewicides available for 2020 that Mr Rimmer may opt for, including proquizanid, metrafenone, fenpropidin and fenpropimorph, but all will have limited knockdown effect.

If mildew is established at T0 and knockdown is required, the curative and protectant cyflufenamid is also an option, says Mr Rimmer.

“Where you miss the T0 and mildew is still active, a prothioconazole-based mix at T1 with the addition of a mildewicide may be necessary to clear it out,” he adds.

Further west, AICC agronomist David Lines covers Herefordshire and Shropshire and also sees mildew as a threat, along with yellow rust, in late-drilled or weak varieties.

Many of his clients’ wheat variety choices have good resistance to septoria and this has enabled them to cut out a T0 fungicide in recent seasons.

Targeted fungicides

This spring will be similar, with a septoria-active T0 not planned in many situations, but if mildew or rust is active in backward wheats, he will be adding disease-specific fungicides to a first plant growth regulator (PGR) at growth stage 30.

Where yellow rust is the only concern, he would lean towards Amistar Opti at a low rate, but if mildew is also present, he would use Cyflamid with the addition of tebuconazole to cover both.

“The beauty of Cyflamid is that it’s a very good eradicant product. From experience it clears mildew out and keeps it out. I’ve rarely had to use an alternative mildewicide as a follow-up spray,” says Mr Lines.

Winter wheat varieties with low mildew resistance (2019-20)

Variety

Mildew rating

Skyfall

5

Detroit

5

Firefly

5

Basset

5

Dunston

5

Myriad

5

Gravity

4

Leeds

3

Source: AHDB, \*=scale 1-9 with 9 having the highest resistance

JOURNAL : Farmers Weekly

Wheat growers are being warned to be extra vigilant for signs of yellow rust this spring, even where varieties with seemingly good disease resistance ratings are being grown.

New yellow rust races found following the testing of samples by UK Cereal Pathogen Virulance Survey (UKCPVS) sent in during 2019 appear to confirm what many already suspected and add to the complexity of existing, highly diverse rust populations.

While work continues to assess which varieties are most at risk from the 10 new strains identified, there is every reason to be wary and not rely on the resistance ratings given to popular variety choices.

See also: How to manage ramularia without chlorothalonil

That is because these ratings are an indicator of average UK performance from previous years, so they are only as up-to-date as the testing system allows.

As a result, they can be subject to change within a season if new races with the ability to overcome certain resistance genes occur.

In common with other diseases, yellow rust ratings are reported on the AHDB Recommended List for all varieties, using a simple scale from 1 (least resistant) to 9 (most resistant).

At present, 63% of current wheat varieties are highly rated for yellow rust, with either an 8 or 9.

However, a footnote on the latest Recommended List for 2020-21 stresses that these are national average figures and that all varieties should be closely monitored, as higher-than-expected levels of yellow rust were seen on varieties in some trials last year.

With the highly dynamic nature of yellow rust populations also being highlighted by the AHDB, there is no room for complacency.

Yellow rust findings

2019 saw changes in populations

New isolates identified

Investigations continue

Be vigilant

Regional variation

An added dimension for growers and agronomists to get to grips with in 2020 is regional variation, after very localised outbreaks were recorded last year including different experiences within the same county.

Of the new strains found, there was no correlation with location – meaning that researchers can’t predict where they will pop up in 2020.

As Amelia Hubbard of UKCPVS explains, new races can emerge sporadically and may not be uniformly distributed, which is what she believes was seen in 2019.

“That means we can expect them to spread in 2020. Your local rust population may be very different to those in other parts of the UK, but even local experience can’t be completely relied on.”

One pathotype of particular interest is similar, but not the same, to the Hereford race of yellow rust, which was initially seen in Sweden in 2015 at a low frequency.

The first time it has been detected in the UK, this strain has now been taken through for both seedling and adult plant resistance testing on Recommended List varieties.

That explains why there were no major changes to disease ratings on the 2020-21 Recommended List, with just three varieties slipping by one point. These include Zyatt, Bennington and Viscount.

“At UKCPVS, our first step is to identify populations changes,” she explains.

“From there, we then identify the risk associated with any changes, which means doing variety seedling and adult plant tests.”

Adult resistance

While there are only nine wheat varieties that have seedling stage resistance, there are many more which have adult plant resistance.

As the name suggests, this only operates at the adult plant stage.

“Adult plant resistance differs between varieties and seasons,” she adds.

“It’s not as well understood as seedling resistance and may also be influenced by environment and plant tissue.”

As a general guideline, she says that it is effective by growth stage 39, but stresses that the mechanism varies between varieties.

“Many growers aren’t prepared to take the risk of waiting for it to kick in.

"Given what we saw last year and what we have since learned, that seems very sensible.”

Varietal resistance

Wheat varieties with a 9 rating and no yellow rust at the seedling stage:

Costello

Crispin

Illustrious

Firefly

Jackal

Parkin

Saki

Siskin

Theodore

In the field

The later-drilled crops that many growers are dealing with this year may have a lower risk of septoria, but small plants are known to be more susceptible to yellow rust, warn agronomists.

The disease is already being found in fields, after a mild winter and plenty of green material to survive on, prompting discussion about the best way of preventing its spread.

“One of the most common questions we get from farmers is whether early-stage development yellow rust matters or not,” says Zantra’s technical director Chris Bean.

“After what they experienced with some varieties last year, that’s not easy to answer.”

Results from the company’s trials last year mean that he will be keeping a close eye on Zyatt, as well as being more cautious with Firefly, Gleam, Shabras, Spotlight and Dunston than before.

“There were differences in variety susceptibility between our trial sites, which emphasises the value of having information from local trials when it comes to managing varieties.”

For many of the late-drilled situations, the early T0 spray isn’t as relevant this year, he acknowledges, but there could be an exception when it comes to yellow rust.

“It might be important this season. We’ve previously seen good responses from a T0, even in a low disease year, where the results were driven by rust.”

Combined T0 and T1

If the T0 and T1 sprays are going to be combined, growers should consider adding a strobilurin to the azole/chlorothalonil mix.

“You may not need an SDHI, but the strobilurin will add in rust control and perform a greening function.”

Mr Bean's other point is that the lower leaf layers deliver more yield in more open crops, so looking after them becomes essential for protecting yields.

That is something that Dick Neale, technical director at Hutchinsons, agrees with, pointing out that there are crops that will only have five leaves this year.

“Small, backwards plants are going to have half the leaves that they normally would and the light will be able to get right down through the canopy.

“So you need to look after all of them as you can’t afford to lose any leaf.”

He also points out that juvenile plants get yellow rust and that adult plant resistance will arrive later in small, backwards crops.

“We’re in a situation now where we can’t rely on yellow rust ratings, especially where the variety is widely grown.

“For that reason, I am recommending a T0 spray this year, as rust is not difficult or expensive to control.”

Mr Neale advises an application of tebuconazole at growth stage 30, which he predicts will be early to mid-April.

“It’s cheap and effective. If you let yellow rust get in at the outset, you tend to be chasing it for the rest of the season.”

In-field early warning system

A suitcase-sized mobile laboratory using genomic techniques to determine what strain of yellow rust is present in the field has been developed at the John Innes Centre.

Known as Marple, it works by extracting DNA from an infected leaf and allows rapid diagnostics and surveillance of the rust pathogen, producing a result within two days.

As Diane Saunders explains, the technology is portable and can be used without electricity or the internet, with the back of the car proving suitable for its operation when trialled on farms in Ethiopia.

“Knowing what strain of yellow rust you are dealing with allows you to take the most appropriate action,” she points out.

“Previously, you had to wait two to three months for the results from any sample.”

Having real-time diagnostics is step forwards and the plan is to incorporate it into the UKCPVS work, speeding up the time taken to determine which varieties are likely to be affected by new races.

JOURNAL : Farmers Weekly

Government plans to reintroduce subsidies for onshore wind mean that farmers who had shelved plans to build a turbine should now look at reviving the idea, experts say.

This week, prime minister Boris Johnson rolled back a 2016 ban on subsidising onshore wind farms imposed by his predecessor, David Cameron, over fears about their visual impact on the landscape.

There will also be support for solar energy generation and energy storage, with payments coming in the form of fixed prices for electricity generated.

See also: Where now for renewable energy on farms?

Jonathan Scurlock, the NFU’s chief adviser on renewable energy and climate change, said the turnaround would send confidence throughout the embattled supply chain.

Many turbine manufacturers and suppliers have gone out of business in the intervening years, with new onshore wind capacity falling to its lowest level in a decade last year.

Softening in attitudes

The change, coupled with the desire in local government to contribute to solving the climate crisis, is likely to see a softening in attitudes towards new applications among planning officers, said Dr Scurlock.

Planning consent for onshore wind has long been a challenge for applicants as they require the consent of the local community as part of the application process.

“We are not going to overturn planning regulations, but I think we might see a little bit more leeway and liberal interpretation of national planning guidance,” he said.

The most profitable installations are likely to be larger turbines that generate between 25kw and 100kw and feed into the national power network, as smaller windmills have greater maintenance costs proportional to their output, he said.

These projects had been approaching break-even point in recent years without subsidy, but the high up-front cost of £100,000-£500,000 means government backing to guarantee energy prices will be very welcome.

Smaller, off-grid turbines that offset significant amounts of energy purchased at retail prices will also be attractive.

JOURNAL : Farmers Weekly

Travelling exotic and, at times, dangerous corners of the world was never something that Peter Burn imagined would be for him. He left school at 16 with the ambition of working on farms in Northumberland.

Fast-forward almost a decade and the farmer's son has explored 52 countries – the most recent being war-ravaged Syria.

He's found that his ties with farming have helped breakdown language and cultural barriers abroad, unlocking an immersive experience in foreign lands.

See also: Shropshire dairy farmer on his emotional overseas aid work

At school, Peter had a desire to carve a career in ***agriculture*** and found full-time work on a 800ha mixed farm near his family's livestock enterprise, just outside the market town of Morpeth, some 15 miles north of Newcastle upon Tyne.

It was only when he started to see fellow young farmers take off for work abroad that he began to ponder life overseas.

"I never really wanted to travel the world, but I really wanted to work out in New Zealand on a dairy farm," says the 25-year-old.

Having worked in most other farming sectors, Peter was keen to gain dairying experience and had heard about the impressive setups that some New Zealand farmers were running.

Flying solo

He boarded a one-way flight to the other side of the globe, finding work on a unit south of Christchurch on the country's southern island.

He spent the following six months milking, calving and driving tractors, all the while earning good money for a well-deserved month or two on the road exploring all the country had to offer.

After a further three-month stint working at a kiwi fruit orchard spraying and harvesting the trees, Peter's time working abroad was seemingly at an end.

"The initial plan was to work in New Zealand for a year and then come home," he says. "But I'd caught the travelling bug by then and that year just went so quick.

"Australia was just next door, so I started Googling for jobs and found there was so much work available for tractor operators."

It was well-paid work, too, with some shifts earning him the equivalent of almost £14/hour. This is where Peter's cycle of working hard, earning good money and then travelling a country to absorb its culture really got into its stride.

He landed a job at a 2,000ha beef and arable farm in the remote vastness of Western Australia, where the nearest pub was a two-hour drive away, then spent three months raking up silage for a contractor in New South Wales and even did a spell driving a 30t dumper truck.

"It's an addiction to always want to see more and more of the world," he explains. Even when he eventually decided to head back to the UK, he returned via Asia and was instantly captivated by Middle Eastern culture.

Sheep and snow leopards

Back at home, he's currently working for three farmers during the hectic lambing season and plans to visit Pakistan for a second time this June.

Having taken a 150cc motorbike for a grand tour of the mountainous northern region two years ago, he's itching to explore more of the country.

"I got this motorbike and took it up to the mountains, where there's a lot of livestock farmers with sheep and goats. I actually stayed with a farmer in his shepherd's hut and they do speak some English.

"I told him about how we had 2,000 sheep at home, and he said I must be a very rich man, because owning 100 sheep is means you're very wealthy in Pakistan."

Peter told the farmer how sheep in the UK are at risk of attack from foxes, showing him a photo because he had not heard of this creature. The farmer dismissed Peter's fox tale, explaining that his sheep are sometimes eaten by snow leopards.

"They says that music is an international language, and I think farming is too. It is a fantastic international connection," he says. "There are farmers in every country in the world and it has been fascinating to see how they work all around the world."

He encourages more farmers to travel the world, especially the younger generations, although he does accept that not everyone has the luxury of being able to leave the family farm for long periods of time.

"I'm lucky in that I'm not relied upon on the farm. I was inspired by my dad, but I was never told to do a certain thing. If you get the opportunity to travel, then you'll never regret it.

"It works really well for me and the farmers I work for because I'm around when they need an extra pair of hands and then I go travelling when they don't."

Peter is clear that this solo adventuring isn't something that he will continue past his youth, because he still dreams of running the farm. He has already laid the foundations of a return to life in rural Northumberland, founding a music festival called West Ben Fest on the farm four years ago.

"I love my home life, the farm and the countryside and I'm very much a local lad. I know there's a time coming when I will need to do more on the farm and my dream is to run an events business on the farm."

JOURNAL : Farmers Weekly

Young farmers in Cornwall are providing food deliveries and support to elderly and vulnerable people who are self-isolating over the coronavirus.

Members of the Probus Young Farmers’ Club (YFC) are offering to deliver food and essential items to vulnerable and isolated people who are opting to stay in home during the pandemic.

Sam Oatey, Probus YFC chairman, told Farmers Weekly: “Anyone who has elderly parents or grandparents knows that going 24 hours on your own is hard enough as it is. When you think that these people are going to go into isolation for the next few months, it’s absolutely hellish.

See also: Farm events rescheduled due to coronavirus

“We have seen other countries, such as Italy and Spain, have been hit hard by the coronavirus. It’s sad to think of what’s about to happen here. This is about bringing the club together and getting people involved – it’s all part of farmers’ values.

“If it costs me a couple of pounds to go to the shop and help elderly or vulnerable people, that’s fine.”

How the scheme works

Probus YFC has set up a helpline – 07722 591088 – which elderly and vulnerable people can call if they need assistance ***collecting*** and delivering urgent supplies, such as food, or other essential household items in the mid-Cornwall area.

Members of the 60-strong YFC team will then drive to the store, ***collect*** the paid-for items and deliver them to homes free of charge. All members use their YFC membership cards as proof of identity.

Mr Oatey said the club decided to act after learning that, due to panic buying, some local supermarkets were not taking orders on home deliveries any earlier than three weeks.

The club said it was looking forward to helping support the local community.

Finally, Mr Oatey urged the public to help support farmers by buying local. “British farmers are working very hard to produce enough food and drink for everybody across the country. It’s very important that we support them at this difficult financial time.”

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