**(Small detail, In the supp. Table S3, the Benefit value for TAROF is the lowest instead of the highest)**

**SUPPLEMENTAL MATERIAL FOR**

**A multi-criteria evaluation of fall vegetation services and dis-services in 30 cropping systems varying in cover crop system, tillage and residue management**

Virginia Nichols1, Emma Randhal-Beltran1, Marco Gentili1, Mette Sonderskov1, Bo Melander3

*1Aarhus University, Department of Agroecology, Crop Health Section,*

*Forsøgsvej 1, 4200 Slagelse, Denmark*

[*gina.nichols@*](mailto:gina.nichols@)*agro.au.dk*

1. **Supplemental material for Methods and Materials section**
   1. **Measurements and management**

|  |
| --- |
|  |
| **Figure S1. Visualization of the nested plot structure of the trial** |

|  |  |
| --- | --- |
| *A square frame in a grassy area  AI-generated content may be incorrect.* | *A square frame in a grassy area  AI-generated content may be incorrect.* |
| Figure S2. Two examples of photos taken which were used for estimating percent coverage of each species. RAPSR can be seen flowering. | |

**Supplemental table S1.** Product, active ingredient, and resulting Pesticide Load Index (Kudsk et al., 2018) for each herbicide package applied.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Herbicide Package (HP)** | **Product name and application amount** | **Active ingredient name, CAS identification number, and application amount** | **Pesticide Load per unit product** | **Pesticide Load per hectare** |
| HP1 | 2 L ha-1 Roundup Flex XXL | 1000 g ha-1 glyphosate (CAS 1071-83-6) | 0.0992 | 0.19840 |
| HP2 | 2.5 L ha-1 Roundup Flex XXL | 1000 g ha-1 glyphosate (CAS 1071-83-6) | 0.0992 | 0.24800 |
| HP3 | 12 g ha-1 Harmony SX + | 6 g ha-1 thifensulfuron-methyl (CAS 79277-27-3) | 0.0106 | 0.12720 |
| 0.15 L ha-1 Agropol (a surfactant) | - | - |  |
| HP4 | 0.25 L ha-1 Starane 333 HL plus | 83 g ha-1 fluroxypyr (CAS 69377-81-7) | 0.6230 | 0.28600 |
| 0.03 L ha-1 Hussar OD | 3 g ha-1 mefenpyr-diethyl (CAS 135590-91-9) and 1 g ha-1 iodosulfuron-methyl-Na (CAS 144550-36-7) | 0.3840 |  |
| 0.5 L ha-1 Renol (a penetrating oil) | - | - |  |
| HP5 | 1 L ha-1 Metaxone | 750 g ha-1 MCPA (CAS 94-74-6) | 1.0300 |  |
| HP6 | 0.5 L ha-1 Starane XL | 90 g ha-1 Fluroxypyr (CAS 69377-81-7) | 0.5720 |  |
|  | 10 g ha-1 Trimmer SG | 5 g ha-1 tribenuron-methyl (CAS 101200-48-0) | 0.0018 |  |
|  | 0.15 L ha-1 Agropol (a surfactant) | - | - |  |
| HP7 | 0.5 L ha-1 Stomp CS | 228 g ha-1 pendimethalin (CAS 40487-42-1) | 1.3700 |  |
|  | 0.4 L ha-1 Fighter 480 | 192 g ha-1 bentazone (CAS 25057-89-0) | 0.9620 | 0.38480 |
| HP8 | 0.93 L ha-1Agil 100 EC | 93 g ha-1 propaquizafop (CAS 111479-05-1) | 0.6680 |  |

**1.2 Calculation of potential ecological value**

**Supplemental Table S2.** Summary of the indices derived from Yvoz et al. 2021 used in the present study. The reader is directed to the publication for more information.

|  |  |  |  |
| --- | --- | --- | --- |
| **Ecological service category** | **Sub-category** | **Description** | **Components, in brief** |
| Potential benefit to pollinators | Pol1 | Benefit to bees | Value to pollinators group (Table 3 from (Ricou et al., 2014)) flower diameter, average number of flowers per plant, abundance xx |
| Pol2 | Benefit to bumble bees | Same as above |
| Pol3 | Benefit to hoverflies | Same as above |
| Potential contribution to organisms | Cont1 | Contribution to farmland birds | Seed lipid content, seed mass, average number of seeds per plant |
| Cont2 | Contribution to carabids | Seed lipid content, seed mass, seed accessibility (size), average number of seeds per plant |
| Cont3 | Contribution to parasitoid wasps | Nectar quantity, flower form, corolla depth, flower number, extra floral nectar production |

|  |
| --- |
| A graph with different colored squares  AI-generated content may be incorrect. |
| Figure S3. Potential benefit of each species/genus as a sum of each sub-category (Table S2) from the database provided in Yvoz et al. 2021 |

**Supplementary Table S3.** Scaled and summed values for ecosystem food webs and pollinator support, with the maximum value being used to represent a given species/genus in potential fall vegetation benefit calculations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EPPO code** | **Latin name** | **Foodweb contribution\*** | **Pollinator\* support** | **Potential benefit\*\*** |
| AVESA | Avena sativa | 0 | 0 | 0 |
| CAPBP | Capsella bursa-pastoris | 0.24 | 0.03 | 0.27 |
| CIRAR | Cirsium arvense | 0.48 | 0.80 | 1.28 |
| EPHEX | Euphorbiaceae | 0.50 | 0.07 | 0.57 |
| GERSS | Geranium species | 0.80 | 0.13 | 0.93 |
| HORVW | Hordeum vulgare | 0 | 0 | 0 |
| LAMSS | Lamium species | 0.29 | 1.21 | 1.50 |
| LOLPE | Lolium perenne | 0.02 | 0 | 0.02 |
| MATIN | Tripleurospermum inodorum | 0 | 0 | 0 |
| PAPRH | Papaver rhoeas | 0.03 | 0.56 | 0.59 |
| RAPSR | Raphanus sativus | 3.00 | 1.00 | 4.00 |
| SENSS | Senecio species | 0.36 | 0.21 | 0.57 |
| soil | - | 0 | 0 | 0 |
| TAROF | Taraxacum officinale | 0.66 | 2.58 | 3.24 |
| TRFRE | Trifolium repens | 0.03 | 1.38 | 1.41 |
| VERSS | Veronica species | 0.49 | 0.29 | 0.78 |

*\*Maximum possible value is 3*

*\*\*Benefit is the summed value of Foodweb contribution and Pollinator support values, with a maximum value of 6*

|  |
| --- |
|  |
| Figure S4. Sensitivity of vegetation community value to RAPSR ecological value |

**1.3 Statistical analyses**

Crop yields were modelled using *lme4* with main effects of crop, tillage, residue, and cover crop treatment and all possible interactions with a random effect of block, and a random effect of tillage nested within residue nested within block.

For total fall biomass, first a universal model was fit that included fixed effects of a year factor, tillage, residue, and cover crop and their interactions and random effects structure to account for the nested experimental design using *glmmTMB*. The full model failed to converge, so terms were removed iteratively based on visual inspections of variances, and the best model was chosen based on AIC criteria. For visualization of differences, a separate model was fit separately to each year’s data to produce letters of significance using the multcomp package (Hothorn et al., 2008).

For the categorical analysis on the proportion of fall biomass, the cover crop proportion was modelled using glmmTMB with fixed effects of tillage, cover crop, residue, and a year factor with a random effect of block using a binomial family with a logit link.

Coverage…

Community structure…

Number of species…

1. Results

|  |
| --- |
|  |
| Figure Sx. Pesticide loads as calculated using the Danish Pesticide Load Index system differed by year, tillage system, and cover crop system. |