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Nuts and Mediterranean Climate Fruits: Advances in Breeding and New Strategies of Horticultural Management for Sustainable Production

Persian walnut breeding at NARIC Fruitculture Research Institute in Hungary

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The Persian walnut (*Juglans regia* L.) is the most important nut species in Hungary. Growing walnuts has become popular in the past 10-15 years. Pomological evaluation of a double selected walnut population was done to select new promising genotypes at the National Agricultural Research and Innovation Centre – Fruitculture Research Institute. The experimental orchard was established in 1997, and contains approximately 100 double selected different genotypes. The examined genotypes were local selections and the following combinations: 'Milotai 10' x 'Pedro', 'Pedro' x 'Alsószentiváni 117', 'Alsószentiváni 117 x Pedro'. The most important characteristics were examined; leafing-out time, bloom time, ripening time and physical parameters. Five genotypes had late leafing-out time. Significant differences in bloom and ripening time were compared to the standard Hungarian variety were observed. All genotypes achieved the 32 mm fruit size in diameter required for first market grade nuts. The fruit weight and volume of most the hybrids were higher than that of the control variety 'Alsószentiváni 117'. Only two genotypes achieved 50% in kernel rate. Eleven genotypes reached the ideal 70% cracking ratio (ratio of halves to whole). Based on the results of this study three genotypes (tree no. V/2/28-30, tree no. V/3/30-31 and BD6 genotype) were superior. Further studies are required to investigate these three promising walnut hybrids.

The research was supported by National Research, Development and Innovation Office in the frame of "Walnut breeding in order to release new late leafing and lateral bearing cultivar(s) project (project no. 123311).

Keywords:



pomological value, evaluation of genotypes, cross breeding, selection from the local populations,

Researchs on The Selection Walnut (*Juglans regia* L.) in Adıyaman Besni and Golbası Townships

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This work is the province of Adıyaman Besni and Gölbaşı are located in walnut fruit and plant populations in terms of superior quality features through the values for the purposes of determining the walnut types. Between the years 2011- 2012, including the region during the second year of study with all of the nuts from the tree fruit samples were studied and 45. As a result of research and outstanding common types are used for the selection of 17 types of walnut oil and protein samples were analyzed. Types of selected walnut tree yields and holding the side branches are usually seen high level of fruit, examined the types of homogamy 6.66%, protogenous 37.77% and protandrous 55.55% blooming feature determined. Produced with the types of fruit weight were 5.88- 18.7g, kernel weight 2.69- 8.88g, kernel ratio 20.37- 57.18%, shell thickness 0.56 - 2.10mm; while it seen that the colour of fruit peel were 48.88% light yellow and 51.11% dark skinned by ratelty. Important in the chemical analysis of the protein and fat contents of selected types varied from 13.69% to 19.85% and from 49.44% to 60.87%.

Keywords:

Walnut (*Juglans regia* L.), Breeding, Phenology, Pomology

Selection for Verticillium wilt resistance in olive breeding programs

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Verticillium wilt (VW) of olive (*Olea europaea* L.), caused by soil-borne *Verticillium dahliae* Kleb., is an important disease in many traditional production areas. Using a resistant cultivar is the primary control method. However, to date, the few cultivars with limited resistance have important agronomic disadvantages. The IFAPA (Córdoba, Spain) olive breeding program is now selecting new olive genotypes showing both high levels of resistance to VW and good olive oil production. Genotypes from open pollinated progenies of different cultivars and crosses including cultivars with known VW resistance ('Changlot Real' x 'Dolce Agogia', 'Frantoio' x 'Arbosana' and 'Koroneiki' x 'Empeltre') were screened for resistance to *V. dahliae* in growth chamber under controlled environmental conditions. The genotypes selected as a highly resistant were planted in a microplot assay with artificially inoculated soil. The results of this re-evaluation under semi-controlled conditions were compared with the previous result under controlled environmental conditions. Simultaneously, the selected genotypes were also evaluated under natural conditions in four different fields trials in Jaén province, the main Spanish olive growing area affected by VW. In all the trials, 'Picual' and 'Frantoio' were the susceptible and resistant reference controls, respectively. Comparison of the different experimental approaches will be presented and discussed in terms of potential breeding efficiency. VW development in all plant materials and experimental procedures tested allowed the identification of some highly and consistently resistant genotypes that are soon to be released.

Funding source: this research was financially supported by INIA project RTA2013-00019 and IFAPA project AVA201601.2, both partially funded by European Regional Development Fund (ERDF).

Keywords:

comparative field trials, crosses, *Olea europaea* L, open pollination, *Verticillium dahliae*



Nitrogen, phosphorus and zinc fertilization effects on chemical composition of pecans in Argentina

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The Pecan [*Carya illinoensis* (Wangenh.) K. Koch] is a fruit and forest species native to North America has been grown since pre-Hispanic times. We investigated the effects of three years of nitrogen (N), phosphorus (P) and zinc (Zn) fertilization on the chemical composition five-year-old "Stuart" pecan tree fruits. The effect on the ethereal extract and tocopherol concentrations and embryo protein were also evaluated. The treatments were: control without fertilization (T) and three N-P-Zn (kg ha⁻¹) fertilization treatments: F1) 13.2 of N, 5.2 of P and 5.4 of Zn; F2) 29.7 of N, 10.5 of P and 10.8 and Zn; F3) 46.2 of N, 15.7 of P and 21.6 of Zn. The F2 and F3 treatments produced a higher concentration of protein than F1 and T. The values in percentage of embryo dry matter were: 7.6% T, 7.8% F1, 8.3% F2 and 9% F3. No significant differences were detected in the ethereal extract with concentrations between 71.5% and 75.1%. The fatty acids were predominantly oleic acids (C 18: 1) at 62.5% and linoleic acids (C 18: 2) at 26.6%. No significant differences were detected in the γ -tocopherol, α -tocopherol and $\beta + \delta$ -tocopherol isomers. The γ -tocopherol was predominant in the embryo humid matter (MH) at 45.9 - 55.3 mg of γ -tocopherol in 100 g MH-1. Fertilization with N, P and Zn increased the embryo's protein concentration. However, the fertilization treatments had no effect on the ether extract and isomers of tocopherol concentrations.

Keywords:

Pecan fruits, protein, ethereal extract, tocopherol

Nitrogen, phosphorus and zinc fertilization effects on chemical composition of pecans in Argentina

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Keywords: Pecan nuts, protein, ethereal extract, tocopherol

Correlations between walnut yield and tree characters

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The yield and tree characters of walnut (*Juglans regia*) in Feng Shan county, Guang Xi province, China were investigated in this research. The correlations of the relationships among them have been analyzed. The results indicated that: (1) In primary fruit period of early-bearing walnut variety "Yun Xin 14", trunk circumference, branch number of the longest sub-branch and mean crown diameter were positively correlated with walnut yield. While bearing branch length was negatively correlated with walnut yield. Among of them, significant difference was showed between walnut yield and trunk circumference. (2) In primary fruit period of late-bearing walnut variety "Yun Nan Yang Bi *Juglans sigillata*", trunk height, first sub-branch number and length were positively correlated with walnut



yield. Tree height, trunk circumference, opening angle of first sub-branch were negatively correlated with walnut yield. (3) In full bearing period of late-bearing walnut variety “Yun Nan Yang Bi Juglans sigillata”, first sub-branch number and length were positively correlated with walnut yield. While branch number of the longest sub-branch, opening angle of first sub-branch, bearing branch length were negatively correlated with walnut yield. (4) In the same bearing period of early and late bearing walnut variety, there was a great different relevance between fruit characters and yield. Even different (positive or negative) relativity was found. (5) High yield-walnut tree presented tree characters as: trunk height (70-100 cm), opening angle of first sub-branch (30-50°), first sub-branch number (2-4) and length (60-115 cm). This investigation confirmed the importance of pruning for improving walnut production.

Keywords: walnut; yield; tree characteristics; relativity

Correlations between walnut tree yield and characteristics

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The correlation between tree yield and tree characteristics of walnut (*Juglans regia*) in Feng Shan county, Guang Xi province, China were investigated. Among the results: (1) In the primary fruiting period of the early-bearing walnut variety “Yun Xin 14”, the trunk circumference, number of the longest sub-branches and mean crown diameter correlated positively with yield. However, bearing branch length correlated negatively with yield. Among the cultivars there were significant differences between walnut yield and trunk circumference. (2) In the primary fruiting period of the late-bearing walnut variety “Yun Nan Yang Bi Juglans sigillata”, the trunk height, numbers of the first sub-branches and their length correlated positively with yield. Tree height, trunk circumference, opening angle of first sub-branch were correlated negatively with yield. (3) In the full bearing period of the late-bearing walnut variety “Yun Nan Yang Bi Juglans sigillata”, the first sub-branch number and length correlated positively with yield. The number of longest sub-branches, opening angle of first sub-branch, and bearing branch length correlated negatively with yield. (4) In the same bearing period of the early and late bearing walnut varieties, there were large differences between fruit characteristics and yield, including different, positive or negative, correlations. (5) The high yielding



trees had trunk heights of 70-100 cm, opening angles of first sub-branch were 30-50°, and 2-4 first sub-branches that were 60-115 cm long. This investigation confirmed the importance of pruning for improving walnut production.

Keywords:

walnut; yield; tree characteristics; relativity

The Comparion of fatty acid content from nuts of Xinjiang Walnuts offspring progeny

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In order to make full use of Xinjiang walnut germplasm resources, breeding of high quality nuts walnut varieties, using conventional observation method, Soxhlet extraction, gas chromatography, internal quality index variation of temperature and 185 new No. 2 two Xinjiang walnut seedlings were studied with nuts. The results show that the fat content of 185 nuts temperature internal quality was 68.11%, the average fat content of its seedlings is 64.62%, fat nuts, coefficient of variation was 8.61%, temperature 185 nuts monounsaturated fatty acids (MUFA), polyunsaturated fatty acid (PUFA) and saturated fatty acid (SFA) content of the mean were 19%, 69.70%, 11.30%, in the progeny of monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 15.54%, 72.39%, 12.07%. The fat content of the inherent quality of the new No. 2 nuts is 66.55%, the mean of its fat content of the seedlings was 66.48%, fat nuts, coefficient of variation was 3.83%, the new 2 nuts monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 17.03%, 71.01%, 11.96%, in fact, students the offspring of monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 17.42%, 70.95%, 11.63%. In this study, the principal component analysis (PCA) was used to simplify the nutrient index of two new Aksu walnut and their offspring to four independent principal components. The cumulative variance of the four principal components reached 88.43% and 77.76% Indicating that the selected principal component can well represent the determined nut quality index, the results are reasonable. In this study two Xinjiang walnut seedlings as the research object, focuses on the research of walnut fat, saturated fatty acids and unsaturated fatty acids, of



different walnut offspring quality differences between qualitative and quantitative analysis of walnut seedlings nuts quality related indexes.

Keywords:

Keywords: fatty acid, seedling progeny

Fatty acid content of Xinjiang Walnut progeny

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The Xinjiang walnut germplasm collection was evaluated for breeding potential. The fruit characteristics and chemical composition of the 185 new No. 2 Xinjiang walnut seedlings with nuts were evaluated; the latter with Soxhlet extraction, gas chromatography, internal quality index variation of temperature. The results show that the fat content of 185's nuts was 68.11% and the average fat content of its seedlings was 64.62%. Selection 185's nuts had monounsaturated fatty acids (MUFA), polyunsaturated fatty acid (PUFA) and saturated fatty acid (SFA) mean contents of 19%, 69.70%, 11.30%, respectively. In the progeny monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids were respectively, 15.54%, 72.39%, 12.07%. The fat content of of the new No. 2 nuts is 66.55%, the mean of its fat content of the seedlings was 66.48%. The new 2 nuts monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 17.03%, 71.01%, 11.96%. A principal component analysis (PCA) was used to simplify the nutrient index of two new Aksu walnuts and their offspring to four independent principal components. The cumulative variance of the four principal components was 88.43% and 77.76% demonstrating that the selected principal component is representative of the nut quality index.

Keywords: fatty acid, seedling progeny



Flowering time in a diverse range of macadamia cultivars grown Australian climatic condition

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An understanding of flowering time in macadamia cultivars is important for successful production in commercial orchards and also to increase the efficiency in breeding programs. Successful cross-pollination requires synchronisation of flowering among the target cultivars. To identify the variation in flowering time we evaluated 80 mature aged macadamia cultivars of diverse origin (Hawaiian, Australian Hidden valley and old Australian selections) and genetic background (*Macadamia integrifolia*, *M. tetraphylla*, *M. janseni*, *M. ternifolia*, and hybrids). One to four trees of each cultivar were planted in 1982 and 1990 at the arboretum of Maroochy Research Facility at Nambour, Queensland. In 2016 and 2017, the cultivars were characterised for the date of 5%, 50% and 90% flowering. Variability of flowering time was evaluated due to cultivar, year, origin and the genetic background.

Keywords:

macadamia, flowering time, genetic variation, breeding

Molecular characterization of locally grown 'melli' fig genotypes, comparison with common cultivars

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Anatolia is considered as the origin of cultivated fig. Naturally grown fig trees can be seen in most part of Turkey. 'Melli' fig, grown locally only in Bucak, Burdur, Turkey has very attractive taste, smell and aroma attributes. Fruits of this genotype are suitable for fresh consumption and also drying in natural conditions under direct sunlight without any deterioration in the fruit quality. Characterization and conservation of naturally grown local genotypes has significant contributions to breeding studies. In this study, the genetic diversity and relationship of 19 locally growing 'Melli' genotypes along with 8 commonly used fig cultivars were determined using SRAP (sequence related



amplified polymorphism) and SSR (simple sequence repeat) markers. Data was analyzed with the Numerical Taxonomy Multivariate Analysis System (NTSYS-pc) version 2.1 software package (Exeter Software, Setauket, NY, USA). To determine the genetic diversity among the genotypes a genetic similarity matrix was constructed within the SIMGEND module and dendrogram was constructed using UPGMA (Unweighted pair group method) and SHAN (sequential hierarchical and nested clustering) routine. A total of 64 polymorphic SRAP and 31 SSR bands were scored with 15 and 20 primer combinations, respectively. Most of the 'Melli' genotypes grouped in the same cluster and separated from eight external control genotypes. There are no literature or record available regarding to fruit quality parameters of 'Melli' fig genotype. The total soluble solids (TSS) content of 'Melli' and 'Bursa Siyahı' (the most popular Turkish fig variety) fruits were tested by using refractometric method. TSS content of the 'Melli' genotype and 'Bursa Siyahı' variety at harvest were 17.0% and 22.8%, respectively. Further analysis is needed to investigate morphologic and physiologic characterization of 'Melli' fig genotype.

Keywords:

Ficus carica, genetic diversity, molecular markers, TSS content

Association mapping for vitamin E and fatty acid content of Turkish hazelnut core collection

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Turkey is the world's main hazelnut producer and accounts for nearly 60 % of world production. Hazelnut is an economically important nut crop and a source of many metabolites for human health. Turkey has a national hazelnut germplasm collection of more than 400 accessions preserved in Giresun. The metabolite content of these accessions varies due to genetic diversity in the collection. In this study, 30 simple sequence repeat markers were used to screen the molecular genetic diversity of the Turkish national collection and yielded 407 fragments. Genetic diversity analyses, economic importance and morphological differences for nut and kernel traits were used for selection of a core



set to represent the diversity of the entire collection in as few accessions as possible. Thus, 78 hazelnut trees were selected as the core collection. This core set was characterized for vitamin E and seven fatty acids contents. Genomic and metabolite data were used for association mapping analysis using TASSEL software. A total of 32 SSR loci were identified to be significantly associated with fatty acids and vitamin E contents ($p < 0.01$). The results and markers associated with these metabolites provide initial information for understanding the control of vitamin E and fatty acid content in hazelnut and for breeding of these traits.

Keywords:

Association Mapping, Metabolic characterization, QTL, Simple Sequence Repeat, SSR.

Managing a more sustainable use of fertirrigation on pomegranate Author(s):

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Spain is the main European producer and exporter with a production area of approximately 4,000 hectares and 60,000 tonnes, its cultivation area is growing due both to new uses of fruit, juice, arils, other parts of the fruit and plant in response to the healthy properties of its components. However, the chronic scarcity in the Mediterranean basin of water reserves for irrigation, might result in irrigation being the main limiting factor for pomegranate production in the area. Improvements in nitrogen use efficiency in crop production are critical for addressing the triple challenges of food security, environmental degradation and climate change. The effect of different combinations of irrigation, and N-P-K fertilization on yield and fruit quality at harvest of 'Mollar de Elche' pomegranates (*Punica granatum* L.) was studied. Irrigation strategies included a control irrigated at 100% of crop evapotranspiration (ET_c) and regulated deficit irrigation (RDI) with severe water restrictions (25% of control irrigation) during flowering to fruit set (RDI_{flow}) or during the last part of fruit growth and the ripening period (RDI_{ripe}). These irrigation conditions were combined with two fertilization rates of 100 and 50% of the common dose used in the area: 170 N, 100 P₂O₅ and 205 K₂O kg.ha⁻¹ year⁻¹. Overall, reducing water and nutritional resources in pomegranates orchards did not negatively affect yield or fruit quality of 'Mollar de Elche' pomegranates compared to traditional strategies. In terms of P, our study demonstrated that even when P regime was reduced to 50 kg/ha there was still an increase in the soil P levels after three seasons of this fertilization regime.



The influence of abiotic conditions on the productivity of walnut

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Long-term study results of the plant productivity dependence for regionalized and promising walnut varieties bred in Nikita Botanical Gardens from the abiotic conditions of the foothill and steppe Crimea are presented. The data of these studies clearly shows that the main limiting factors that significantly affect the processes of vital activity of walnut varieties and their productivity are winter negative and summer high air temperatures combined with low relative humidity during the period of mass flowering of plants. The statistical processing included data on maximum, minimum and average daily air temperatures, sum of precipitation and average relative humidity in the vegetation periods of 2012-2017. Evaluation of winter hardiness of trees of walnut studied varieties was performed by the method of artificial freezing of separate parts of branches with generative and vegetative organs in the climate chamber of TTC 256 firm "Memmert" at temperature from -8 up to -25°C. During the active vegetation of the walnut plants the following physiological indices were determined: water content and relative turgor of leaves, water deficit after 4-8 hours wilting; water retention and leaf resistance to 18-36-hour dehydration. The heat resistance of plants was determined by the method of stepwise heating the leaves to +42, 45, 48 and 50°C. The studied varieties were grouped into three groups according to their degree of resistance to abiotic habitat factors.

Keywords:

walnut, varieties, resistance

Macadamia response to the growth inhibitor uniconazole

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In long established tree crops, growers can rely on dwarfing rootstocks to reduce scion vigour and to increase productivity. This is not currently an option for macadamias, which are only 2 – 3 generations separated from the wild type. While the macadamia industry does not yet have access to dwarfing rootstocks, there is still the option of controlling tree vigour by means of growth inhibitors. The use of uniconazole has been widely investigated in another subtropical crop, namely avocado, where it not only inhibited growth but also increased yields and altered fruit shape. This study sought to determine whether similar benefits could be attained in macadamia.



Both foliar and soil applications of uniconazole were made over several seasons at different rates and timings. In addition to growth inhibition, the effect on yield, kernel recovery and kernel quality were examined. With foliar applications, increases in yield were seen only in the most vigorous cultivar ('Beaumont'), but kernel recovery improved in cultivars 'HAES 788' and 'HAES 816' – primarily due to increases in kernel weight. The effect on kernel recovery was highly dependent on the timing of the spray application. Very little shoot growth inhibition was seen with foliar applications. In contrast, soil applications had a marked effect on shoot extension but very little effect on kernel recovery. This inhibitory effect was still evident in flushes occurring 2 years after application. There is preliminary evidence that soil applications may also result in a reduction in macadamia kernel discolouration – possibly due to root growth inhibition.

In conclusion, it appears that a number of benefits may be derived from use of growth inhibitors in macadamia orchards. These depend on both the application method and timing. The long-term duration effects arising from soil applications suggest that residues in product may be problematical.

Keywords: Macadamia, uniconazole, yield, kernel recovery, quality

Role of organic manure in shoot and fruit characteristics of Sabz cultivar rain fed fig trees

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Seven types of organic manure (chameleon, partridge, quail, hen, sheep, cow and vermicompost) used in rainfed fig orchard at the start of raining season in order to investigate their effects on Sabz cultivar fig trees. The obtained results showed that type of manure had significant effects on yield (number and weight of fruits), grade, skin color, total soluble solids, ostiole cracking of fruits, nitrogen, phosphorous and sodium of leaves and shoot length and diameter, leaf width and leaf number. Hen and Chameleon manures increased the percent of fruits with dark color and yield respectively. Manure type had no significant effect on potassium amount of fig trees leaf.

Keywords:

organic manure, rainfed, fig tree, fruit

Frost behavior of Hungarian bred Persian walnut cultivars



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The walnut is a mediterranean fruit species, but among Hungarian climate conditions it can survive the -30°C without suffering frost damage. Hungary is located at the northern border of walnut growing. In the case of varieties adapted to the Hungarian climate conditions the late spring frosts could cause serious damages and could decrease the effectiveness of fruit growing. The frost hardiness is permanently changing. Into our examination three Hungarian basic varieties (Milotai 10, Alsószentiváni 117, Tiszacsécsi 83), four Hungarian novel bred varieties (Milotai bőtermő, Milotai intenzív, Milotai kései, Alsószentiváni kései) and an international grown variety the Chandler were involved. To determine the frost hardiness of Hungarian bred Persian walnut varieties we made examinations between October 2015 to March 2016. During this research period we set up frost hardiness trial using climate chamber which can be found at the Budapest Corvinus University of Department of Pomology. Three different treatment temperature were chosen per month. The one year old shoot samples were collected once a month from bearing orchard. From data were computed the LT₅₀ values (the letal temperature which 50% of buds suffering frost damage). Based on our results among examined varieties Tiszacsécsi 83 has the highest tolerance against frost. The deep dormancy period of Alsószentiváni 117 is shorter than Alsószentiváni kései. Milotai 10 and Milotai intenzív varieties have similar frost hardiness. Also Milotai bőtermő and Milotai kései varieties have similar frost hardiness, but in certain month they have bigger tolerance of frost than Milotai 10. The frost hardiness of Chandler variety forms much slowly than the other examined varieties.

The research was supported by National Research, Development and Innovation Office in the frame of "Walnut breeding in order to release new late leafing and lateral bearing cultivar(s) project (project no. 123311).

Keywords:

winter frost hardiness, dormant season, minimum temperature, LT₅₀,

Evaluation of European Hazelnut (*Corylus avellana*) Genetic Diversity Using a Genotyping by Sequencing Approach



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Genotyping by sequencing (GBS) is a relatively modern approach that allows for a more detailed genome analysis than previously available methods. European hazelnut (*Corylus avellana*) is the species of hazelnut grown for commercial nut production and has yet to undergo significant GBS analysis, wherein single nucleotide polymorphisms (SNPs) are used for diversity evaluation. Unfortunately, most European hazelnuts are highly susceptible to eastern filbert blight (EFB), a disease common in the United States caused by the fungus *Anisogramma anomala*. Because of this, breeding efforts have been underway to produce resistant cultivars. The objective of this study is to use SNPs derived from GBS to examine the genetic diversity, relationships, and population structure of a wide panel of cultivated European hazelnut accessions, as well as a subset of new EFB-resistant germplasm originating from the Republic of Georgia. Leaf samples of 248 accessions were collected from Rutgers University, the United States Department of Agriculture's National Clonal Germplasm Repository (Corvallis, OR), and Oregon State University. DNA was extracted using a Qiagen DNeasy kit, barcodes were annealed, libraries were assembled, and samples were pooled and sent to GENEWIZ (South Plainfield, NJ) for sequencing. Stacks, JoinMap, and MapQTL software programs will be used to analyze the DNA reads and to examine the relationships among accessions and results will be presented. The findings resolved from this study can be used in breeding efforts to carefully select unrelated parents for crosses that help maintain and bolster genetic diversity and more efficiently result in high-yielding, EFB-resistant cultivars that thrive in the United States and beyond.

Keywords:

hazelnut, filbert, *Corylus avellana*, *Anisogramma anomala*, eastern filbert blight, genotyping by sequencing, genetic diversity

Agroclimatic zoning of pecan (*Carya illinoensis*) in the Southern Cone



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In order to provide a framework for the dissemination of Pecan (*Carya illinoensis*), in the Southern Cone area (Chile, Argentina, Paraguay, South of Brazil and Uruguay), its agroclimatic zoning was carried out. Since the origin of the species is in the USA where its main cultivation area is also located, a comparative evaluation of the Argentine climate was performed with respect to the production zones in that country. Climatic data from the NOAA/CIRES reanalysis system and the Meteorological Services of the Region were used. Three groups of cultivars were considered (short cycle, intermediate cycle and long cycle) taking into account their bioclimatic requirements in relation to the free period of ground frosts, cold requirements, thermal sums requirements, photoperiod response, frost resistance, water requirements, etc. By these parameters, the areas of different agroclimatic aptitude (optimum, suitable and marginal) were delimited with and without application of irrigation in the region under study. It could be verified that the Southern Cone offers a considerable extension with optimal agroclimate, where the cultivation of the species is possible without irrigation. An even larger area offers suitable conditions for its cultivation with irrigation. Likewise, a submarginal area was delimited, where the bioclimatic elements are limiting enough to require a technological development to overcome the current impediments.

Keywords:

Cultivars, bioclimatic requirements, agroclimatic aptitude

Identification and classification of *Carya*'s introgressed material using SSR markers for its traceability in the Argentine productive system

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This study was undertaken to develop DNA marker profiles that could be used to distinguish among 27 pecan (*Carya illinoensis*) cultivars introduced from the United States (Apache, Caddo, Colby, Curtis, Desirable, Elliott, Forkert, Giles, Gloria Grande, Green River, Hirschi, Hodge, Kanza, Kiowa, Lucas, Major, Maramec, Nacono, Oconee, Osage, Pawnee, Peruque, Riverside, Stuart, Sumner, Western, Wichita) and used in production in Argentina. Eight oligonucleotide markers for microsatellite analysis were selected from Grauke et al. 2003. Only one primer pair was monomorphic and excluded from the analysis. The number of alleles per locus ranged from one to eight, in total 42 alleles have found, seven were private alleles (1 Apache, 1 Caddo, 1 Colby, 1 Giles and 3 Nacono). The Polymorphic Information Content (PIC) values ranged from 0.12 and 0.80. Genetic similarities were calculated and a dendrogram (UPGMA) has been established. A classification analysis was carried out using the “complete” clustering method run for genotype and phenotype (obtained from ARS-USDA Pecan Database) with the NbClust R package. There were obtained K=3 and K=2 for genotypic and phenotypic information respectively and the clusters conformation were similar (87.25%). The genotypic information was consistent with the phenotypic data and it allowed to distinguish all varieties except two pairs: Pawnee-Kiowa and Sumner-Oconee. Phenotypic data showed that the pair Oconee-Forkert was the most similar and on the other hand, Stuart-Curtis the most different. Genotypic data points out Wichita-Pawnee, Wichita-Kiowa and Lucas-Hirschi as the most distant pairs. With seven SSR markers we can unequivocally differentiate 23 of the 27 introgressed varieties, being a valuable tool for the traceability of the material.

Keywords:

Cultivars, SSR markers, genotypic information, phenotypic data

Effect of medium and genotype on growth and development of almond embryos in vitro culture

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In order to determine the appropriate culture medium containing embryo growth of almond in vitro culture, a factorial experiment was conducted based on a completely randomized design with three replications. The kernel of Mamaei, Shahrood 12, Shekoufeh, Rabie cultivars and bitter genotype were sterilized and soaked in the 100 ppm concentration of GA3 for 12 hours. Then the kernels of each cultivar were separately placed in damp cloth in the refrigerator at 5 °C to break of seed dormancy. After three weeks of chilling, the kernels of each cultivars were disinfected and the



cotyledons of each kernel are separated and the embryos were cut with a little cotyledon. The embryos were cultured on MS and WPM culture media in glass tubes (20 cm), in vitro conditions that both media containing 0.5 mg/l GA₃, 1 mg/l IBA and 1 mg/l BAP. The embryos were grown in the growth room with a temperature of 25 ± 2 °C with 16 hours of light and eight hours of darkness. After the growth. After growth of seedlings in vitro culture, the characteristics of stem length, lateral branches, root growth, lateral root growth and number of lateral root were recorded. The results showed that embryos of Shekoufeh cultivar had the highest growth of stem, whereas embryos of Shahrood cultivar had the highest root growth, number of root and branches. The WPM culture medium was producing the highest root growth, the height growth, the number of root and lateral branches. According to the results, the WPM culture medium was better than MS medium with the same hormone combination for embryo culture in vitro of almond cultivars.

Keywords:

almond, cultivar, embryo, in vitro, medium culture

Effect of Putrescine and chilling time on breaking seed dormancy and growth of almond seedlings

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In order to investigate the effect putrescine and chilling on breaking of seed dormancy, germination and growth and development of seedlings in late flowering almond cv. Shahrood 12, an experiment was conducted based on completely randomized design with four replications. The unshelled seed (kernels) were disinfected superficially and then were washed twice with distilled water. After disinfection, kernels were treated in putrescine solution with concentrations 0 (distilled water or control), 500, 1000 and 2000 ppm for 24 hours. Then they were placed separately in wet cleaning cloth in a refrigerator at 5 °C for 0 (without chilling), 10, 20, 30 and 40 days. Germination percentage, germination percentage, mean germination time (MGT) and average germination rate (MGR) and morphological traits of seedlings including height seedling, number of nodes, leaf number, leaf area, fresh and dry weight of shoot and fresh and dry weight of roots were recorded during two months. The results showed that the application of putrescine in combination with chilling increased the germination and morphological characteristics. According to results, using putrescine with 2000 ppm concentration increased most traits, especially germination percentage



(89.33%), germination rate (0.87), seedling height (39 cm), number of leaves per seedling, fresh and dry weight of shoots and than other treatments.

Keywords:

Almond, cultivar, chilling, germination, growth seedling, putrescine.

Comprehensive evaluation on cold hardiness of six pomegranate (*Punica granatum* L.) varieties and selection on methods

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Abstract: **【Objective】** Pomegranate, originating in central Asia, is a kind of important economic fruit tree, but is easily vulnerable to frost damage in central and northern cultivation areas in China, Which seriously restricts the development of pomegranate industry in China. Based on the comprehensive evaluation on cold resistance of six pomegranate cultivars ('Tunisiruanzi', 'Israel 2', 'Qingpiruanzi', 'Mengzitianlvzi', 'Sanbai', 'Shandazi'), we screened a reliable method to select the pomegranate resources with more tolerant to low temperatures. These resources can be used as suitable crossing parents for new varieties with cold hardiness. **【Methods】** At present, there are many methods for the evaluating cold tolerant of fruit trees, each method has its advantages and disadvantages, so we had to comprehensively consider the effects of various indicators when evaluated on the cold hardiness of pomegranate. This research took annual dormant branches of six pomegranate cultivars as materials in dormancy stage. We got the consistent size, no diseases and insect pests branches from different parties in each tree, then wrapped in wet paper, and took back to the laboratory. These branches were rinsed clean in de-ionized water. We measured the branches of six pomegranate cultivars water content including free water and tied water in dormancy stage. Then put branches into the cold incubator for -4°C 、 -8°C 、 -12°C 、 -16°C 、 -20°C five different low temperatures stress processing, each temperature processed for 24 hours and measured the effects of low temperature stress on different physiological indexes. These indexes include the relative conductivity (REC), the semi-lethal temperature (LT50), superoxide dismutase (SOD) activity and the content of proline (Pro), soluble sugar, malondialdehyde (MDA). According to the change of each index with the low temperature stress, we analyzed the cold resistance of six varieties. Last comprehensive evaluation on cold tolerant of six pomegranate cultivars by membership function. **【Results】** According to the ratio of tied water and free water in the branches



of six pomegranate varieties, the order of their cold-tolerant was: was 'Sanbai' > 'Shandazi' > 'Mengzitianlvzi' > 'Qingpiruanzi' > 'Israel 2' > 'Tunisiruanzi'. The ratio is positively correlated with resistance, so the bigger the ratio, the greater the resistance. Relative conductivity of six varieties increased with the low temperature stress continuously, which indicated that cell membranes have been destroyed. The change of relative conductivity negatively correlated with cold resistance of the plant. Processing of relative conductivity data on SPSS.19 to obtain LT50, and their cold-hardiness according to LT50 was: 'Sanbai' > 'Shandazi' > 'Mengzitianlvzi' > 'Qingpiruanzi' > 'Tunisiruanzi' > 'Israel 2'. Proline and soluble sugar can be used as osmotic regulation substances in plant, improve cell osmotic potential and delay cell excessive dehydration, protect the cytoplasm colloid from solidification when cells meets cold. Proline content in some varieties constantly increased with the temperature stress, other varieties rose in the first stage, and then decrease. The order of cold hardiness by Proline was: 'Shandazi' > 'Sanbai' > 'Qingpiruanzi' > 'Mengzitianlvzi' > 'Tunisiruanzi' > 'Israel 2'. Soluble sugar content of six varieties rose in the first stage, and then decreased with the low temperature. The order by soluble sugar was: 'Sanbai' > 'Shandazi' > 'Mengzitianlvzi' > 'Tunisiruanzi' > 'Israel 2' > 'Qingpiruanzi'. Active oxygen in plants is stable under the suitable growth environment, but will be a large number of outbreaks when plants suffer from adversity. Plants remove active oxygen by protective enzyme system, such as SOD. The order of cold hardiness by SOD was: 'Shandazi' > 'Mengzitianlvzi' > 'Sanbai' > 'Tunisiruanzi' > 'Israel 2' > 'Qingpiruanzi'. MDA is one of the main products of membrane lipid peroxidation, and its content can indicate the degree of membrane structure and function. Besides 'shandazi', MDA content in other varieties showed a trend of decline after rising first. The cause of decline may be low temperature is already beyond the range of MDA regulation. The cold-hardiness order by MDA was: 'Sanbai' > 'Qingpiruanzi' > 'Shandazi' > 'Israel 2' > 'Mengzitianlvzi' > 'Tunisiruanzi'. The change of MDA negatively correlated with cold resistance of the plant. Due to different methods receive different results, so we analyzed cold hardiness of pomegranate cultivars in membership function. 【Conclusion】 Cold tolerant of six varieties were comprehensively evaluated by membership function, the order was as follow: 'Sanbai' > 'Shandazi' > 'Mengzitianlvzi' > 'Qingpiruanzi' > 'Tunisiruanzi' > 'Israel 2'. The results was the same as the order by LT50, which showed that LT50 is a feasible method to briefly identify cold tolerant of pomegranate varieties.

Keywords:

pomegranate(*Punica granatum* L.); low temperature stress; physiological indexes; membership function; semi-lethal temperature

Advances in studies on the mechanism of dichogamy in walnut(*Juglans regia* L.)

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Abstract: Walnut (*Juglans regia* L.) is a typical dichogamous plant, which directly affects the process of sexual reproduction in flowering, pollination . Bloom dates of the female and male flower in walnut are asynchronous, which seriously impacts pollination rate and fruit set rate, and subsequently directly affects the quality and yield of walnut fruit, and economic value. At present, as development of walnut industry, China has formed several big producing areas. It is beneficial to further development of walnut industry to study dichogamy mechanism of walnut. In this paper, the recent studies on flower bud differentiation, male and female flower development, walnut flowering phase, genome of walnut and transcriptome analysis were reviewed to provide a theoretical basis to the future research on the dichogamy flowering mechanism of walnut.

Keywords:

Walnut(*Juglans regia* L.); Dichogamy; Flower differentiation; Phenological characteristics; Hormone regulation; Genetic characteristics and analysis

The Comparion of fatty acid content from nuts of Xinjiang Walnuts offspring progeny

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In order to make full use of Xinjiang walnut germplasm resources, breeding of high quality nuts walnut varieties, using conventional observation method, Soxhlet extraction, gas chromatography, internal quality index variation of temperature and 185 new No. 2 two Xinjiang walnut seedlings were studied with nuts. The results show that the fat content of 185 nuts temperature internal quality was 68.11%, the average fat content of its seedlings is 64.62%, fat nuts, coefficient of variation was 8.61%, temperature 185 nuts monounsaturated fatty acids (MUFA), polyunsaturated fatty acid (PUFA) and saturated fatty acid (SFA) content of the mean were 19%, 69.70%, 11.30%, in the progeny of monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 15.54%, 72.39%, 12.07%. The fat content of the inherent quality of the new



No. 2 nuts is 66.55%, the mean of its fat content of the seedlings was 66.48%, fat nuts, coefficient of variation was 3.83%, the new 2 nuts monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 17.03%, 71.01%, 11.96%, in fact, students the offspring of monounsaturated fatty acids, polyunsaturated fatty acids and saturated fatty acids which were respectively 17.42%, 70.95%, 11.63%. In this study, the principal component analysis (PCA) was used to simplify the nutrient index of two new Aksu walnut and their offspring to four independent principal components. The cumulative variance of the four principal components reached 88.43% and 77.76% Indicating that the selected principal component can well represent the determined nut quality index, the results are reasonable. In this study two Xinjiang walnut seedlings as the research object, focuses on the research of walnut fat, saturated fatty acids and unsaturated fatty acids, of different walnut offspring quality differences between qualitative and quantitative analysis of walnut seedlings nuts quality related indexes.

Keywords:

walnut; fatty acid ; seedling progeny

Possibility of Evaluation of Two Phase Olive Mill Pomace By Composting in Turkey

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Vast amount of olive mill wastes exist due to olive oil production season (November- February). The inability to evaluate the olive mill waste water and discharge it to the water resources creates high pollution environment. The conversion of the olive oil mills system to the two-phase system is regarded as a solution for reducing environmental pollution. In this study, two-phase olive mill pomace were composted with separated dairy manure, poultry manure, and straw using aerated static pile composting methods for evaluation in organic farming. Active aeration has been applied to the compost piles to shorten the composting period and to improve compost quality. During composting, the temperature was periodically measured at different depths of the composting piles. Composting piles were monitored for moisture, pH, electrical conductivity (EC), water soluble carbon and microbiological enzymes at periodical intervals. Aerated static pile composting method was used for composting of olive oil production wastes. Rutgers aeration strategies were performed for



aeration of piles. At the later stages, 0.38 kg cotton seed meal per dry matter of initial compost was added to each compost pile for enrichment of composts at 330 days of composting (maturation and stabilization stages). Additionally, 0.16 kg of rock phosphate and 0.02 kg of potassium salt per dry matter of initial compost was added to each compost pile for enrichment of composts at 360 days of composting. Phytotoxic analysis was carried out at the end of composting.

Keywords:

Olea europae, organic farming, composting, olive mill waste water, olive pomace, organic manure

Effects of Two Phase Olive Mill Pomace Compost on The Growth of Olive Saplings in Turkey

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In this study, compost obtained from composting of two-phase olive mill pomace with separated dairy manure, poultry manure, and straw using aerated static pile composting methods for evaluation in organic farming. The effects of compost on the growth of olive saplings were determined by pot experiments in greenhouse. It has been determined that olive saplings grown in growing media containing composts obtained from two-phase olive mill pomace at a certain rate (25%, 50%, 75% and 100%) are much better than control plants grown in standard growing media. It has been found that all the macro and micro element levels of samples taken from all pot mixtures to determine the nutritional status of organic olive saplings were sufficient for compost application at different doses. Nitrogen, calcium and magnesium deficiencies of macro elements and iron, manganese and copper deficiencies of micro elements were observed in leaf samples. Nitrogen, calcium, magnesium, manganese and copper values were low in leaf samples of control group. Nitrogen and some micro element deficiencies were observed in the control group saplings. As a result of the study, it is determined that two-phase olive mill pomace, which are harmful to environment, can be composted and used as plant nutrition, soil amendment and organic matter source in olive saplings.

Keywords:

Olea europae, Organic farming, Composting, Two-phase olive mill pomace



Identification of the Major Factors Affecting Pistachio Production in Saline Condition (Case study: Yazd province, Central Iran)

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Iran is known as the biggest Pistachio (*Pistacia Vera L.*) producer in the world. In 2014, for instance, Iran and the United States were the major producers of pistachios, together accounting for 76% of the total world production. However, while less than 1.4 tons pistachio is produced from each hectare of Iranian orchards that of US is more than 2.6 tons per hectare. At the same time, high yielding pistachio orchards with more than 12 tons per hectare are reported in Iran. This can be related to several different factors such as climate, geography, water shortage or quality, soil physicochemical properties as well as plant properties. The present study was aimed to evaluate the most important factors affecting the variations of pistachio production in salt affected commercial pistachio orchards of the central part of Iran as well as to identify the most limiting factors. For this purpose, twenty four representative commercial pistachio orchards, located in Yazd province, were selected and evaluated for the major yield-related parameters. Correlation matrix and Factor Analysis (FA) approaches were used to identify the most effective factors on pistachio production. Several different factors including climate (e.g. temperature, humidity, wind speed and etc.), geography (latitude, longitude and altitude), quality and quantity of water and soil resources (e.g. salinities of irrigation water and soil, leaching fraction, depth of applied water and etc.), soil physical properties (sand, silt and clay contents, bulk density, field capacity and PWP) as well as pistachio tree features (age, daily and seasonal evapotranspiration) were correlated with the pistachio yield. Results of this investigation showed that latitude ($r=0.49$), air humidity ($r=-0.43$), evapotranspiration ($r=0.60$), soil moisture at the PWP point ($r=-0.30$) and leaching fraction ($r=0.33$) parameters had crucial role on pistachio yield. Whilst, other parameters like sunshine hours, longitude and irrigation water pH had lower and insignificant effects on yield of the representative commercial pistachio orchards. Overall, irrigation system optimization, pistachio tree rejuvenation as well as increasing soil water holding capacity are recommended for improvement of pistachio production in the studied region.

Keywords:

Factor Analysis, Correlation Matrix, Pistachio, Salinity, Yield.

Fruit quality attributes as affected by variety mixture in pomegranate (*Punica granatum L.*) orchards

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Cultivar mixture have been studied for increasing yields and disease control in pomegranate orchards. Some previous reports recommended mixed variety mixture since cross-pollination increased fruit set and some quality characteristics. However, these studies have not been supported by practical trails. In the present study, we examine the influence of mixture of two pomegranate varieties (Gabsi and Jebali) and monovarietal culture on fruit quality attributes. Results showed that variety mixing enhanced fruit size (weight, height and diameter) and skin thickness but decreased aril yield for both varieties. A differential behavior of varieties was observed for some fruit traits. Indeed, fruits from mixture (Jebali x Gabsi) provided the most red-colored juice and the highest total anthocyanin level. An improvement in fruit color associated with an increase in total soluble solids content was observed for Jebali monovarietal plots. Total flavonoid content was lower in fruits from the mixture Gabsi x Jebali compared to Gabsi monovarietal plantings. However, no significant variation was registered for juice yield, titratable acidity and total phenol content. Variety mixture can be a useful agricultural practice in order to assure a good quality. Understanding such practice benefits is critical for ensuring not only the yield but also the fruit quality. Further studies would be helpful in order to confirm the importance of variety mixing on pomegranate productivity and fruit attributes and to identify other pairs of cultivars.

Keywords:

Pomegranate, variety, mixed plantings, quality characteristics, Tunisia.

Photosynthetic responses of fig (*Ficus carica* L.) plants to water stress and recovery

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Fig production in Tunisia has recently raised by 12.5%. The production has increased from 22550 tons in 2016 to 25800 in 2017. In fact, fig (*Ficus carica* L.) is widely spread and it is adapted to grow under rain-fed conditions in arid and semi-arid regions. However, fig yield and fruit quality may decrease by subjecting plants to water stress. The present work aims to determine photosynthetic capacity of



some fig cultivars under water stress and their ability to recover. This study could help to identify the most adapted cultivars to water deficit. This study was conducted on potted plants of three fig cultivars. Water stress was applied by withholding irrigation for 14 days. Control plants were irrigated twice a week to maintain water content close to field capacity. After the stress period, the water-stressed plants were subjected to a partial and full rehydration. Photosynthesis intensity was measured during the stress and after rewatering in order to evaluate the physiological responses of studied fig cultivars. The results showed that the net photosynthesis (P_n) was higher for all cultivars during august compared to september and october. P_n of the control plants ranged from 3.1 to 11 $\mu\text{mol m}^{-2}\text{s}^{-1}$. During the stress period, San Pedro type cultivars had the lowest photosynthetic activity compared to Smyrna type. Water stress caused a slight reduction in P_n after five days of drought initiation. After 12 days, P_n decreased to low levels as a consequence of stomata closure and reached 0.4 $\mu\text{mol m}^{-2}\text{s}^{-1}$ in San Pedro type. After 14 days without irrigation, leaf fall occurred in all stressed plants. New leaf flush was assessed after 20 days of recovery with full water supply and after 40 days with a partial rehydration. The P_n after relief of water stress in new leaves of previously stressed plants was higher than that in unstressed controls and reached 16.1 $\mu\text{mol m}^{-2}\text{s}^{-1}$. However, in previously stressed San Pedro type plants, no significant recovery has been recorded in partial re-watered plants. The study of the re-establishment of the photosynthetic system has a great importance to understand fig behavior and resistance to cope with water deficit.

Keywords:

Ficus carica, photosynthesis, water stress, recovery, Tunisia

Regional and variety suitability for expansion of the Australian hazelnut industry

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Hazelnut production in Australia has considerable potential for expansion, to supply domestic and international markets, with current production not meeting domestic consumption let alone reaching international markets. As a southern hemisphere country, Australia has the potential for counter-seasonal production - to supply fresher nuts for six months of the year. Recent investment has seen the Australian hazelnut industry expand drastically from 140 ha (2011) to 1,370 ha planted (2016) and is predicted to continue to do so with projections of 2,760 ha planted by 2025. For this work experimental sites were established in regions with climatic conditions ranging from similar to different to traditional regions where hazelnuts are grown. Our aim is to determine the regional and varietal suitability and potential for the Australian hazelnut industry to further expand production.

The research provides information on establishment of 15 hazelnut varieties under different climatic conditions through experimental sites established in three regions in New South Wales; Central



Tablelands, Riverina and Murray regions. These regions vary in rainfall, elevation and temperature, with one site in a traditional climate for hazelnut production (Central Tablelands) and the other two sites in less traditional climates (Riverina and Murray). Comprehensive data were collected over the course of tree establishment, indicating difference in tree height and width, nutrient and water use, and fruit development between regions and varieties.

Over the next five years data collection will continue at the three regional sites as these hazelnut varieties mature into full productivity, providing further assessment of suitability. This work will demonstrate the potential for hazelnuts to be grown in less traditional (Riverina and Murray) or traditional (Central Tablelands) climatic regions where water and land may be more accessible.

Keywords:

Corylus avellana, climate, temperature, phenology, establishment

Variations in sugar composition of Sarılop fig fruit

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Sarılop is the main Turkish fig variety for sun-drying. In most studies, samples representative of the lot or of the treatment are taken and analyzed to determine the average composition or quality. It is also well known that variation exists among individual fruit even on the same tree. The study aimed to determine the variation in sugar composition of fig fruit (*Ficus carica* L. cv Sarılop) that may occur on a single tree and appear with drying. Fruit were harvested at fresh, shriveled (partially dried) and dried stages from two rain-fed orchards in Meşeli (N 37° 56.716', E 027° 41.006' – altitude: 431 m) and Akmesit (N 37° 59.'763', E 027° 40.889', altitude: 687 m.) villages. In fresh fruit, peel and flesh were analyzed separately. Sugar fractions, glucose, fructose and sucrose were quantified by UHPLC using a Refractive Index Dedector. The results confirm the previous studies that fructose and glucose are the major sugars in fig fruit. However the analyses of individual fruit showed that glucose/fructose ratios vary between fresh and dried fruit. The peel of fresh fruits had either equal levels of both reducing sugars or slightly higher levels of glucose at concentrations around 6.0 g/100 g. Fruit flesh had total of 11 to 15 g/100 g reducing sugars. Sucrose was detected only in some of the fully dried fruit at concentrations of up to 3.23 g/100 g DM. The presence of sucrose only in some individual fruit explain the contradictory results stating the presence or non-existence of glucose in fig fruit.



Keywords:

Ficus carica, dried fig, pulp, peel, reducing sugars, sucrose

Evaluation of agronomic and fruit quality attributes of red varieties of pomegranate (*Punica granatum* L.) grown in Mediterranean conditions

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Pomegranate shows high diversity of pomological traits. A significant demand for red peel, sub-acid flavor and soft tegmen especially. Taking into account the characteristics of the current cultivars, a priority in manybreeding programs is to obtain new varieties of pomegranate focused on these attributes. Fruit quality of twenty varieties of pomegranate was evaluated aimed at establishing new commercial orchards destined for fresh consumption, using three commercial varieties as controls. The trial consisted on three selected crossbred progenies and seventeen local and foreign varieties. For three years, the traits measured at harvest were annual yield, as well as fresh weight of fruit, aril weight, the color of the peel and juice (CIELAB), and the values of pH, soluble solids content (SSC), titratable acidity (TA) and maturity index (MI). Varietal susceptibility to black hearth (*Alternaria* sp) and cracking was evaluated as percentage of fruits per tree affected. The results show that 'Acco' and 'Iliana' were the earliest varieties, and 'Wonderful' and 'Ink' showed the highest annual yield. Four out of twenty varieties do not reach desirable fruits size, bigger than 300 grams. Seventeen out of twenty varieties have medium to large aril (over 0.25 g). Values of color of the juice of pomegranates were in a range between (15.0-26.7) L*, (3.7-9.2) a* and (0.01-1.05) b*. On the other hand, among the varieties that exhibited the better organoleptic traits, TSS and MI values ranged from 13.0 °Brix ('Zudbeja') to 17.9 °Brix ('Salavatskii'). Overall, the new hybrid cultivar 'Rugalate' showed excellent sensory characteristics. This study will allow to select the most interesting and suitable sort of varieties based on market needs, ripening season, sourness and fruit colour by the pomegranate grower.

Keywords:

crossbreeding, fruit color, maturity index, SSC

The performance of recent introduced late flowering almond cultivars in Georgia

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Almond (*Prunus dulcis*) is a well-known nut crop for East Georgia since ancient time. However, In the ecological conditions of East Georgia, where are a frequent spring frost evidence in the almond flowering window - the characteristic features of almond traditional varieties - early blossoming has made the serious barrier for establishment almond production sector in Georgia.

The use of Specific late blooming almond varieties in production is one of the important ways to solve this difficulty. In spite of the existing fragmented scientific and practical attempts in XX Century to include in an almond industry the some of the genotypes of local and introduced varieties into cultivation - not find a wide expanse. In the order to overcome this problem in the first decade of the XXI, through UN FAO support and initiatives of research Institute IHVO was introduced some of the promising late flowering almond cultivars in Georgia.

A Special demo almond orchard has been established in Kakheti (East Georgia) region in the beginning of the second decade of this century, there was planted a number of prospective international varieties, including of cv Supernova, Guara, Soleta and etc. The purpose of the targeted research was to identify the proper highly adaptive genotypes based on the multiyear study of agronomic and commercial features of almond varieties, which could be become the Main stone for the building of the almond production sector in Georgia. Based on the given research, several prospective almond cultivars have been distinguished and recommended for the East Georgia conditions.

Keywords:

Almond, Cultivars, Georgia,

Application of electrotherapy to eliminate viruses in olive

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Viruses are amongst the most problematic pathogens in fruit trees in which they are transmitted via vegetatively propagation. Olive trees are affected by various viruses causing significant economic



losses, therefore the necessity of virus-free planting material is undeniable for stocks production. This study was carried out to eliminate the Cucumber Mosaic Virus (CMV), Cherry Leaf Roll Virus (CLRV), Strawberry Latent Ring Spot Virus (SLRV) and Arabis Mosaic Virus (AMV) in some of the commercially important olive cultivars in Iran. A horizontal electrophoresis apparatus was used in all the electrotherapy treatments. In vitro and in vivo shoot tips were exposed to 0, 50, 100 and 150 miliampers (mA) for 0, 5, 10 or 20 minutes followed by immediate sterilization in 2.5% (w/v) of sodium hypochlorite for five minutes and were then washed again with sterilized water for 10 minutes. The shoot tips were then cultured in specific olive medium. After two months, virus detection was carried out by RT-PCR in the generated plantlets. This research is still in progress and the results would be presented at the symposium.

Keywords:

Cucumber Mosaic Virus, Cherry leaf roll Virus, Strawberry Latent Ring Spot Virus, Arabis Mosaic Virus, Electrotherapy

The First Findings to Fruit Characteristics of Nutrient and PGPR Applications on Chandler Walnut Variety

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In Turkey, which is among the oldest walnut growing countries of the world, cultivation with standard walnut varieties has been increasing gradually. Nowadays, a large number of orchards are established with the Chandler variety. However, it is not possible to obtain the desired level and quality from the walnut orchard. As it is known, plant nutrients and PCPR are important in increasing yield and quality. In this study, the first year results of yield and some fruit characteristics were evaluated with application of different plant nutrients (nitrogen, potassium, boron, zinc, manganese) and plant growth promoting rhizobacteria (107,108) in that variety. According to this, the highest value was obtained with boron application in terms of fruit weight, width, length, height, shell weight and yield. There is a positive effect of applications on yield. Internal shrinkage ratio in walnut was found the lowest with potassium application (22%).

Keywords:

Walnut, plant nutrients, PCPR, fruit characteristics, yield



SELECTION OF LATE FLOWERING GENOTYPES WITHIN NATIVE ALMOND (*Prunus amygdalus* Batsch) POPULATIONS IN GAZİANTEP

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In this research selection of almond genotypes having late flowering in almond population which has taken a place in Araban and Yavuzeli districts of Gaziantep which has a huge richness in native almond population and suitable ecological conditions economically almond growing was aimed. Selection study was carried out between 2014 and 2017 years.

Genotypes, having the latest full flowering time at their altitudes in terms of late flowering characteristic were determined as promising genotypes. In the selection region, totally 290 genotypes were followed based on their late flowering characteristic, and 5 genotypes in Araban district (A-94, A-95, A-96, A-146 and A-164) and 7 genotypes in Yavuzeli district (Y-18, Y-19, Y-24, Y-28, Y-29, Y-102 and Y-103) were determined as promising. Genotypes marked as promising genotype for late flowering were defined by SSR method.

The selected promising genotypes have been taken to be protected in the Gaziantep Pistachio Research Institute Directorate Genetic Resources parcel in order to keep them for further breeding studies.

Keywords:

almond, selection, genotype, late flowering, Gaziantep

SELECTION OF SUPERIOR GENOTYPES FOR FRUIT CHARACTERISTICS WITHIN NATIVE ALMOND (*Prunus amygdalus* Batsch) POPULATIONS IN GAZİANTEP

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In this research selection of almond genotypes having appetizer consumption in almond population which has taken a place in Araban and Yavuzeli districts of Gaziantep which has a huge richness in



native almond population and suitable ecological conditions economically almond growing was aimed. Selection study was carried out between 2014 and 2017 years.

In respect of shelled and kernel characteristics, genotypes having medium and/or large fruit in size, non-rancid kernels, medium or high yield during harvest maturity season were determined as promising genotypes and recorded for further evaluations. In the selection region, totally 152 genotypes which were followed because of their nut and kernel characteristics, 3 genotypes in Araban district (A-59, A-151 and A-153) and 3 genotypes in Yavuzeli district (Y-29, Y-51 and Y-104) were found as promising genotypes.

Besides nut characteristics, protein (%), fat (%), ash (%), humidity (%) and mineral contents of nuts and vegetative characteristics in promising genotypes which were determined according to the data obtained during selection years were also investigated.

The selected promising genotypes have been taken to be protected in the Gaziantep Pistachio Research Institute Directorate Genetic Resources parcel in order to keep them for further breeding studies.

Keywords:

almond, selection, genotype, kernel, shelled almond, Gaziantep

Characterization of total phenol content and antioxidant activity in ChandlerXKaplan-86 F1 Walnut Population

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Walnuts are unique among the edible tree nuts because of their relatively high content of polyunsaturated linoleic and linolenic fatty acids polyphenol compounds. Several studies indicated that frequent nut intake (a serving per day, of ~28 to 100 g/d) confers protective effects against cardiovascular disease. A large variation in phenols and antioxidant capacity was found in the nuts evaluated in the previous studies. In breeding programmes detection of total phenolic compounds and antioxidant activity of kernels become important. For this purpose cultivar breeding is important to improve rich in total phenolic compound and antioxidant capacity cultivars. In this study, it was aimed to characterize total phenol content and antioxidant activities of ChandlerXKaplan-86 F1 walnut (*Juglans regia* L.) population. Total phenol analysis was performed using Folin-Ciocalteu reagent. The antioxidant capacity of aqueous extracts was assessed through reducing power assay, scavenging effects on DPPH (2,2-diphenyl-1-picrylhydrazyl) radicals. According to the obtained results walnut kernel having an important source of total phenol and antioxidant capacity and their content varied in ChandlerXKaplan-86 F1 population.

Keywords:

Walnut, total phenol, antioxidant capacity.

Characterization of total phenol content and antioxidant capacity in ChandlerXKaplan-86 F1 Walnut Population

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Walnuts are unique among the edible tree nuts because of their relatively high content of polyunsaturated linoleic and linolenic fatty acids polyphenol compounds. Several studies indicated that frequent nut intake (a serving per day, of ~28 to 100 g/d) confers protective effects against cardiovascular disease. A large variation in phenols and antioxidant capacity was found in the nuts evaluated in the previous studies. In breeding programmes detection of total phenolic compounds and antioxidant activity of kernels become important. For this purpose cultivar breeding is important to improve rich in total phenolic compound and antioxidant capacity cultivars. In this study, it was aimed to characterize total phenol content and antioxidant activities of ChandlerXKaplan-86 F1 walnut (*Juglans regia* L.) population. Total phenol analysis was performed using Folin-Ciocalteu reagent. The antioxidant capacity of aqueous extracts was assessed through reducing power assay, scavenging effects on DPPH (2,2-diphenyl-1-picrylhydrazyl) radicals. According to the obtained results walnut kernel having an important source of total phenol and antioxidant capacity and their content varied in ChandlerXKaplan-86 F1 population.

Keywords: Walnut, total phenol, antioxidant capacity.

Cutting Propagation Potentials of Rejuvenated Stock Plants of *Arbutus unedo* L. Genotypes

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Cutting propagation of many woody plants are possible with cuttings. It is more favorable and is increasing the success rate if the cuttings obtained from healthy and rejuvenated plants. *Arbutus unedo* is an important plant for the Mediterranean climate and for rural people, living near these natural resources. Sustainable management of these natural plantations is important and degradation are among the most important issues in this regard as a result of the urbanization and un-controlled collection of fruit and leaves. Sapling production is required for the establishment of new plantation areas for strawberry tree cultivation. In this study, selected *Arbutus unedo* L. genotypes were used as a plant material. Stock plants were established with cutting propagated materials in the high plastic tunnels conditions. In the mid of June, when the yearly obtained shoots has just started to lignify, cuttings were collected from two genotypes (UL1 and NM2). 20 cuttings with three replicates were studied and each experiment was repeated at least once. The collected cuttings were treated with IBA (2, 4, 6, 8 and 10 mg/l) and placed into a misting system beds in the greenhouse. Rooting responses (as survival rate %, rooting percentage %, root number, root length cm), shoot formation (%) during the rooting process, and callus formation (%) were measured. Rooting values was evaluated after three months and data was recorded. The survival rate was higher in genotype NM2 (76.67%) but rooting rate was not effective as genotype UL1 (rooting rates



are 59.95 in NM2; and 63.73 in UL1). Callus formation rate is not high (4.04% and 10.73% in UL1 and NM2, respectively). Shoot development was observed in more than half of the cuttings in both of genotypes. Survival rates of propagated plants were very high after transfer to soil. As a result, rejuvenation of stock plants is recommended to increase the success rate of cutting propagation. Rooted cuttings turned to sapling and the next field performance were very high for both of genotypes. 3 years field performance of the plants were also given in this study. Propagation protocols is ready for the future studies.

Keywords:

Strawberry tree, rejuvenation, cutting, IBA, rooting

Effect of Shading Manipulations and Growth Regulators on Shell Differentiation in Walnut (*Juglans regia*)

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Walnut (*Juglans regia* L.) shell, is often ignored, plays an important role in nut development, transportation, washing and storage. In particular, kernel quality has close relations to shell seal grade and thickness. Walnut shell structure is influenced by cultivars, illumination intensity and harvest period; effective mechanism is not well understood. In this study, the morphologic characteristics and composition of nutshell were studied with applications of different plant growth regulators and two levels of shading. Result show that mature shell is composed of three parts, sclereid layer, sclerenchyma cell layer and fiber-like cell layer, from outside to inside respectively. 30% and 70% shading treatment caused shell thickness to thin and number of sclereid layer to reduce, content of lignin and polyphenol to decrease, number of fiber-like cell layer to increase. In addition, 70% shading treatment significantly caused shell seal grade to reduce. 50mg/L GA3 treatment dramatically caused shell thickness and number of sclereid layer to increase. 100mg/L paclobutrazol treatment significantly caused shell thickness and number of sclereid layer to thin, content of lignin and polyphenol and seal grade to reduce. From these data light and plant regulators are important affected the nutshell structure.

Keywords:

Walnut, Shell, sclereids, light, plant growth regulators



Obtain by selection pomologic characteristics some of the types of figs in province Artvin, Giresun and Ordu

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This research was carried out in Artvin region of Turkey on fig types (*Ficus carica* L.) in 2013-2014 years under the project of "The Selection of Fig in the Black Sea Region. Some pomological characteristics of figs were investigated in this study to select the best genotypes for growing. The fruit weight and index, TSS, the ostiol distance, the color of fruit peel and the peeling condition has been examined. This research included types of 19, 14 and 13 has been selected in Artvin, Giresun and Ordu respectively.

The average fruit weight, the fruit index, the ostiol distance and the soluble dry matter in the water of the types which were selected have been found as 45.75 g, 1.02 mm, 3.03 mm and 15 % respectively. The fruit peel takes place in the colours of purple and yellow-green and in the three groups of easy, middle and hard peeled ones. These types can be consumed as fresh and processed in jam.

Keywords:

Fig, *Ficus carica*, selection, TSS, fruit weight, ostiole

The influence of abiotic conditions on the productivity of walnut

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Long-term study results of the plant productivity dependence for regionalized and promising walnut varieties bred in Nikita Botanical Gardens from the abiotic conditions of the foothill and steppe



Crimea are presented. The data of these studies clearly shows that the main limiting factors that significantly affect the processes of vital activity of walnut varieties and their productivity are winter negative and summer high air temperatures combined with low relative humidity during the period of mass flowering of plants. The statistical processing included data on maximum, minimum and average daily air temperatures, sum of precipitation and average relative humidity in the vegetation periods of 2012-2017. Evaluation of winter hardiness of trees of walnut studied varieties was performed by the method of artificial freezing of separate parts of branches with generative and vegetative organs in the climate chamber of TTC 256 firm "Memmert" at temperature from -8 up to -25°C. During the active vegetation of the walnut plants the following physiological indices were determined: water content and relative turgor of leaves, water deficit after 4-8 hours wilting; water retention and leaf resistance to 18-36-hour dehydration. The heat resistance of plants was determined by the method of stepwise heating the leaves to +42, 45, 48 and 50°C. The studied varieties were grouped into three groups according to their degree of resistance to abiotic habitat factors.

Keywords:

walnut, varieties, resistance

The French walnut improvement program: preliminary investigations

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With 34,000 tons of in-shell walnuts produced in 2014, France is in 10th world position among major producers. Walnut orchards increased by almost 20% between 2000 and 2010 and walnut is the most important crop other than apple. Nevertheless, the varietal choice does not appear to be adapted to the new future constraints and the new French walnut improvement program, led by the Ctifl, has to take into account the global warming context and the reduced use of plant protection products. In this way, two preliminary studies have been conducted regarding the effect of climate change on walnut phenology under French climate conditions, and concerning an emerging disease in French walnut orchards, a form of anthracnose, due to *Colletotrichum acutatum*. On the one hand, as regards phenology aspect, historical data have been collected for several genotypes thanks to the late Eric Germain, former head of breeding program at INRA of Bordeaux from 1977 to 2007 and thanks to the work of the two French walnut experimental stations of Creysse and SENURA. A significant advance in bud break date and male and female flowering dates was found. On the other hand, as concerns the emerging disease, a qualitative detached leaf assay (absence or presence of necrosis) have been carried out in order to quickly find out which accessions of the French germplasm (composed of 259 accessions from worldwide including 200 accessions of *J. regia*, the



cultivated walnut tree, and 39 accessions of related species) are tolerant. Results show that, after 7 days of spores inoculation on detached leaflets, all *J. regia* accessions have specific symptoms of anthracnose due to *C. acutatum* (black to brown spots with orange acervules) and that two related species, *J. cinerea* and *J. sieboldiana*, do not present any symptom, revealing a potential tolerance to *C. acutatum*.

Keywords:

Juglans regia L., French walnut improvement program, historical data, phenology, *Colletotrichum acutatum*, detached leaflet assay

Identification of the Major Factors Affecting Pistachio Production in Saline Condition (Case study: Yazd province, Central Iran)

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Iran is known as the biggest Pistachio (*Pistacia Vera* L.) producer in the world. In 2014, for instance, Iran and the United States were the major producers of pistachios, together accounting for 76% of the total world production. However, while less than 1.4 tons pistachio is produced from each hectare of Iranian orchards that of US is more than 2.6 tons per hectare. At the same time, high yielding pistachio orchards with more than 12 tons per hectare are reported in Iran. This can be related to several different factors such as climate, geography, water shortage or quality, soil physicochemical properties as well as plant properties. The present study was aimed to evaluate the most important factors affecting the variations of pistachio production in salt affected commercial pistachio orchards of the central part of Iran as well as to identify the most limiting factors. For this purpose, twenty four representative commercial pistachio orchards, located in Yazd province, were selected and evaluated for the major yield-related parameters. Correlation matrix and Factor Analysis (FA) approaches were used to identify the most effective factors on pistachio production. Several different factors including climate (e.g. temperature, humidity, wind speed and etc.), geography (latitude, longitude and altitude), quality and quantity of water and soil resources (e.g. salinities of irrigation water and soil, leaching fraction, depth of applied water and etc.), soil physical properties (sand, silt and clay contents, bulk density, field capacity and PWP) as well as pistachio tree features (age, daily and seasonal evapotranspiration) were correlated with the pistachio yield. Results of this investigation showed that latitude ($r=0.49$), air humidity ($r=-0.43$), evapotranspiration ($r=0.60$), soil moisture at the PWP point ($r=-0.30$) and leaching fraction ($r=0.33$) parameters had crucial role on pistachio yield. Whilst, other parameters like sunshine hours, longitude and irrigation water pH had lower and insignificant effects on yield of the representative commercial pistachio orchards. Overall, irrigation system optimization, pistachio tree rejuvenation as well as increasing soil water holding capacity are recommended for improvement of pistachio production in the studied region.

Keywords:



Factor Analysis, Correlation Matrix, Pistachio, Salinity, Yield.

Diversity of Nut and Kernel Characteristics in different populations of Walnut (*Juglans regia*) in hills of Uttarakhand, India

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The hilly region of Uttarakhand is most suitable for the cultivation of walnuts. Uttarakhand hills are having many wild walnut species and it is expected that, there may be nearly 8-10 wild walnut species; propose to carry out research indicating that the state is within the center of diversity for walnut. Uttarakhand's walnut germplasm is regarded as among the most diverse and valuable genetics resources for walnut improvement. They found at various altitudes comprised between 1500 - 2700 m above sea level, in different environments, e.g., higher hills and in mid-hills. They are the dominating plant species in the hills, where, areas usually receive over 100 mm of rainfall. The local walnut cultivars, commonly found in Uttarakhand, are characterized by economically valuable fruit trees, but their potential of productivity is limited because of their seedling origin and the terminal type of their bearing.

The varied walnut species growing in the farmers field and in wild in the state of Uttarakhand receive a great deal of attention mainly because of their high value as germplasm, especially from fruit breeders and nurseries to assess their potential to be used as rootstocks material and scion for the varietal improvement programme, contributing to the useful traits such as early crop maturity, lateral bearing habit, thin shelled nut, late bloom, drought, lime and salinity resistance. The CITH varieties known for their lateral type of bearing have also been planted in different locations in Uttarakhand. These varieties are also under evaluation mainly for early leafing, fruits size and sensitivity to frost, when they grow under the Uttarakhand conditions. Simultaneously, it is necessary to carry out a breeding programme for developing new cultivars with lateral bearing, late bud-break, disease resistance and valuable economic traits of fruits. The programme is also to introduce cultivars, possessing the above-mentioned characters and suitable to be grown under the Uttarakhand conditions. The new developed varieties will improve the competitiveness of Indian walnut production and also meet the other criteria for cultivation and for high quality nuts.

Keywords:

Walnut, late-bud break, germplasm, thin shelled, lateral bearing.



Sowing media effects on emergence and growth of cashew (*Anacardium occidentale*) in Nigeria

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Topsoil for raising tree crops seedlings is fast becoming limiting and expensive in Nigeria. It is imperative, therefore, to investigate into alternative sowing media for cashew seedling production. To this end, study was conducted at the Cocoa Research Institute of Nigeria, Ibadan in 2014 and 2015 to evaluate the effects of topsoil, sawdust and combinations of the two at three levels on the emergence and growth of cashew seedling in a semi-nursery environment. The five treatment sowing media combinations namely: 100% topsoil, 100% sawdust, 50% + 50% topsoil/sawdust, 25% + 75% topsoil/sawdust and 75% + 25% topsoil/sawdust were laid in Randomized Complete Block Design (RCBD) in four replicates. Data were taken on percentage seedling emergence, plant height, stem diameter, number of leaves and dry matter yield. Descriptive statistics and Analysis of variance (ANOVA) were used for data analysis. Means were separated using Duncan Multiple Range Test (DMRT) at $p \leq 0.05$. Results showed that percent emergence was highest (75.0) in sawdust and least (56.3) in topsoil in 2014. Cashew seedling emergence in quantity and rate was enhanced, in both years, by the presence of sawdust in the sowing media. Growth parameters of plant height, stem diameter, number of leaves were higher in sawdust than in topsoil though the difference was not significant ($p \leq 0.05$) in both years of experimentation. The use of cured sawdust in place of topsoil could therefore be recommended in cashew seedling production in Nigeria. Consequently, there will be a reduction in the cost of seedling production and competition for topsoil in seedling production and field establishment of cashew could be averted.

Keywords:

alternative, limiting, sawdust, seedling, topsoil

Linkage maps development and biotechnological tools for hazelnut and chestnut breeding

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The cultivation of nut species, such as hazelnut and chestnut, still largely relies on traditional cultivars that were selected across centuries. In fact, up to date, only a few breeding programs are active, yielding a limited number of new accessions, due to the particularly long time required for the selection process and the high heterozygosity of these species. At present, there is an urgent need for improved breeding techniques based on marker-assisted selection (MAS) and biotechnological tools, in order to face new threats, such the spread of alien species and the climatic changes.

In this research we present the results of 10 years of activity addressed to the development of genetic maps in hazelnut (*Corylus avellana* L., progeny 'Tonda Gentile delle Langhe' x 'Merveille de Bollwiller' syn. 'Hall's Giant') and chestnut (progeny *Castanea sativa* x (*C. sativa* x *C. crenata*)) aimed at the detection of markers for MAS.

Saturated maps for the parent cultivars of the 2 progenies, accounting about 180 individuals each, were constructed using both SSR markers and SNP markers obtained by Genotyping by Sequencing, using the reference genomes as template. In hazelnut, phenological traits and fruit characters of commercial and technological relevance were mapped as QTLs; in chestnut a trait of resistance to *Dryocosmus kuriphilus* Yasumatsu was mapped as a simple Mendelian character, and its genomic region is under deep investigation to find putative genes of resistance.

Further breeding strategies are being carried out using in vitro techniques aimed at developing efficient systems of genetic transformation for the modification or introduction of genes, such as those related to self-incompatibility and resistance to major pathogens.



The research was funded by: cooperation program Italy-France Alcotra 2007-2013, Regione Piemonte Administration, Ferrero Hazelnut Company, Fondazione Cassa di Risparmio di Torino.

Keywords:

Genotyping by Sequencing, *Corylus avellana*, *Castanea*, QTL, SSR

Determination Of Some Mineral Nutrition Of Different Pistachio Cultivars Grown At Akcakale (Sanliurfa) Province

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This study was conducted on some pistachio types and cultivars at GAP Agricultural Research Institute at Akçakale Station in the pistachio research plot. The mineral elements were analyzed. In this research Siirt, Ohadi, Hacı Reso, Kerman, Mumtaz, Vahidi, Barak Yıldizi and Tekin, cultivars with Male A ve Male B were used. The leaf samples were taken in 24 July of which is suitable to take leaf sample date. The soil samples were taken different part of the orchard to determine physical and chemical contents of soil.

Results indicated that soil samples showed high lime content and low organic matter content. Macro and micro element contents among the cultivars and types determined were statistically. Only Male-B and Mumtaz cultivars were enough as low level to Nitrogen. All cultivars were sufficient as Phosphorus, Iron copper and manganese. Ohadi, Hacı Reso, Kerman and Vahidi were enough as Magnesium, Ohadi, Hacı Reso and kerman sufficient as calcium. Kerman Barak Yıldizi, Male-A and Male-B were insufficient content as zinc. Boron was enough all the cultivars except Barak Yıldizi.

Keywords:

Pistachio, cultivars, types, macro, micro nutrients.

Determination Of Micro Nutrient Contents Of Pistachio (*Pistacia vera* L.) Orchards at Different Provinces In Sanliurfa



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In Turkey, there have been several studies in a wide range on the relationship between the products obtained from soil and it is maintained. This study was conducted in order to reveal the nutritional problems of pistachios (*Pistacia vera* L.) in the province of Sanliurfa. Soil and leaf were examined in terms of micro nutrients.

100 soil and leaf samples were taken from four districts (Birecik, Bozova, Halfeti and Karaköprü) simultaneously for this purpose. Soil samples were examined in terms of physical and chemical properties (texture, pH, salt, lime and organic matter) and micro-element composition (B, Cu, Fe, Mn, ve Zn). In addition, it was trying to determine micro element ingredient (B, Cu, Fe, Mn, ve Zn) of the leafs which taken from the soil samples of orchards in addition to leaf samples.

The results of the soil analysis showed that, samplings of orchard soil were generally have clayey and clayey-loam structure, the pH level is neutral and low alkaline, content of lime is high, contents of organic matter are usually low and salt-free soils. Result of chemical analysis of the orchards soils showed that contents of Cu and Zn which could be taken from plant were enough, on the other hand Fe content were medium level in all districts. It was also concluded that B content were enough for Karaköprü, Bozova and Halfeti, and Mn contents were enough for Halfeti but not enough Birecik, Bozova and Karaköprü. The results of the leaf showed that, the total B content of the leaves were deficit districts Fe concent of the leaves were sufficient for all districts and Cu, Zn and Mn contents were deficit Birecik, Karaköprü and Halfeti and sufficient for Bozova.

Keywords:

Pictachio, micro nutrients, *Pistacia vera*, soil, leaf

A Study on Determination of Physical and Chemical Properties of Aydın Pine Nuts

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Pine nuts are hard-shelled fruits that are rich in nutrition and very important export product for Turkey. They contain high amounts of unsaturated fatty acids and have protective effects against of hypertension and cardiovascular diseases. In this research, it is aimed to reveal the physical and chemical properties of pine nuts collected from Aydın Province Koçarlı District (37 ° 40'47 " N 27 ° 40'41 " E 730 m altitude) which is one of the most important pine nuts production regions of Turkey. In the years of 2014 and 2015 in-shell pine nuts samples were selectively picked from 6 different gardens from the villages where pine nut agriculture was heavily done in the Koçarlı District. In the pine nuts samples, in-shell pine nut length-width (mm), pine nut kernel length-width (mm), yield (%), weight of 100 kernels (g), the percentage of cracked pine nuts (%), water content (%), water activity (aw), ash content (%), and macro-micro element analyzes were also made in addition to revealing the fatty acid composition of the pine nut samples was also revealed. By comparing the parameters obtained from different years, certain physical and chemical parameters were determined. The in-shell pine nut size varied between 18.22 mm and 16.61 mm, while the yield was measured between 28.31% and 22.60%. Among the macro elements, potassium, phosphorus and nitrogen are the elements with the highest values, while oleic and linoleic acids of the unsaturated fatty acids are the major fatty acids.

Keywords:

Pine nut, stone pine, physical and chemical properties, Aydın

Evaluation of three genotypes selected within the Sicilian autochthonous olive (*Olea europaea* L.) germplasm in new planting systems based on tree density and shape

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An intense survey of the Sicilian territory (37°30' N) started at the beginning of the 1980s, resulted in the selection of 150 olive genotypes. This germplasm was evaluated over 30 years and three



genotypes (Trinakria I, Trinakria II and Trinakria III) were finally selected for their early bearing, high and constant productivity, as well as high oil content of the fruits and excellent chemical (oleic acid and polyphenol content) and organoleptic profile of the oil. Recently, an evaluation study has been carried out to evaluate the agronomic performances of these selected genotypes under various plantation density (in the range of 300-1000 trees/ha) and training systems. The cultivar 'Nocellara del Belice', widely cultivated in the area of the trial, was used as reference. Five years after planting the three selected genotypes showed good performances in the different planting density and training systems. The early bearing and the high productivity of the three tested genotypes, open new opportunities to improve the economical sustainability of the Sicilian olive oil industry. The unique organoleptic profile and chemical composition of the oil obtained from these three new genotypes, increase the opportunity for their success in the olive oil industry.

Keywords:

planting density, tree shape, mechanical harvesting, crop efficiency, quality

Variability of Phenols and Anthocyanins in Nut Clones of *Gevuina avellana* Mol

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The variability of selected clones in function of nut yield and other physical and chemical characteristics of nuts were studied in Southern Chile. The secondary metabolites such as some phenols, particularly anthocyanins, have a great phytotherapeutic value, mainly due to its antioxidant power, but their content in Gevuin nut have not been studied. As well as the Gevuin lipid complex (which includes tocotrienols and sterols), anthocyanins can behave as a natural UV filter, anti-inflammatory and healing compound of ephitelial tissues. Nuts harvested from six VAX clonal selections were held in polyethylene bags frozen at -80°C. They were analyzed for total phenolic content (TP) and total anthocyanin content (TA), to determine differences between clonal selections and from tissues: pericarp (shell), cuticle and cotyledons (kernel). TP content was measured using the Folin–Ciocalteu assay, expressing results in mg of gallic acid equivalent/100 g of sample (mg AGE/100 g). TA was measured by spectrophotometry (520 nm absorbance), expressing results as cyanidin-3-glucoside mg/100 g of sample Results were subjected to an analysis for variance homogeneity (Bartlett test) and normal distribution (Shapiro-Wilks test). Data analysis by ANOVA and Tukey average test ($P \leq 0.01$) were made. Significant differences ($P \leq 0.01$) were found among clonal selections for TP content (range from 546.14 to 1396.24 mg AGE/100g), and TA content (range from 0.53 y 0.67 mg cyanidin/100g). Significant differences ($P \leq 0.01$) were also determined in regard to TP content from tissues: 13.40, 953.59 and 1892.99 mg AGE/100g, for cotyledons, cuticle and pericarp, respectively. TA content was similar for cuticle and pericarp (0.65 and 0.70 mg cyanidin/100g, respectively), but much higher than cotyledonar content (0.01). In order to better understand the variability in the content of TP and TA, the interactions between the clonal selections and nut tissues are presented.



Keywords:

Gevuin nuts, clonal variability, secondary metabolites, phenols, anthocyanins.

Effects of Different Peeling Methods on Aflatoxin Levels in Pistachios

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Aflatoxins are highly toxic and carcinogenic secondary metabolites which produced by some *Aspergillus* species. The presence of aflatoxin in many agricultural products such as pistachio, fig, apricot, peanut, cottonseed and almond is an important problem. For those who consume aflatoxins through food, it can cause significant health problems and product losses for producers. This study was carried out between 2013-2015. In the study, 3 different peeling treatments (peeling off fresh pistachio, peeling off the husk of dried pistachio with soaking and peeling off the husk of dried pistachio without soaking) were applied to the pistachios which harvested in 3 different periods (early, normal and late). Then their effects on aflatoxin formation in pistachios were studied. In addition, the stability of dry husk and freshly peeled pistachios during storage was examined periodically with analysis of free fatty acid content and peroxide number. As a result of the analyzes made, aflatoxin formation was not observed in the fresh pistachios after harvesting, while the highest values were found to be 2,357 ppb fresh peeled samples, 44,433 ppb highest in with soaking peeled samples and 36,387 ppb aflatoxin highest in without soaking peeled samples. When the harvest times were compared, it was found that intensive aflatoxin formation was detected during Early Harvest and Late Harvesting periods and almost no aflatoxin formation was observed during Normal Harvesting Period. As a result of the storage practices, it was determined that there was no difference between the storage of pistachios as with dry husk and fresh peeled in room conditions for 2 years.

Keywords:

Pistachio, Peeling, Mycotoxin, Aflatoxin, Food Safety



Diseases occurring on *Juglans sinensis* in South Korea

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Juglans sinensis is a deciduous broad-leaf tree, and 15 species that belong to the genus *Juglans* are widely distributed in Europe, Asia and the Americas. Two species, *J. mandshurica* and *J. sinensis* are reported occurring in Korea that are believed to be introduced from China in the 4th century. *Juglans sinensis* is widely planted (approximately 1.2 thousand areas across the country) in South Korea, including Buyeo, Cheonan, Gimcheon, Muan, Muju and Yeongdong, to mainly produce nuts in the country. Various fungal diseases have been reported occurring on *J. sinensis* in South Korea. This includes anthracnose caused by *Glomerella cingulata*, powdery mildew caused by *Microsphaera juglandis*, melanconis disease caused by *Melanconis juglandis*, twig blight caused by *Phomopsis albobestita* and white mold disease caused by *Microstroma juglandis*. Of those that have been reported in South Korea, anthracnose of *J. sinensis* caused by *G. cingulate* was a major problem that induced significant yield losses in nut production up to 5% ~ 30% across the country. In 2011, white mold disease was first reported from Gimcheon and Muan, followed by from Buyeo in 2017. In addition to the fungal diseases on *J. sinensis* in South Korea, the bacterial disease, walnut blight, caused by *Xantomonas arboricola* pv. *juglandis* was first reported in 2016, and this became a serious problem in orchards where walnut trees are cultivated across the country.

Keywords:

Juglans, fungal diseases, bacterial diseases

Comparison the Growth and Yield Values of Some Fig Cultivars in Young Period under Irrigated Conditions

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The project was carried out in Aydın İncirliova conditions at 2015-2017 for the purpose of comparing some significant dried and fresh Turkish fig varieties. In the study, Sarılop and Divrek Kara varieties as dried, Bursa Siyahı, 208, Sultan Selim, Beyaz Orak, Morgüz varieties as fresh, Siyah Orak, Yeşilgüz varieties used as both dried and fresh were compared. The trial garden was established at the second month of February 2015 according to randomized parcel trial design with 9 trees of every variety and with a 6 x 4 m interval. Pruning of trees was made according to “modified leader system” Irrigation was performed with underground drip irrigation system by monitoring the soil humidity with gravimetric method. In young trees included in the project, growth values (stem diameter, canopy height, canopy width, number of shoots, shoot length, number of nodi per shoot and length between nodiums), phenology (inception of foliage, fruit birth, time of fertilization, onset and end time of fruit maturation, the first year yield (yield per tree and per decar) and some quality values (fruit size, TSS) values were measured. In terms of stem diameter Morgüz and Yeşilgüz, in terms of canopy height Morgüz and Sarılop, in terms of canopy width Morgüz and Bursa Siyahı shows the best improvement and the weakest development was in Sultan Selim and Siyah Orak varieties among fig varieties in the project. Although yield obtained from varieties in 2016, they were not evaluated because there was so much fruit, thus, yield and quality assessments were made in 2017. Beyaz Orak and Bursa Siyahı varieties have highest efficiency while the lowest yield were taken from Siyah Orak variety.

Keywords: fig, variety, yield, growth, morguz

EFFECTS OF DIFFERENT ZINC DOSE APPLICATIONS ON YIELD AND SOME QUALITY OF OLIVES GROWN AT SOUTHEAST ANATOLIA REGION

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Nutrient problems have often occur in our olive gardens because of the both they take place widespread inclined lands and do not have enough maintenance works. Although, olives are rich plants of poor soil but they are also extremely sensitive to the lack of plant nutrients such as boron, zinc and iron. In this study, which was carried out by GAP Agricultural Research Institute for 5 years, was to determine the requirement for micro nutrient of Gemlik olive cultivar. In the trial, olive trees were 13 years old and planted 6x6 interval-distance. According to the applications, zinc sulfate ($ZnSO_4 \cdot 7H_2O$, % 23 Zn) was used as zinc source. Experiment was designed as randomized block design with three replications. First two years the applications were not started and only yield values determined. After the second year the nutrient applications was started. Within the scope of this study foliar Zn (0-300-600-900 ppm) was sprayed at different concentrations in 2 periods with 15 days intervals about three weeks before flowering in spring. At the end of the chemical and pomological analysis, it was determined that different dozes of Zn fertilization from leaf have some improvement effect on yield and quality but this increase did not have an important effect statistically, but some quality parameters was found statistically significant and its importance for human nutrition was showed. According to obtained results tried to be determined the efficiency of



applicability of the olive leaf fertilization, yield of the plant and quality of the fruit in the arid conditions like the Southeastern Anatolia Region.

Keywords:

Sanliurfa, Olive, Zinc, Yield and Quality.

Evaluation of Mechanical and Chemical Strategies to Enhance Winter Chill Accumulation in Pistachios

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Lack of chill accumulation in pistachios has been a growing production issue in the California for the past several years. Growers have been facing crop losses as a consequence of these changes and there is a dire need to address this very important issue. This study hypothesized that some mechanical and chemical methods could be beneficial to compensate for lack of chill or to induce physiological changes in the trees so as to have a normal bloom and crop load. Fifteen-year-old pistachio trees of Kerman variety on UCB-1 rootstock were selected for this study at the California State University Campus in Fresno. The treatments included covering the trees with two type of shade netting (Black and Gray), spray of horticultural oils and kaolin clay dust. These treatments were compared with an unsprayed control over two years. Trees were covered by November 1 and the shade nets removed in late February both years. In the kaolin clay treatments, trees were sprayed with clay material throughout the winter months as and when need depending on rain events. The idea was to keep the trees covered throughout the chill accumulation period. Temperature and light intensity data were collected both inside and outside the shade netting using dataloggers. Chill accumulation was calculated using dynamic chill accumulation model as described by Glozer (2009). Data on bloom progression, nut growth, nut weight and volume, shell strength progression, yield and number of blanks were collected. The trees under oil spray bloomed significantly earlier than the trees under kaolin clay and shade netting treatments. Oil treatment trees were also ahead of other treatments in progression of nut growth and shell strength. Statistically significant differences were found among different treatments in nut yield and number of blanks.

Keywords: (

chill, pistachio, kaolin, netting

Selection of fig varieties (*Ficus carica* L.) in Calabria (South Italy) for breba production



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In Calabria (South Italy) the fig (*Ficus carica* L) industry is ancient and based on the cultivar Dottato, traditionally processed as dried fruit. In this last years, the demand of consumers for fresh figs is continuously increasing and it makes economically sound the development of such sector. However, the potential development of fresh fruits market depends on the availability of proper cultivars. Within the autochthonous germplasm of Calabria have been found several genotypes that produce breba, traditionally consumed as fresh fruits. The best genotypes were selected and subsequently evaluated respect to ripening time and the carpometric characteristics (fruit weight, shape, skin color, easiness of peeling, pulp colour and other qualitative traits). "Citralara", "Columbro bianco", "Columbro nero", "Melenzana" and "Schiava" showed great potential for breba production because of their productivity and the high-quality standard of the fruits. A selection activity carried out for several years has allowed to identify the most interesting genotypes for the production of breba fruits.

Keywords:

germplasm, selection, genotype evaluation, cultivar Dottato, fruit skin colour

CHESTNUT GROWING IN AYDIN PROVINCE AND PROBLEMS

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The chestnuts in the Fagales, are part of the Fagaceae family. The chestnut-producing countries in the world are China, Bolivia, Turkey, Korea, Italy, Greece and Japan. Chestnut 530 thousand 309 ha in the world in the world 2 million 51 thousand tons of products are obtained. In this sense, our country, which is third in the world in terms of production amount, meets 3.1% of world production with 63 thousand 762 tons chestnut in 2016. Turkey's chestnut production is approximately 39.87% of the 25 thousand 423 tons of the city of Aydin meet. *Castanea sativa* Mill. in Anatolian chestnuts is a native species of the Mediterranean basin. One of the most important problems in chestnut breeding in our region is the lack of standard varieties. There are varieties or types that are cultivated



locally in each region. Another important issue in chestnut is as important as selection of varieties, selection and multiplication of appropriate rootstocks. These two points are among the issues that need to be resolved for our country as much as it is for our knowledge. Chestnuts are normally grown in natural ecosystems without irrigation. It is very difficult to process the soil using the tillage tools in the chestnuts which are usually in the form of scattered trees and are located on slopes and steep terrain. One of the most important problems in chestnut growing in Aydın province is the lack of terraces. It is on sloping land near to all the chestnuts. So, tillage, irrigation and rains caused erosion. The most important disease in chestnut is chestnut cancer disease (*Cryphonectria parasitica*), which is a parasitic disease, and it is a parasitic scar, and the disease continues to develop in the above-ground parts of the plant by entering the plant from the wounds in the tree. The second biggest problem affecting the growth and yield of chestnut trees is galley. Chestnut harvest is usually done in the form of beating trees with poles. Chestnuts are traditionally gathered in the gardens under the trees in the heap and are covered with ferns, are covered with plants and stored in the medium called "burial". There is only a small capitol business regarding the technological evaluation of chestnuts in Aydın province. It can be said that our processing industry and our entrepreneurial industrialist are inadequate for the technological processing of chestnuts. Chestnut is generally regarded as a table product in our province and freshly sent to the inner and outer market. Taking into consideration the current situation, problems and all the issues addressed in the context of the solution proposal for Aydın chestnut growing; a strategic planning process related to the cultivation of Aydın province chestnuts is required

Keywords:

chestnut, growing, problem, Aydın

Genetic diversity, relationships and association mapping for gender in *Ficus carica*

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The fig (*Ficus carica* L.) breeding is expected to benefit from genotypic classification of the genetic resources and development of molecular markers for important traits. The objectives of the study were to elucidate genetic diversity and identify molecular markers linked to sex expression across natural populations of male and female figs. Ninety-six samples including 47 male and 49 female fig genotypes previously collected from different geographic regions of Turkey and 2 genotypes from



USA were analyzed by using sequence-related amplified polymorphism (SRAP), male-specific marker-SRAP (MS-SRAP), simple sequence repeat (SSR), and inter-simple sequence repeat (ISSR) primers. Initially, two bulk DNAs created by mixing an equal amount of DNAs of 7 male and 7 female figs were subjected to rapid screening and polymorphic markers between the two bulks were applied to the 96 samples. A total of 150 polymorphic molecular markers produced in this study were used to perform unweighted pair group method arithmetic average (UPGMA), principle component analysis (PCA) and association mapping for estimating sex-linked markers. The UPGMA and PCA analyses largely distinguished the male and female genotypes, but did not group them based on their geographic origins. Data files of population structure produced by sub-structuring Bayesian analysis as covariance, marker and phenotypes were used to estimate sex-linked markers. Five markers explained 77% of the variation for sex expression and only MS2FEM10 marker developed in this study explained the 66% of the total variation.

Keywords:

Fig, natural population, molecular markers, molecular characterization

Efficiency of foliar applications of potassium sulphate on walnut production

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Besides basal dressing and cropping systems using split applications such as fertigation, foliar sprays can also be considered as an effective way to supply nutrients to the plant. They are widely used for micro-elements but less so when it comes to macro elements, particularly potassium. When it comes to nuts and fruit trees, foliar applications are a fast and effective way to supply potassium during high demanding stages.

Nuts in general and walnuts in particular have the highest demand in potassium during fruit growth. Thanks to a new grade of soluble potassium sulphate, specially designed for foliar applications, it is now possible to supply potassium during those critical stages. An experiment was carried out during 3 years in cooperation with the "Station de Creysse", the French research centre specialized in walnut production.

This article presents results on the effect of foliar applications of potassium sulphate on yield and quality as a complement to the basal dressing. Three treatments were compared: T0 as control with 100 % as basal dressing of the recommended fertilization; in T1, 80 % of the potassium is applied to the soil and 20 % as foliar; T2 is equivalent to T0 and an additional 20 % of the potassium dose as foliar,



Cumulative yield over 3 years shows an improvement by 9.4 % for T1 over T0 and 23.7 % for T2 over T0. Quality parameters such as kernel colour and size are also improved. Income for the grower is also increased by 8,500 €/ha over the 3 years.

Keywords:

Walnut, potash fertilization, potassium sulphate, foliar applications

Effects of Pollinators on Fruit Set in New Hazelnut Cultivars "Okay28" and "Allahverdi"

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In this study, it was aimed to determine the effects of pollinators on fruit set in new hazelnut cultivars 'Okay28' and 'Allahverdi'. 'Tombul', 'Palaz', 'Kalinkara' and 'Foşa' hazelnut cultivars were used as pollinators. The experiment was designed as randomized plots with 3 replications in 2015-2017 at Hazelnut Research Institute located in Giresun province, Turkey. Controlled pollinations were performed, and pollen quality have been investigated for all cultivars. Pollinations were made on individually bagged branches by use of Tyvek Housewrap. The fruit set of 'Okay28' was significantly different in hybridization with cultivars according to the self-pollination in 2016. Fruit set rate was determined the highest on pollination with Foşa cultivar by 57.67%, the lowest on self-pollination by 9.67%. In 2017, while the fruit set rate did not varied considerably, it was determined the highest on pollination with 'Tombul' by 77.38%, and the lowest with 41.92% in the self-pollination. In 2016, while the rate of fruit set 'Allahverdi' did not varied considerably, it was determined the highest on pollination with 'Kalinkara' by 71,67% and the lowest in the self-pollination by 40,05%. The rate of fruit set 'Allahverdi' in 2017 varied considerably. The highest fruit sate was determined in pollination with 'Palaz' cultivar by 86,20%. 'Tombul', 'Palaz', 'Kalinkara', 'Foşa', 'Okay28' and 'Allahverdi' cultivars of pollen germinating rates determined in 20% and 25% sucrose solutions in 2016 and 2017 years. 'Tombul' have the highest value in every two years. 'Tombul' was followed by Foşa in 2016 and 'Foşa', and 'Allahverdi' in 2017. The rate of pollen viability did not differ statistically, but the highest in both years was determined in 'Tombul'.

Keywords:

Hazelnut, *Corylus avellana*, New Cultivar, product, pollen, self-incompatible

Genome editing in Mediterranean fruit trees: CRISPR/Cas9 approaches of *Ficus carica*

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Fruit-tree breeding is a lengthy process with many limitations. Classical breeding strategies using conventional cross-breeding and induced mutations have played an important role in the development of new cultivars in fruit trees. Precise genome editing could be a very useful tool for the improvement of crop plants. Efficient regeneration and transformation systems, a prerequisite for genome editing, were developed in several fruit trees. Genome editing techniques including ZFNs, TALENs, and recently CRISPR/Cas9 based approaches were employed for various crop plants



including fruit trees. CRISPR/Cas9-based approaches hold great potential in genome editing due to their simplicity. There is a need to adapt CRISPR/Cas9 methodologies to fruit trees. The different application of CRISPR/Cas9 methodologies in fruit trees will be described. Here we describe efficient CRISPR/Cas9 genome editing in fig. Transgenic fig lines carrying a mutated GUS construct (mGUS), were developed. mGUS editing, using the CRISPR/Cas9 system was confirmed by GUS staining and PCR. We further describe the induction of a targeted gene mutation in the endogenous fig phytoene desaturase (PDS) gene using the CRISPR/Cas9 system. Figs are very attractive due to their nutritive and antioxidant properties. Yet, ripened fresh figs are highly perishable and require delicate postharvest handling. Characterizing the transcriptome of ripening fig fruits we found several genes that display altered expression during ripening and related to the ABA, ethylene hormonal processes and cell wall degradation. Currently we are using the CRISPR/Cas9 methodology to generate non-GM fig fruits that exhibit delayed ripening.

Keywords:

Breeding, Genome editing, CRISPR/Cas9, *Ficus carica*

Relationship between Calcium salts treatment and Aflatoxin contamination of Pistachio (B1, B2 and total) in Iran

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Aflatoxins are highly toxic and carcinogenic secondary fungal metabolites of *Aspergillus* species and have been detected in pistachio nuts before and during harvest. Calcium is thought to be the most important mineral element determining fruit quality. Hence, this study was conducted to investigate the effects of several calcium compounds (Calcium Nitrate and Calcium Chloride 0, 0.5 and 1%) on Pistachios' cracking, early splitting, splitting as well as yield and aflatoxin contamination (B1, B2 and total) in Ahmad- Aghaii Pistachio. Spraying trees was carried out in different growing stages, two weeks after full bloom (stage 1), before endocarp hardening (stage 2) and the combination sprays of stage 1 and stage 2 (stages 1+2). Results indicated that application of Calcium Nitrate and Calcium Chloride in different stages to cause reduction of early splitting and increasing of splitting and yield of Ahmad- Aghaii Pistachio. Furthermore, using of Calcium in stages (1+2) decrease B1, B2 and total aflatoxin contamination significantly. Results showed that foliar application of calcium during the growing season might be a proper strategy of preventing early splitting and subsequently decreasing the aflatoxin contamination.

Keywords:

Aflatoxin, Calcium, Iran, Pistachio, splitting

