Third Balkan Symposium on Fruit Growing

BOOK OF ABSTRACTS

September 16-18, 2015
Belgrade, Serbia

THIRD BALKAN SYMPOSIUM ON FRUIT GROWING

Book of Abstracts

Publisher:
Faculty of Agriculture, University of Belgrade
Department of Fruit Growing

For publisher:
Prof. dr Milica Petrović, dean

Editor:
Dragan Milatović

Technical editor:
Dragan Milatović

Printing:
Birograf Comp doo
Atanasije Pulje 22
11080 Beograd-Zemun

Circulation:
250 copies

ISBN 978-86-7834-228-8

The publishing was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia

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Section 1.

FRUIT BREEDING AND BIOTECHNOLOGY

S1-O1 (Invited lecture)

New Cultivars of First Quality Cherries at Dresden-Pillnitz

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In Germany the sweet and sour cherry breeding is concentrated at the Julius Kühn-Institut in Dresden-Pillnitz since 2001. The main breeding goals are directed on sweet cherries for fresh market and sour cherries for processing and nowadays also for the fresh market. The selection of new cultivars is focused on fruit quality, high and stable fruit set and tolerance to biotic and abiotic stress. During the last years molecular markers were developed for the cherry breeding. These markers were used for *S* allele studies and for characterization of fruit size and disease resistance in the cherry breeding. New interspecific hybrids were developed to increase the genetic basis for breeding. As result of the breeding activities six new sweet cherry cultivars, 'Narana', 'Areko', 'Polka', 'Bolero', 'Swing' and 'Habunt', were selected. Four new cultivars, 'Coralin', 'Spinell', 'Jachim', 'Boas', were selected as result of the sour cherry breeding program.

Keywords: *Prunus avium*, *P. cerasus*, fruit breeding, molecular markers, cultivars

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S1-O2 (Invited lecture)

New Selections of Peach, *Prunus persica* (L.) Batsch, for Mediterranean Climate

Tiziano Caruso[1*], Claudia Di Miceli[1], Francesco Paolo Marra[1], Placido Volo[1], Marcello Cutuli[2], Alisea Sartori[2], Massimo Terlizzi[2] and Davide Neri[2]

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In the late '90s, CRA and University of Palermo initiated a peach breeding program in order to select new genotypes suitable for the fruit growing areas of the Southern Italy. These regions are generally characterized by short, mild winter and long hot dry summer. They have a local well-adapted traditional peach germplasm, while cultivars released in continental environments have often problems related to climatic limitations such as the failure to satisfy the winter chill requirements. About 30 different peach and nectarine varieties with different fruit characteristics (size, skin color and overcolor, flesh firmness, sugar content, titratable acidity, absence of split pit) were used as parental. The selections were propagated through grafting onto peach x almond GF 677 rootstock and then tested in different sites, including one experimental orchard located in Sicily (Lat. N 37.30). Three plants per each clone of the 300 genotypes obtained by CRA fruit center in Rome were planted in the experimental orchard in Sicily. Over the past 15 years, the aim was to identify the most "rustic and good" selections. This article reports the main agronomic (as disease susceptibility, productivity, ripening time) and qualitative characteristics (as sugar content, acidity, firmness, color) of 12 yellow peaches, 1 white peach, 1 clingstone, 1 flat peach, and 3 yellow nectarines selected to date in Sicily. Data were collected for 5 years at least and compared with some international cultivars in the same experimental orchard. The ripening period of the different selections runs from the third week of May until the first week of September. Some selections show innovative characteristics, with excellent fruit quality and well adapted rustic trees. For the climatic conditions in which they were assessed, it is believed that the selected genotypes can perform well in areas with low Chilling Units (400 – 600, eventually even lower) and high Growth Degree Hours (40,000 to 60,000).

Keywords: fruit breeding, biotechnology and genetic resources

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S1-O3

Transgenic Approach for Improving Resistance of Stone Fruits to Sharka Disease

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Since the first record of Sharka disease in Bulgaria, the disease has progressively spread via infected plant materials throughout Europe were it has destroyed well over 100 million stone fruit trees. The disease has serious agronomic and political consequences due to the enormous economic losses. Because only few PPV resistance genes have been found to naturally occur in Prunus, scientists have utilized genetic engineering techniques to develop resistant plums by inserting specific genes from the PPV genome into the DNA of *Prunus* host plants. For improving the plants resistance to plum pox virus (PPV) we used two technologies based on co-suppression gene and RNA-silencing. Transgenic plum clones were infected by bud-grafting. PPV detection was analyzed RT-PCR by using primers targeting the 3' untranslated region and *HC-Pro* gene of PPV. Western blot analysis was performed using rabbit polyclonal antibodies to PPV coat protein (Loewe). We observed absence of PPV in all four tested lines of St-pCam PPVRNAi. Field testing of transgenic plants is underway in the field plots. For improving biosafety and public acceptance of transgenic plum and other stone fruits new generation of vectors for transformation has been created. PPVRNAi expression cassette was integrated into MF2 vector (PRI) with recombinase activity for selective marker elimination. First results of application of this system for transformation of peach and plum cultivars and rootstocks will be present.

Keywords: Plum Pox Virus resistance, transformation, plum

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S1-O4

Examination of Hungarian Bred Disease Resistant Sour Cherry Genotypes

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The *Monilinia laxa* (Aderhold & Ruhl.) Honey has been caused serious infections in Hungary for 20 years. Beside cherry leaf spot (*Blumeriella jaapii*) the brown rot (*Monilinia laxa*) is the most important disease of sour cherry. The most susceptible Hungarian sour cherry variety is 'Érdi bőtermő'. Its importance in the Hungarian sour cherry growing is high because this variety is grown around 4000 hectares in the country. During the examinations of *Monilinia* susceptibility of sour cherry varieties was established that the *Blumeriella* resistant 'Csengődi' variety shows high tolerance against *Monilinia laxa* as well. Nowadays we use the 'Érdi bőtermő' variety as mother plant and the 'Csengődi' variety as pollen donor plant in our resistance breeding programme. The most important aims of the breeding programme are: to get hybrid seedlings resistant or tolerant to *Monilinia laxa*, the fruit characteristics and productivity of the selected hybrids equal or higher than 'Érdi bőtermő' variety, self-fertility, and to select *Monilinia laxa* isolates suitable for artificial infections according to their pathogenicity. As result of our breeding programme a new sour cherry candidate variety, the 'Érdi bíbor', was applied for state registration in 2014. In the frame of our selection work we start experiments cooperated with Corvinus University of Budapest Department of Genetics and Plant Breeding to examine compounds related to resistance against *M. laxa* pathogen. In this experiment we use OPLC (over pressure layered chromatography) method for separation and quantification of saccharide composition of artificially infected shoots of the most susceptible and the most resistant sour cherry hybrids and their parents. Based on our results so far, the monosaccharide content of infected phloem of the varieties and their hybrids correlates with the disease resistance.

Keywords: sour cherry, resistance, saccharide content, *Monilinia laxa*, infection

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S1-O5

Selection and Fertility of Seeds Producing Almond's Hybrids in the Contex of *S*-genotypes

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Almond rootstocks are used for almond's varieties, and they are the second important rootstocks for peaches. The nurseries use mostly stone types originated from the virus-free nuclear stock in Cegléd. Four clones were used as parents (C.471, C.449, C.446 and C.431). They have good graft compatibility with the cultivars, but the mother trees have got disadvantageous characteristics. As a result of breeding activity 600 hybrids were planted at the test plot between 2003 and 2004. The first fruit set was in 2007. Six hybrids (1/117, 2/3, 2/78, 3/48, 3/58 and 4/45) were selected from offsprings of the above mentioned 4 parents between 2007 and 2010, with the aim to obtain new seed producing varieties, that contain the advantageous characteristics of parents. Field pollination experiments were carried out using pergamin bags as isolators and cross-breeding method completed with reciprocal cross. Parallel the sterility of the hybrids was investigated. Simultaneously blooming varieties are important prerequisite for pollination; therefore we monitored the progress of the blooming and determined the coverage of the main blooming periods. We found that hybrids were able to pollinate each other. PCR was conducted using the degenerate primers EM for the amplification of the second intron region of the *S*-RNase gene and *S*-genotypes in hybrids. S_5, S_9, S_{11} and S_{24} were found in addition to 3 alleles, which are not identical to the previously known almond *S*-alleles, therefore indicated S_x, S_y, and S_z letters. Incompatible combinations are not found among the hybrids. We found that the hybrids main blooming periods overlap, so does not hinder adequate pollination.

Keywords: almond, rootstock, breeding, selection, *S*-genotype

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S1-O6

Some Interspecific Hybrid Chestnut Genotypes from Turkey

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This research has been conducted with the aim to select interspecific chestnut genotypes which have superior yield and nut characteristics. Hand crossing studies were made between 'King Arthur' and 'Lockwood' at The Connecticut Agricultural Experiment Station in 2004. The former is a mollissima/seguine hybrid and the latter is a crenata/sativa/dentata hybrid. Seeds of a complex hybrid were imported from USA in 2005. They were planted at The Black Sea Agricultural Research Institution in 2006. Seven genotypes were examined in 2006-2014. For this aim, yield, precocity, number of nut per bur, nut size (number of nut/kg), color, brightness and thickness of shell, kernel color, penetration of testa into the seed (mm), and taste were investigated. The data was evaluated by the weighted-rankit method with the scores of the chestnut genotypes being determined by their qualitative and quantitative characteristics. Additionally, their relative values were evaluated with regards to fresh consumption and processing. The genotypes found to be superior were as follows: A-14, A-25, and A-100.

Keywords: chestnut, hybrid, breeding

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S1-O7

Selection of Mulberry (*Morus alba*) ın Artvin

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This research was carried out in Artvin region of Turkey on mulberry types (*Morus alba*) in 2013-2014 years. Some pomological characteristics of mulberries were investigated in this study to select the best genotypes for growing. In the scope of observations productivity, fruit weight, total soluble solids (TSS), seediness, fruit juice yield, fruit dry yield, titratable acidity and taste were measured. This research included 16 mulberry types. Among the selected types fruit weight ranged 0.85-2.46 g, soluble solids 15.53-30.20%, fruit juice yield 31.45-49.40% and titratable acid content 0.06-0.14 mg/100 ml respectively. These types can be consumed as fresh, dried and processed in jam.

Keywords: mulberry, *Morus alba*, selection, fruit weight, soluble solids

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S1-P1

Promising Apple Genotypes from Turkey

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Turkey is one of native growing areas of apples. Apple growing areas in Turkey spread all over Turkey. Turkey has a big share within Europe in apple production with 2,444,444 tons. Turkey has a big diversity of apple in many of districts. One of these districts is 'Camili' in Eastern Black Sea Region in Turkey. 'Camili' is only biosphere reserve area in Turkey. 'Camili' is rich in apple genetic resources, with very different characteristics such as time of bloom, early and late ripening and variable fruit quality. This study was carried out in order to determine some fruit characteristics such as fruit weight, firmness, titratable acid content and soluble solid content and important phenological periods such as harvest of these apple genotypes in 'Camili' district. In the examined genotypes, fruit weight ranged from 36.6–224.2 g, fruit firmness ranged from 5.3-10.1 kg/cm^2, titratable acid content ranged from 0.21-1.54% and soluble solid content ranged from 9.2-13.7%. In the studied apple cultivars harvest date was from 30 July to 23 November. 'Bağ Elması', 'Büyük Bağ Elması', 'Güzel Elma', 'Yeşil Güzel Elma', 'Yeşil Demir Elması' and 'Beyaz Amasya Elması' cultivars were found as promising in terms of examined characteristics.

Keywords: apple, Camili district, *Malus communis*, local cultivar, fruit properties

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S1-P2

Some Biological and Economic Qualities of Apple Hybrids

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Six apple hybrids created at the Institute of Agriculture, Kyustendil (Bulgaria) were tested in 2012 – 2014. The trees were grafted on MM 106 rootstock and planted in the spring of 1998 at the distance 4.5 × 2.5 m. The trial was established in five replications (1 tree per replication). The flowering period, ripening time, tree growth, yield, weight and dimensions of the fruits and chemical content (soluble solids, total sugars and titratable acids) were measured. The earliest bloom was observed in hybrid № 1/16 ('Winesap' × 'Erwin Baur') - 10 April, and the latest in № 1/38 ('Prima' × Cooper 4') - 16 April. The weakest growth (trunk cross-section area) had the trees of № 1/21 ('Spartan' × 'Prima') and the strongest of № 1/38. Fruit were ripened between 21 and 25 September, respectively for № 1/20 ('Winesap' × 'Erwin Baur') and № 1/36 ('Prima' × 'Cooper 4'). Hybrids № 1/23 ('Spartan' × 'Prima') and № 1/16 produced the highest average yields (22.8 and 22.7 kg/tree). The fruits of № 1/20 were the largest (197.3 g). Average soluble solids content was between 11.7% and 13.6 %, total sugars ranged from 6.7% to 7.7% and titratable acids from 0.15 to 0.76%.

Keywords: *Malus domestica*, phenology, growth, yield, fruit quality

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S1-P3

Preliminary Results of Romanian-Korean Apple Breeding

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Apple cultivars with high fruit quality, good productivity and disease and pest resistance are highly required by fruit growers. A common breeding program between Research Institute for Fruit Growing Pitesti, Romania and Gyeongsangbuk-Do Agricultural Research and Extension Services, Korea started in 2014 in order to combine European and Korean apple market demands. Large fruit size, red skin colour, high sugar content and good orchard performance are the major objectives for the cooperation. Beginning with autumn 2014, 10 apple Romanian cultivars ('Generos', 'Aura', 'Doina', 'Dani', 'Starkprim', 'Bistriţean', 'Iris', 'Salva', 'Jonaprim', 'Luca'), 2 Assian cultivars ('Aiko', 'Summer King'), and cultivars of other origin ('Red Jonaprince', 'Topaz', 'Idared', 'Red Idared', 'Ariane', 'Golden Lasa', 'Greensleaves', '3191 A', 'Dalinbel', 'Ariwa', 'Orion', 'Priam', 'Saturn') were evaluated following physical parameters (weight, fruit diameter, flesh firmness) and soluble solids (Brix %). As useful genitors for large fruit size ('Red Jonaprince', 'Dalinbel', 'Aiko'), red skin colour ('Iris', 'Crimson Crisp'), general appearance and high sugar content ('Ariane', 'Topaz', 'Fuji', 'Summer King'), long storage life and red skin colour ('Enterprise') were selected. Seven cross combinations were released in spring 2015, which included 2,485 inflorescences hand pollinated and 1,070 hybrid fruits. The paper deals the first steps of the work.

Keywords: apple, breeding, fruit quality, selections

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S1-P4

Evaluation of Relationships between Pear Genotypes Using SSR Markers

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The pear (*Pyrus communis* L.) is one of the most important fruit species grown in many temperate regions all over the world. Turkey is rich in pear genotypes adapted to different ecological regions of the country. This study was carried out to identify the genetic relationships between the local pear genotypes grown in Sinop province, Northern Black Sea Region of Turkey, using SSR markers. Molecular characterization was performed in 4 standard and 97 local pear genotypes using 15 SSR primers. DNA was extracted from newly emerged leaves of the genotypes. Genetic similarities among the pear genotypes were calculated using the Nei and Li's coefficient of similarity and a dendrogram supported by SSR data was constructed. In the examined genotypes, the amounts of DNA were in the range of 145-3419 ng/µl, while the purity of DNA between 1.10-1.89 was found. As a result of SSR analysis in the pear genotypes, fragment sizes from 20 to 760 bp were obtained, and similarity index was 0.13 to 1.00. As a result of this study, the most genetically similar pear genotypes ('Akça', 'Yumuşak', 'Sarı', 'Kirli', 'Ciğer', 'Nar', 'Bağrı Kara' and 'Orak') were also determined as morphologically similar.

Keywords: *Pyrus*, pear genotype, SSR, genetic similarity, Black Sea region

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S1-P5

New Pear Hybrids for Growing in Latvia

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Successful and profitable pear growing is dependent on the availability of cultivars with high fruit quality, resistance to diseases and adaptability to local growing conditions as well as good storability. There is a lack of high-quality winter cultivars among currently grown in the commercial orchards in Latvia. Actually only one pear cultivar appropriate for storage fits these requirements and unfortunately is already outdated and should be replaced. Therefore the aim of this study was to evaluate two selected pear hybrids for growing in Latvia. Hybrids BP 8965 and BP 10529 are developed from cross between the cultivars 'Clapp's Favourite' and 'Beurre Blumenbach' and their evaluation for economic characters was done at the Latvia State Institute of Fruit-Growing, located in Dobele (56°36'39.37" N 23°17'48.86" E). Both hybrids had high quality fruits to be used for fresh consumption and processing, and their fruit weight was higher than 200 g. The skin of fruits BP 8965 is greenish yellow, blushed red by sun exposure, whereas fruit skin of BP 10529 is green with russeting. The flesh of ripe fruits is tender, juicy and buttery for both of them. The flavour is sub-acidic, sweet and aromatic. Fruits endure common harvest manipulation, have good transportability and good storage performance and can be kept for six months after picking. Tested hybrids were productive and precocious. They have a good resistance to the most important fungal diseases – pear scab and European pear rust. Hybrid BP 8965 showed very good compatibility with quince (*Cydonia oblonga*) rootstock BA 29.

Keywords: *Pyrus communis*, breeding, fruit traits, evaluation, fungal diseases

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S1-P6

Pomological Characteristics of the New Plum Cultivar 'Ostromila'

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The tree is moderate in growth, with a moderately large spherical crown. Flowering is late and abundant. The tree is a spur-bearing type. Fruits are large (38 – 40 g), their size being 43,4 × 39,5 × 36,4 mm, oval in shape. The sides are symmetrical, swollen. The cheek side is flattened, with a very wide and shallow groove and a poorly outlined ventral suture. The apex is slightly truncated, with a small cavity. The tip point is slightly outlined. The pedicel cavity is moderately wide and moderately deep. The skin is dark purple-blue in colour, covered with a dense silvery wax coating. It is thin to moderately thick, not separating from the fruit flesh. Fruit flesh is light golden yellow, medium dense, moderately juicy, homogeneous in texture, with a good sweet taste, pleasant acidity and moderate aroma. The stone is medium large, free from the flesh, located in a small cavity. It is elongated in shape, brown-coloured, with flattened sides and a rough surface. The ventral suture is wide, arched, with a slightly outlined central ridge and still less visible side ridges. The dorsal ridge is very narrow, symmetrical to the ventral. The tip is rounded, with a small tip point. The basal part is narrowed and thin, ending in a small aperture. The fruit pedicel is pale green, short, with fine hairs. It is easily detached from the fruit, without destroying the skin. The cultivar is highly fertile, with a very good sensory profile of the fruits. They are suitable for fresh consumption and for processing. The cultivar is resistant to Sharka disease (Plum pox virus PPV) and tolerant to shot-hole (*Stigmina carpophila* (Lev.) M. B. Ellis). Attacks by leaf aphids (*Aphididae*), plum fruit moths (*Cydia funebrana* Treitschke), oriental fruit moths (*Cydia molesta* Busck) and black plum sawflies (*Hoplocampa minuta* Christ.) were not reported.

Keywords: plum, *Prunus domestica* L., breeding, new cultivar

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S1-P7

‘Evmolpiya’ - New Bulgarian Peach Cultivar Resistant to Leaf Curl Disease [*Taphrina deformans* (Fuskel) Tulasne]

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An organized programme of peach breeding in Bulgaria was officially launched in 1989 at the Fruit-Growing Institute in Plovdiv. An important breeding aim set in the programme, is the development of cultivars resistant to economically important diseases such as the peach leaf curl caused by the obligate fungus [*Taphrina deformans* (Fuskel) Tulasne]. The first successes in creating Bulgarian disease resistant peach cultivars are connected with the name of the breeder Stoyan Dabov who had established at earlier stages the dessert cultivars ‘Pomoriiska zora’, ‘Aheloy’ and ‘Remil’, as well as the canning ones ‘Stoyka’ and ‘Malo Konare’. Those cultivars were developed by complex crossings between the species *Prunus persica* (L.) Batsch and *Prunus ferganensis* (Kost. & Rjab.) Kov. & Kost., the latter as a carrier of the gene for resistance to the causative agent of powdery mildew disease *Sphaerotheca pannosa* (Wallr.: Fr.) Lev. var. *persica*. At a later stage another peach species *Prunus davidiana* (Carr.) Franch., carrying different genes for resistance to the fungal pathogen *Taphrina deformans* (Fuskel) Tulasne and to Plum Pox Virus (PPV) / Sharka Potyvirus, was also included in the hybridization programme. Later on, by interspecific hybridization of the parent cultivars ‘Fantasia’ x (‘J.H.Hale’ × *Prunus davidiana*), the next product of the breeding programme was established – the new dessert cultivar ‘Evmolpiya’ that was officially recognized in Bulgaria in 2009. Fruits of ‘Evmolpiya’ cultivar ripen about 15 – 20 September. They are very large, spherical in shape, slightly asymmetric, their mean weight being 225 g and their size 73.7 × 76.8 × 73.9 mm. The fruit is slightly fuzzy, with red to dark red colour covering to 60% of the fruit surface. Fruit flesh is yellow, tender, and juicy, with a balanced sour-sweet taste and a pronounced aroma. The stone is small, its relative share being only 4.09%, totally freestone. ‘Evmolpiya’ cultivar shows complex field resistance to the agents causing the economically most important diseases in peach – leaf curl and powdery mildew. That makes it very suitable for integrated and organic fruit production.

Keywords: *Prunus persica*, peach, breeding, new cultivar

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S1-P8

Evaluation of Peach Hybrids for Yield and Fruit Quality in the Crimean Steppe Area

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The hybrid fund of *Prunus persica* (L.) Batsch created on the basis of domestic and foreign varieties was investigated in the Steppe Branch NBG – NSC. The aim of the research was to identify winter-hardy peach hybrids with high yield and good fruit quality (size, appearance, and taste) for further study and transfer to the state variety trial. The selection field is located on the border of the steppe and foothill soil-climatic zones of the Crimea. The climate is dry, moderately hot, characterized by a long growing season, rather short, unstable winter and return spring frosts. For hybrid evaluation we use "Program and methodology of variety trials of fruit, berry and nut crops" and other methods of breeding fruit crops adopted in European countries. Hybrid seedlings were obtained by interspecific and intraspecific crossing using classical breeding techniques. In total, 2010 seedlings of 39 hybrid families of F_1 and F_2 generations were analyzed. Results of researches revealed the most potentially productive hybrid F_2 families that were obtained by self-pollination of combinations 'Veteran' × 'Moldavskiy Zheltyiy', 'Ak Sheftalli' × 'Krasnoflotskiy', 'Oranzhevyiy' × 'Oranzhevyiy' and F1 'Gurzufskiy' × F_1 hybrid 26-76, and 'Moravia' × 'Pushistyiy Ranniy'. Their average score of flowering was 4.0 – 5.0 on a 5-point scale. Hybrid seedlings 'Valiant' × 'Tovarisch' and 'Moravia' × 'Moravia' of F_1 families with the average grade yield of 2.9 – 3.0 points proved to be the most fruitful. Highlighted is some F_1 hybrid families, whose average evaluation of the fruit quality were more than 4 points on a 5-point-scale: 'Valiant' × 'Tovarisch', 'Zolotaya Moskva' × 'Vedetta', 'Moskvic' × 'Gvardeyskiy Zheltyiy' etc. Thus, it was selected more than 100 of hybrids that are characterized by good productivity, and attractive, large fruits of excellent taste and quality.

Keywords: peach, hybrid, hybrid family, fruit quality, yield

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S1-P9

Inheritance of Qualitative Fruit Traits of Peach in Generative Progeny

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In our investigations we made hybrid analysis of such heritability traits as fruit shape, fruit flesh consistence, density and colour, stone adherence to flesh for hybrid seedlings of peach in 48 – 60 breeding combinations for determination of economical valuable trait donors and their accessory to particular ecogeographycal groups and ecotypes. All hybrid progeny (100%) inherited round fruit form, fibrous flesh consistence, white color, delicate flesh with free stone in breeding combinations with homozygous-dominant cultivars or in the combinations of homozygote and heterozygote. Among 16 donors of round fruit shape 50% belong to both northern Chinese and Iranian ecogeographycal groups. Among the ecotypes most of cultivars and forms belong to European ecotype of northern Chinese group (43.8%). Through 34 donors of fibrous flesh consistence 55.9% belongs to northern Chinese ecogeographycal group and 44.1% to Iranian one. Most of donors were noticed in European ecotype of northern Chinese group (50.1%). Among three donors of white flesh colour 66.7% were from northern Chinese ecogeographycal group. Among ecotypes, most donors belong to European ecotype of northern Chinese group (66.7%). Among donors of delicate flesh 60% belong to northern Chinese ecogeographycal group and 40% to Iranian one. Through ecotypes, most donors were from European ecotype of northern Chinese group (53.2%). Among two freestone donors one form was from northern Chinese group and European ecotype and the other cultivar was from Iranian group and American ecotype. Thus, it is reasonably to use in hybridization homozygous-dominant cultivars that are donors of valuable traits and transfer the entire trait to the hybrid progeny. Most of donors belonged to the European ecotype of northern Chinese group.

Keywords: peach, hybridological analysis, inheritance, qualitative fruit traits, donors of traits, ecogeographycal groups, ecotypes

Acknowledgement: The study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

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S1-P10

Screening of Some Turkish and Foreign Apricot Cultivars for Self-(in)compatibility Using Molecular Markers

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Turkey is the most important country in terms of apricot production in the world. Apricot has been produced throughout Anatolia since ancient times for its edible fruit, but mostly in Eastern Anatolia. In flowering plants, gametophytic self-incompatibility is one of the major problems preventing self-fertilization. It is controlled by a single locus with several allelic variants. Among the fruits, apricots also show self-incompatibility, especially that of Middle-Asian and Iranian-Caucasian origin. In our research, we have studied some apricot cultivars in terms of self-(in) compatibility in Turkey. Apricot cultivars used in this study consisted of 20 Turkish and 10 foreign accessions. Analyses were carried out using AprFBC8-F and AprFBC8-R, EM-PC2consFD and EM-PC3consRD primer pairs to determine self-incompatible alleles and SRc-F and SRc-R primer pairs to determine self-compatible alleles. After the DNA isolation and PCR process, PCR product was conducted in metaphor agarose. According to results, 8 of 20 Turkish cultivars were self-compatible, whereas 12 of them were self-incompatible carrying S_2 – S_{13} alleles. Because Turkish apricots are mostly self-incompatible pollinizer cultivars should be considered for planting new orchards with these self-incompatible cultivars.

Keywords: apricot, fertilization, self-compatibility

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S1-P11

New Sweet Cherry (*Prunus avium* L.) Selections from Research Station for Fruit Growing Iaşi, Romania

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At Research Station for Fruit Growing Iasi the breeding programmes objectives were to continuously improve the sweet cherry assortment in the N-E area of Romania. In these breeding programmes during the period 1994 – 2015, 28 new sweet cherry cultivars have been obtained through controlled hybridization, free pollination and clonal selection. The studies have been taken in the three-year period (2011 – 2013), having as research material nine sweet cherry selections from which four of them ('Moldavia', 'Elaiaşi', 'Coralis' and 'Amaris') have been approved in 2015 and five of them are still in tests. Observations and determinations were made concerning the trees vigour, the resistance to frost and anthracnose, the main phenological stages, the production (kg tree^{-1}) and physico-chemical features of the fruits. The highest values concerning the fruits weight (8.9 – 9.4 g) were registered for 'Moldavia', 'Coralis' and 'Elaiaşi'. The values of the soluble solids content were between 15.3 – 18.8°Brix, the titratable acidity were between 0.4 – 1.1 mg malic acid per 100 mL^{-1} of fresh juice and the total content of poliphenols registered values between 146 – 751 mg GAE per 100 mL^{-1} of fresh juice.

Keywords: breeding, hybrid, fruit, firmness, phenology

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S1-P12

Promising Sweet Cherry Genotypes as Cherry Rootstocks from North Anatolia (Preliminary Results)

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The sweet cherry is apparently native in North Anatolia. There are many genotypes in Anatolia, which may be gene resource for developing new cultivars and rootstocks. New training systems for high density cherry growing have been developed recently. At these systems, dwarf rootstock such as Gisela 3, 5, 6, PHLC etc. are very important. These dwarf rootstocks are also important for cherry growing under tunnel. We collected 42 cherry genotypes from Amasya and Giresun provinces in Northern Turkey between 2000 and 2009. We budded them on different rootstocks such as Gisela 5, 6 and Mazzard. We studied 10 of them for developing new dwarf rootstock. The following parameters were determined: trunk diameters, canopy volume, shoot length, node number on current shoots, and number of spurs on two-year old shoots. Generally, 'A1', 'A2', 'A7', 'A8', 'A10', 'A14' genotypes were found as promising in terms of examined characteristics.

Keywords: cherry, dwarf rootstocks, promising, *Prunus avium*, Turkey

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S1-P13

‘Cane's’, a New Sweet Cherry Cultivar from Serbia

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‘Cane`s’ is a new sweet cherry cultivar released from the breeding program started at the Faculty of Agriculture, University of Belgrade, which aim was to create an early ripening cultivar with large fruits. It was selected as a spontaneous seedling and recognized in 2014 by the Serbian Ministry of Agriculture and Environmental Protection. Comparisons with the standard cultivar ‘Bigarreau Jaboulay’ were done during two consecutive years (2012 – 2013). Averagely, it bloomed a day after the control cultivar. Method of fluorescent microscopy proved that this is a self-incompatible cultivar. The maturing time is 3 – 4 days after ‘Bigarreau Jaboulay’. The productivity is little lower but the fruit weight is much higher in ‘Cane`s’ (8.75 g) comparing with the standard cultivar (6.75 g). The taste is sweet, having soluble solid/total acidity ratio (23.31) comparing to 18.89 in standard cultivar. Aroma is very pleasant. It showed resistance to economically important diseases (*Monilinia laxa* and *M. fructigena*, *Blumeriella jaappi* and *Wilsonomyces carpophilus*) and low temperatures, like standard cultivar. Regarding large fruit and pleasant taste, this cultivar started spreading in the Belgrade’s surrounding.

Keywords: *Prunus avium*, sweet cherry, early ripening, large fruits

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S1-P14

‘Lenka’, a New Sour Cherry Cultivar from Serbia

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‘Lenka’ is a new sour cherry cultivar released from the sour cherry breeding program at the Faculty of Agriculture, University of Belgrade. It was selected as a spontaneous seedling and recognized in 2014 by the Serbian Ministry of Agriculture and Environmental Protection. The evaluation of this cultivar was done in the comparison with the control cultivar ‘Meteor Korai’ during a two-year period (2012 – 2013). Averagely, it bloomed a day after the control cultivar. Method of fluorescent microscopy proved that this is a self-compatible cultivar. The maturing time is also a day after ‘Meteor Korai’. The productivity is on a level with standard cultivar. The fruit is larger (7.6 g), comparing to ‘Meteor Korai’ (5.6 g), with significantly higher fruit stalk length (4.53 and 3.63 cm, respectively). The taste is sweet-acidic, harmonic, having higher soluble solids / total acidity ratio (17.72) comparing to standard cultivar (13.67). Fruits are suitable both for fresh consumption and for processing. It showed resistance to economically important diseases (*Monilinia laxa* and *M. fructigena*, *Blumeriella jaappi* and *Wilsonomyces carpophilus*) and low temperatures, like standard cultivar. Regarding large fruit and pleasant taste, this cultivar could be used both for processing and table consumption.

Keywords: *Prunus cerasus*, fruit, processing, table consumption

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S1-P15

Intravarietal Diversity of Sour Cherry Cultivar 'Maraska'

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Sanitary status, as well as genetic selection, are the obligatory precursors for the production of certified planting material of fruit species. Sour cherry production in the coastal part of Croatia is based on the cultivar 'Maraska'. To improve the quality of the 'Maraska' planting material mass positive clonal selection was performed. Research was conducted in the the Vlačine orchard, the largest sour cherry orchard in Croatia owned by Maraska Inc. In year 2014 trees with elite characteristics were selected, evaluated and tested for their sanitary status by ELISA and PCR. Trees free of tested viruses were evaluated again in year 2015 for their agronomic properties. In addition, DNA analysis using microsatellite (SSR) markers was performed and the results were compared with SSR profiles of other sour cherry cultivars grown in Croatia and surrounding countries. Results of the intravarietal diversity detected in years 2014 and 2015 among 'Maraska' trees are presented.

Keywords: sour cherry, clonal selection, microsatellites, viruses

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S1-P16

Early Bearing Genotypes of Walnuts: A Suitable Material for Walnut Breeding and High Density Orchards

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Walnut (*Juglans regia*) is a non-precocious bearing and vigorous tree. Standard seedlings of walnut have long juvenility and are hard to propagate by usual propagation methods like cutting, layering and somehow grafting. There is an excellent genetic diversity among Juglans regia populations from China to Central and West Asia including Iran. Among the populations there are some genotypes of walnut that are precocious and have short juvenile phase. These genotypes usually have cluster bearing flowering habit, low vigor and good rooting ability that make them suitable for easy propagation by cutting and stool layering. Most of these genotypes have basitonic phenotype in nature. Such dwarf genotypes which have ability to induce precocity in scion not only can be used as a rootstock in walnut breeding programs to shorten the vegetative adult phase of the scion and reduce duration and costs of a breeding program, but also have potential for establishing high density orchards. Precocity trait also has a high heritability in walnut. Low vigor genotypes show the highest proliferation rate and smaller shoot size, lower callus formation and higher rooting percentage in vitro. Moreover, these genotypes showed in vitro flowering on microshoots. Therefore, these genotypes of walnut are an ideal material for molecular genetic investigations for breeders and geneticists to find the genes involved in precocity, growth, flowering habit, easy rooting and other valuable traits in walnut. In this article we have reviewed the researches done about these genotypes.

Keywords: *Juglans*, precocity, propagation, rooting, grafting

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S1-P17

Molecular Characterization of Allelic Status of the *Rpf1* and *Rca2* Genes in Six Cultivars of Strawberries

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The strawberries cultivars (*Fragaria* × *ananassa*) are susceptible to fungus diseases and its resistance is one of the most important economic traits desired for growers. To induce resistance to these diseases using conventional methods is difficult, time consuming and affected by epistatic interactions between genes. Conventional plant breeding takes time and depends on the ambient conditions. The breeders are very interested in new technologies that could make this procedure more efficient and faster. In the present work, six strawberry cultivars: 'Mira', 'Idea', 'Benton', 'Marmolada', 'Elsanta' and 'Cambridge Favourite', were evaluated to determine the presence of resistant alleles *Rpf1* to red stele root rot (*Phytophthora fragariae*) and *Rca2* to anthracnose (*Colletotrichum acutatum*) using molecular markers: OPO-16C_438, SCAR –R1A_285 and STS-Rca2_240. The molecular assays demonstrated the presence of *Rpf1* resistant allele to red stele root rot in homozygous status for 'Benton' and 'Mira' cultivars and in heterozygous status for 'Idea' cultivar. For 'Cambridge Favourite', 'Marmolada' and 'Elsanta' was detected susceptible allele, *rpf1*. Regarding *Rca2* gene, the molecular analysis showed that only 'Benton' cultivar carries the resistance allele, *Rca2*, but we cannot say if this gene is in homozygous or heterozygous status. As a consequence, it can ascertain that 'Benton' cultivar contains *Rpf1* (RR) resistance gene to red stele root rot and *Rca2* (RR or Rr) gene resistant to anthracnose. So, 'Benton' cultivar could be used for transfer of these genes or pyramiding more genes for resistance to red stele root rot and to anthracnose using markers assisted selection (MAS) in the strawberry breeding program.

Keywords: *Fragaria* × *ananassa*, molecular markers, resistance allele, susceptible allele

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S1-P18

Zizyphus (*Zizyphus jujuba* Mill.) Gene Pool in the Nikita Botanical Gardens

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Zizyphus collections in Nikita Botanical Gardens is one of the fullest in the world. Basis of this collection is eight cultivars, which were delivered in 1953 from China. Then collection was replenished with new forms from areas of their natural growth and new selected cultivars. Among other subtropical crops zizyphus maintains frosts the best (up to –27°C), and it is resistant to pests and diseases. High and regular productivity is typical for it. The main zizyphus value is its fruits having the large nutritious, dietary and medical importance. The nutritional value of fruits is caused by high content of sugars, starch, and protein. Zizyphus fruits are rich in pectin (up to 3%), and contain P-active substances (up to 650 mg%). There are 120 cultivars and forms of zizyphus in Nikita Botanical Gardens now. Cultivars with different terms of fruit ripening, weight (from 3 to 50 g) and taste, productivity, technological characteristics of fruits, content of biologically active agents are represented in this collection. The main task of our investigations is formation and preservation of zizyphus gene pool for using in breeding, research work, educational programs, and expansion of genetic variability. The basic zizyphus collection is studied with the use of different methods of breeding. New cultivars with early term of ripening (the II-III decades of September), fruitful (12 – 15 tons per hectare), having fruit weight from 12 to 50 g are created.

Keywords: zizyphus, fruits, gene pool, genetic collection, breeding, new cultivars

Acknowledgement: This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

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S1-P19

Grape Genetic Resources and Breeding in Latvia

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The climate in Latvia is marginal for grape growing, nevertheless it comprise comparatively long history as well as diverse current developments. The 15th century can be considered as a starting point of grape growing in Latvia when the first plantations were established in the western part of the country and wine was made and sent to Russia. Later there were several more and less successful attempts of grape variety introduction, breeding and growing. Therefore diverse and locally adapted grape germplasm is available. The total area occupied by grapes in Latvia is not large (about 20 ha), but plantations are increasing and become as an interesting production places and tourism attractions. Several grape growers groups could be noted: gardening enthusiast, collectors (80 to 400 grape cultivars in several collections) and owners of commercial plantations (1 to 5 and more ha). The Latvian breeders have achieved good results in developing outdoor grapes for such marginal growing conditions, by using genotypes of *Vitis vinifera*, *V. labrusca* and/or *V. amurensis*. The main selection criteria are very early ripening, winter-hardiness, resistance to mildew (*Plasmopara viticola*, *Oidium tuckeri*), good taste and appropriate total sugar content in berries. Comprehensive screening of available grape germplasm and its evaluation was performed to characterize grape plant material grown in Latvia, 132 varieties in 18 plantations were taken into account and evaluated for winter hardiness, disease resistance and fruit quality.

Keywords: *Vitis* spp., disease resistance, winter hardiness, quality

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Section 2.

CULTIVAR AND ROOTSTOCK EVALUATION

S2-O1

Biological Properties of Some Autochthonous Apple Genotypes from the *ex-situ* Collection of Fruit Research Institute – Čačak

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Autochthonous apple genotypes in the Republic of Serbia can potentially provide a rich and useful genetic variability, especially for resistance and fruit quality traits. The Fruit Research Institute, Čačak has a long tradition of collecting new genotypes, as well as of evaluation, characterization and utilization of autochthonous genotypes in the existing apple collection. This study was carried out to determine the main biological properties of 10 *ex situ* apple genotypes – 'Bihorka', 'Budimka', 'Kraljica', 'Ovčiji Nos', 'Petrovača', 'Strekinja', 'Šimun Viparoš Struga', 'Šumnjaja', 'Tip 1' and 'Zejtinka'. The following properties of these genotypes were assessed: flowering phenophase (onset, full and end of flowering); harvest maturity; pomological properties (morphometric and chemical); disease susceptibility to: scab [*Venturia inaequalis* (Cooke) Wint.], mildew [*Podosphaera leucotricha* (Ell. & Ev.)] and fireblight [*Erwinia amylovora* (Burnill)], in accordance with Apple Descriptors (IBPGR) and standard morphometric and chemical methodologies. Based on the full flowering and harvest maturity, the genotypes can be classified into five groups (from extremely early to intermediate/late) and three groups (from mid-season to very late), respectively. The highest average fruit weight, height and width were determined in 'Ovčiji Nos' (209.38 g, 66.26 mm and 89.99 mm, respectively), while the lowest were in 'Tip 1' (34.36 g, 40.74 mm and 42.34 mm, respectively). The best fruit quality among the assessed genotypes, measured by the fruit chemical composition, was found in the 'Ovčiji Nos' (total and soluble solids content – 19.64% and 15.60%, respectively; total sugars and acid content – 13.13% and 0.41%, respectively). All of the studied genotypes showed field resistance to fireblight and a wide range of field susceptibility to scab and mildew. Based on the overall results and the fact that breeding programmes need new germplasm to improve current cultivars, autochthonous apple genotypes in the Republic of Serbia appear to carry useful traits.

Keywords: apple, indigenous genotype, physiological properties, pomological properties, resistance

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S2-O2

Tree Vigour and Yield of Plum Grown under High Density Planting System

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During the second through the sixth growing seasons, under the environmental conditions of Čačak (Serbia), tree vigour, yield (kg tree^{-1} and t ha^{-1}), biennial bearing index and fruit weight were studied in five plum cultivars ('Čačanska Rana', 'Čačanska Lepotica', 'Čačanska Najbolja', 'Čačanska Rodna' and 'Stanley') grafted on myrobalan (*Prunus cerasifera* Ehrh.) seedlings. Trees were planted at a spacing of 4 m × 2 m (1,250 trees ha^{-1}). Five-year results showed that the final tree vigour, expressed as trunk cross-sectional area (TCSA), was the lowest in 'Čačanska Lepotica' (39.92±0.90 cm^2) and the highest in 'Čačanska Rana' (75.01±2.20 cm^2) and 'Čačanska Najbolja' (82.86±2.18 cm^2). 'Čačanska Rodna' and 'Čačanska Najbolja' gave their first yields as early as the second year (1.08±0.08 and 1.47±0.10 kg tree^{-1}, respectively), whereas the first significant yields in all cultivars were obtained in the third year. Cumulative yield was the lowest in 'Čačanska Rana' (30.75±1.42 kg tree^{-1} and 38.44±1.77 t ha^{-1}), somewhat higher in 'Čačanska Najbolja', 'Čačanska Lepotica' and 'Stanley' (43.86±2.40 t ha^{-1}; 60.37±1.21 t ha^{-1} and 73.40±4.43 t ha^{-1}, respectively), and the highest in 'Čačanska Rodna' (66.36±5.13 kg tree^{-1} and 82.95±6.40 t ha^{-1}). However, 'Čačanska Rodna' had the highest biennial bearing index (0.61), whereas the other cultivars exhibited a moderate or poor biennial bearing habit during the experimental years. The lowest biennial bearing index was recorded in 'Čačanska Lepotica' (0.13). Yield efficiency was the lowest in 'Čačanska Rana' (0.12 kg cm^{-2}) and the highest in 'Čačanska Rodna' (0.41 kg cm^{-2}). The average fruit weight was in agreement with cultivar-specific traits, and ranged from 27.39±0.90 g in 'Čačanska Rodna' to 51.78±2.43 g in 'Čačanska Rana'.

Keywords: plum, high density planting, yield

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S2-O3

Evaluation of Some American Apricot Cultivars in the Region of Belgrade

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The evaluation of nine introduced apricot cultivars originating from the United States, was carried out in the region of Belgrade over a period of six years (2009 – 2014). Control cultivar for comparison was 'Hungarian Best'. Introduced cultivars flowered 2 – 5 days before the control, while their harvest occurred 3 – 17 days earlier than in the control cultivar. Compared to the control, significantly higher yield was achieved in 'Orangered', 'Tomcot' and 'Goldrich', while significantly higher fruit weight was found in 'Goldrich', 'Robada' and 'NJA-55'. Introduced cultivars had lower content of soluble solids than the control. Cultivars 'Goldrich' and 'Orangered' stood out for both fruit appearance and quality. Of the cultivars studied, the following can be recommended for growing in Belgrade region:'Goldrich' 'Orangered' and 'Tomcot'.

Keywords: *Prunus armeniaca*, flowering, maturing, yield, fruit quality

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S2-O4

Evaluation of Some Sweet Cherry Cultivars Suitable for the North - East Area of Romania

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Evaluation of sweet cherry cultivars suitable for North-Eastern area of Romania has great significance in this period for the private producers. In Romania is ongoing a national restructuring program for fruit trees culture and recommending new cultivars is very useful. During 2012 – 2014 ten sweet cherry cultivars were studied: 'Cătălina', 'Bigarreau Burlat', 'Mihailis', 'Bucium' 'Andreias', 'Van', 'Boambe de Cotnari', 'Margo', 'Alexus' and 'Kordia'. Some parameters related to phenological stages, fruit diameter, fruit weight, fruit firmness, skin colour and resistance to cracking of fruits, soluble solids content and ripening time were determined. Largest fruits size was measured in 'Alexus' with 10.1 g of fruit weight and 26.4 mm of fruit diameter. 'Margo' has yellow skin colour, 'Boambe de Cotnari' was bicolor, 'Cătălina', 'Bigarreau Burlat', 'Bucium' and 'Van' were shiny red and 'Mihailis', 'Andreias', 'Alexus' and 'Kordia' were dark red. 'Cătălina', 'Bigarreau Burlat' are early ripening cultivars, 'Mihailis', 'Bucium' 'Andreias', 'Van and 'Alexus' are medium ripening cultivars, 'Boambe de Cotnari' and 'Kordia' are cultivars with medium to late ripening time, while 'Margo' is a cultivar with late ripening time.

Keywords: *Prunus avium* L., phenology, fruit, ripening, quality

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S2-O5

Morphological and Pomological Variability of Some Autochthonous Cherry Varieties in Republic of Macedonia

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This paper considers description of morphometrical and pomological characteristics of several autochthonous cherry (*Prunus avium* L.) varieties ('Ohridska ranka', 'Crvena krcka', 'Ohridska crna', 'Dolga siska', 'Ohridska zolta rana', 'Bela docna', 'Dalbazlija', 'Ohridska brza', 'Bela cresa', 'Stambolka', 'Rozeva cresa', 'Koleska rana', 'Koleska', 'Bugarka', 'Ranica' and 'Maticka') grown in the region of Ohrid, Resen (South western part) and Strumica (South eastern part) of the Republic of Macedonia. The study has been performed during two consecutive years (2013 – 2014). The varieties were studied from the viewpoint of identification and characterization. The aim of the study was to description of morphological and pomological characteristics of autochthonous varieties grown in the local agroecological regions. Most of the studied varieties have a high risk of extinction since at the present are market minor varieties. The following characteristics were investigated: period of flowering and ripening, morphological characteristics of the leaves, fruit size, fruit weight, soluble solids, acidity of the fruits and description of quality characteristics of the fruits. Major characterization characteristics of the varieties were conducted using UPOV descriptor. The results have shown that among evaluated autochthonous varieties medium to strong vigour of the trees dominate with semi-upright to spreading habit. Flowering started between 10 April and 24 April and fruit ripening between 15 May ('Bugarka') and 10 July ('Crvena krcka'). Cordate fruit shape dominates at varieties from the region of Ohrid and Resen, while oblate fruit shape dominates at varieties that originate from Strumica region. Skin color ranged from yellow to blackish. 'Ohridska dolga siska' is characterized with the best quality of the fruits consider their weight (10.95 g). The lowest value for fruit weight was obtained at variety 'Bugarka' (2.39 g). The fruits of the above varieties could be used for fresh consumption. Some of selected cherry varieties can be used for commercial growing, while some of them can be used in breeding programs.

Keywords: fruits, genetic resources, *Prunus avium* L., germplasm

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S2-O6

First Results of Evaluation of Some Early Sweet Cherry Cultivars on Novel Bred Hungarian Mahaleb Rootstocks

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Evaluation of ten cherry rootstocks (‘Bogdány’, *Cerasus mahaleb* ‘Cemany’, ‘Egervár’, ‘Érdi V’, ‘Korponay’, ‘Magyar’, ‘SM 11/4’, ‘Vadcseresznye C.2493’, ‘GiSelA6’, control: ‘INRA SL 64’rootstock) combined with early ripening sweet cherry cultivars (‘Petrus®’, ‘Vera®’, ‘Carmen®’) has been studied under non-irrigated conditions at Experimental Fields of NARIC Fruitculture Research Institute (Central Hungary). Aim of our study was to find suitable rootstock(s) for novel bred Hungarian sweet cherry varieties. It can be stated after seven years investigation that ‘Petrus’ was the most vigorous variety, which is followed by ‘Vera’ and ‘Carmen’. The ‘GiSelA6’rootstock had the lowest vigor among examined rootstocks and ‘INRA SL64’was the most vigorous one in our trial. Trunk cross sectional area (TCSA) of ‘Petrus’ grafted on ‘SM11/4’ and ‘Bogdány’ was significantly bigger than on ‘C.2493’, ‘Egervár’ and ‘GiSelA6’rootstocks. Other rootstocks such as ‘Érdi V’, ‘Korponay’, ‘Magyar’ and ‘Cemany’ indicated high – moderate high vigor for ‘Petrus’. ‘GiSelA 6’/‘Vera’ combination had significantly smaller TCSA compared to combinations of ‘Vera’with other rootstocks. In the case of ‘Carmen’, rootstock ‘Cemany’ showed high, ‘Érdi V’, ‘C.2493’, ‘Egervár’, ‘Korponay’ indicated medium and ‘GiSelA6’produced low vigor. ‘Petrus’ produced the biggest yield and the smallest fruit size among observed cherry varieties. Yield of ‘Carmen’ grafted on ‘Érdi V’, ‘Egervár’, and ‘GiSelA6’was the highest, but only ‘Érdi V’ had a positive effect on fruit size because more than 40% of examined fruits were larger than28,1 mmin diameter. ‘Vera’ yielded well on ‘Érdi V’ and ‘Egervár’, while the best fruit size was produced on ‘Érdi V’. On the basis of value –yield index, which was calculated by actual market price per fruit size category, ‘Carmen’ produced the highest income per tree on ‘Egervár’ and ‘GiSelA6’and ‘Vera’ was the most valuable on ‘Egervár’, ‘INRA SL 64’, ‘and ‘Érdi V’ rootstocks.

Keywords: sweet cherry, rootstock, growth, yield, fruit size

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S2-O7

Vegetative and Productive Performances of 'Kordia' and 'Regina' Cultivars Grafted on Four Dwarfing Rootstocks in Alpe Adria Region

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The sweet cherry rootstock experiment was conducted in six locations in the Alpe Adria region: Verona and Sondrio (Italy), Bilje and Maribor (Slovenia), Haidegg (Austria) and Zagreb (Croatia). Four dwarfing rootstocks ('Gisela® 5', 'Gisela® 6', 'Piku 1', 'P-HL C'), grafted with 'Kordia' and 'Regina' were compared. After eight years of testing, the behavior of both cultivars showed no substantial differences, even though significant interactions were observed in some parameters, which lead to further analysis of rootstock, location and year effect. None of rootstocks showed superior performance in all parameters. Moreover, 'P-HL C' was the least interesting, as it had the lowest cumulative yield and yield efficiency along with high mortality and the highest sucker activity. In general, a positive correlation between the tree vigour and fruit weight was observed. Among the other three rootstocks ('Gisela 5', 'Gisela 6' and 'Piku 1'), the only significant difference is significantly lower vegetative growth of 'Gisela 5', with the same production efficiency, fruit weight, cumulative yield and tree mortality as 'Gisela 6' and 'Piku 1'. The results show that rootstock 'Gisela 5' functions well in good pedoclimatic conditions while in sub-optimal conditions not, so it is advisable to use 'Gisela 6' or 'Piku 1'. High mortality of 'P-HL C' was observed on all locations. The results of Sondrio, where tree mortality was the highest, show that none of tested rootstocks is resistant against replant disorders. There is a need to have vigorous trees, with good vegetative growth, which will allow a constant renewal of the foliage, avoid rapid ageing and prevent negative effect on fruit quality.

Keywords: sweet cherry, rootstocks, rootstock cultivar interaction, Alpe Adria

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S2-O8

The Performance of '0900 Ziraat' Sweet Cherry Variety on Different Rootstocks

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Determining the performances of new sweet cherry rootstocks which were grafted with '0900 Ziraat' cultivar was aimed. Six sweet cherry rootstocks ('Gisela 5', 'Ma×Ma 14', 'SL-64', 'Tabel- Edabriz', 'Weiroot 158', and Mazzard seedlings) were investigated from 2000 to 2009. This study was carried out in Egirdir Fruit Growing Research Station (37°49'17.97" N; 30°52'22.44" E). Trees were planted on calcareous (12% total lime), alkaline (pH 8.34) and loamy textured soil at 5 × 3 m distance. Central leader training system was applied in all trees. The orchard was subjected to the usual cultural practices including drip irrigation. At the end of the study, rootstocks were separated into three groups according to their vigor. 'SL-64' was vigorous, 'Ma×Ma 14' and Mazzard seedling rootstocks were semi vigorous, whereas 'Tabel-Edabriz', 'Weiroot 158' and 'Gisela 5' were semi dwarf. High tree death ratio was found on 'Weiroot 158' rootstock. Consequently, 'Gisela 5', 'Ma×Ma 14' and 'SL-64' are determined as suitable rootstocks for the interior of Anatolia and Lakes Region.

Keywords: *Prunus avium* L., 0900 Ziraat, rootstock, performance

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S2-O9

Frost Hardiness of Hungarian Bred Persian Walnut Varieties

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Knowledge of ecological demands of every fruit species and variety is essential to find the optimal growing site. Hungary is located at the northern border of walnut growing. The walnut is a Mediterranean fruit species, but under Hungarian climate conditions it can survive the temperature of –30°C without suffering frost damage. 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 during the year. Into our examination three Hungarian main varieties (‘Milotai 10’, ‘Alsószentiváni 117’, ‘Tiszacsécsi 83’), four Hungarian novel bred varieties (‘Milotai bőtermő’, ‘Milotai intenzív’, ‘Milotai kései’, ‘Alsószentiváni kései’) and a widely grown variety ‘Chandler’ were involved. To determine the frost hardiness of Hungarian bred Persian walnut varieties we made examinations between October 2014 and March 2015. One year old shoot samples were collected once a month from a commercial orchard. During this research period we started frost hardiness trial using climate chamber at the Department of Pomology of the Budapest Corvinus University. Three different temperature treatments were chosen per month. From obtained data the LT_{50} values (the lethal temperature for 50% of buds) were computed. Based on our results ‘Milotai 10’ and ‘Milotai intenzív’ varieties had similar frost hardiness. Also, ‘Milotai bőtermő’ and ‘Milotai kései’ varieties had similar frost hardiness, but in examined months they had higher tolerance to frost than ‘Milotai 10’. The deep dormancy period of ‘Alsószenitváni 117’ was shorter than ‘Alsószentiváni kései’. Among examined varieties ‘Tiszacsécsi 83’ had the highest tolerance against frost. The frost hardiness of ‘Chandler’ variety developed much slowly than in the other examined varieties.

Keywords: *Juglans regia*, walnut breeding, frost hardiness, LT_{50}, Hungary

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S2-O10

Evaluation of Fruit Bearing Habit of Apple, Sweet Cherry, Walnut and Strawberry Cultivars in Bulgaria - An Overview

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One of the main purposes of modern orchards is high quality fruits and regular cropping and to manage the tree shape and fruit load with minimal pruning, by taking advantage of the natural trends of the cultivar and thereby reducing the cost of this manual operation. This motivated us to start a bearing and age habit evaluation at our institute of cultivars from different fruit species – such as pome, stone, nut and small fruit groups. The fruit bearing habit as a part of fruit tree architecture was evaluated in apple orchards with 49 cultivars including 22 resistant to scab on 'MM106' and 'M9' rootstocks. According to Lesspinasse classification, the cultivars have been divided in four fruiting types: type I 'Starkrimson', type II 'Reine des Reinettes', type III 'Golden Delicious' and type IV 'Granny Smith'. The apple cultivars with type I and II have the fruiting spur habit related to biennial bearing and type IV to regular ones. The fruiting type of 9 sweet cherry cultivars on 'Gisela 5' rootstock have been divided in two types - type I 'Sunburst' ('Regina', 'Kordia', 'Lapins', 'Katalin') and type II-B. Burlat ('Nalina', 'Summit', 'Hudson'). According to the type of bearing habit of 7 walnut cultivars grafted on *Juglans regia* L. seedlings very promising under our climatic conditions are lateral cultivars 'Izvor 10', 'Fernor' and 'Lara'. The nut fruits on one- and two-year old wood have higher mean fruit and kernel weight than on three- and four-year old wood. The percentage of ripened strawberry fruits from first three pickings is more than 50% of the total crop from one-year old plants in cultivars 'Thetis', 'Don', 'Seascape', 'Bogota', 'Selene', 'Selva', 'Idea', 'Linda' than from two years old plants. The evaluated fruiting type led us how to improve and maintain good balance between vegetative and reproductive growth.

Keywords: apple, sweet cherry, walnut, strawberry, cultivars, bearing habit

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S2-O11

The Importance of *Pistacia* Species for Pistachio Production in Turkey

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The genus *Pistacia* L. is a member of the family *Anacardiaceae* which also includes cashew, mango, poison ivy, poison oak, pepper tree and sumac. The genus consists of eleven or more species. In South-eastern Anatolian region of Turkey *P. vera* L., *P. terebinthus* L. and *P. khinjuk* Stocks and their natural hybrids are widely spread. *Pistacia terebinthus* is mainly present in the provinces of Gaziantep, Adiyaman, Kahramanmaraş and Sanliurfa. *Pistacia khinjuk* is found in Siirt, Hakkari, Gaziantep, Adiyaman, Bitlis. *Pistacia vera* and its hybrids are present in Gaziantep and Kahramanmaraş. In Mediterranean and Southeast Eagean region *P. atlantica*, *P. mutica*, and *P. terebinthus* are widely spread and some wild trees of *P. palaestina* and *P. lentiscus* can be also found in this region. In Eagean region *P. atlantica*, *P. mutica* and *P. terebinthus* are widely spread. *P. palaestina* and *P. lentiscus* can also be found here. In Central Anatolia, transitional areas between Central Anatolia and Mediterranean and transitional areas between Central Anatolia and Aegean Sea Region in some areas stands of *P. vera*, *P. atlantica*, *P. terebinthus* and *P. mutica* can be found. Mainly *P. khinjuk*, *P. terebinthus*, *P. atlantica*, *P. khinjuk*, *P. palaestine* and *P. mutica* are is distributed in Turkey. Except *P. mutica*, the others are using as rootstock for *Pistacia vera* cultivars. The best rootstocks seem to be *P. khinjuk* for the all types or cultivars of pistachio nut. The weak or dwarf rootstock is *Pistacia terebinthus* for pistachio cultivars when it is budded on it. There are some research results on pistachios budded or used as rootstock on some *Pistacia* spp. The incompatibility problem can occur between *Pistacia vera* seedlings and cultivars. This problem is solving using *Pistacia khinjukas* interstocks.

Keywords: *Anacardiaceae*, *Pistacia* spp., pistachio, rootstock

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S2-O12

Investigation of Different Olive Varieties for Some Biochemical and Pomological Characteristics during Maturation

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Olive (*Olea europaea* L.) has great genetic variation in Turkey as important crop due to its economic value. There are many varieties, types and landraces which have various morphological characters in different ecological conditions of Turkey, having good potential for productivity, oil quality and table olive characters. Northwestern region of Turkey with cool subtropical climate has most suitable ecological conditions for highest quality olives and olive oils. This research was carried out to compare some biochemical and pomological characteristics of eight local olive varieties named 'Ayvalık', 'Domat', 'Edincik Su', 'Gemlik', 'Karamürsel Su', 'Memecik', 'Samanlı' and 'Uslu', which are widely grown in Turkey. Varieties were collected in periods of 10 days from 15th September to 22th December in 2014. In this research fruit width (mm), fruit length (mm), fruit shape index (length/width), fruit shape, 100 fruits weight (g), seed width (mm), seed length (mm), seed shape index (length/width), seed shape, 100 seeds weight (g), percentage of water in fruit (%), percentage of fruit flesh (%), maturity index (MI), chlorophyll-a (µg ml^{-1}), chlorophyll-b (µg ml^{-1}) and total carotenoid (µg ml^{-1}) were assessed. According to the results, concentrations of chlorophylls (chlorophyll-a and chlorophyll-b) decreased although concentration of carotenoids increased when skin color of fruit is turning red, purple or black more than half of the surface (MI>3 and MI=4). Besides, fruit size enlarged with the increase of maturity.

Keywords: olive, *Olea europaea* L., local olive varieties, pomological characteristics, maturity index

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S2-P1

Agrobiological Characteristics of Apple (*Malus domestica* Borkh.) Cultivars

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The study was conducted during the period 2010 – 2014 in an apple plantation of the Institute of Agriculture – Kyustendil (Bulgaria). The aim was to investigate five new introduced apple cultivars under the conditions of the region. The apple trees (5 from each cultivar) were grafted on rootstock MM 106 and planted in 2002 at the distance 4.5 × 2.4 m. Cultivars 'Prima' and 'Granny Smith' were used as standards. The earliest vegetation was observed in 'TSR' on 27 March. The blooming period for all cultivars was in the frame from 11 to 15 days. From the beginning of vegetation until the start of blooming were necessary 42 – 44 days and temperature sum over 5°C from 145.9 to 151.5°C. According to ripening time, 'Ginger Gold' and 'Arkchari' are summer, while the others are winter cultivars. 'TSR' and 'Arkchari' had the weakest growth expressed by the trunk cross-sectional area. The average yield per tree and cumulative coefficient of productivity were the highest for 'Rosana' and 'TSR'. The highest fruit weight was recorded in 'TSR' (179.4 g) and 'Arkchari' (174.6 g) and the least in 'Rosana' (95.2 g). The fruit of 'TSR' had the highest firmness, percentage of soluble solids (15.38%) and total sugars (8.19%).

Keywords: apple, flowering, ripening, temperature sums, yield

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S2-P2

Comparative Study of Apple Rootstocks 'M9-T337' and 'Supporter 4 Pi 80' in Orchard with Seven Cultivars

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Vegetative and reproductive characteristics of rootstocks 'M9-T337' and 'Supporter 4 Pi 80' budded with the cultivars 'Breaburn Fenbra', 'Gala Venus - Fengal', 'Golden Delicious clone B', 'Pinova', 'Red Delicious Hapke', 'Red Delicious Redkan' and 'Rubinfuji Romf. 811' were compared in the intensive orchard planted at the density of 2380 trees per hectare (3.5 × 1.2 m) in the period 2008 – 2011. Trees were formed as tall spindle. It was found that, with the exception of the cultivar 'Pinova', rootstock 'Supporter 4 Pi 80' induced a greater trunk cross section area, higher trees and greater crown volume to the tested cultivars in comparison with 'M9-T337' rootstock. A higher yield per unit area was obtained on 'Supporter 4 Pi 80' rootstock compared to 'M9-T337' budded with low vigorous cultivar 'Red Delicious Redkan', whereas 'M9-T337' was superior on this parameter in combinations with 'Breaburn Fenbra', 'Gala Venus - Fengal', 'Red Delicious Hapke' and 'Rubinfuji Romf. 811'. The rootstock 'Supporter 4 Pi 80' favors formation of larger fruits at the cultivars 'Golden Delicious clone B' and 'Red Delicious Redkan'.

Keywords: apple, rootstocks, vigor, productivity, fruit weight, yield

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S2-P3

Growth and Yield Characteristics of Quince Cultivars

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The characteristics of growth and yield of seven cultivars of quince 'Vranjska', 'Morava', 'Pazardzijska', 'Hemus', 'Asenica', 'Portugal' and 'Triumph' were studied in the Belgrade region during the four-year period (2010 – 2013) in comparison with the cultivar 'Leskovacka', which was used as the standard. The tested cultivars were significantly different in terms of vigour and productivity. The lowest vigour was shown by 'Leskovacka' cultivar and the highest by 'Portugal', 'Morava' and 'Triumph'. The cultivars that had greater vigour, also demonstrated the higher yields per tree and per unit area. The highest yield per tree and per unit area was found in 'Triumph' and 'Portugal' cultivars, and the lowest in standard cultivar. With the exception of 'Vranjska' and 'Pazardzijska' cultivars, the other cultivars had significantly higher yields per tree and per unit area than the standard cultivar. Although 'Leskovacka' cultivar had the lowest yields per tree and per unit area, due to low vigour, it had higher yield efficiency than most of the studied cultivars. Based on the cropping potential, for commercial growing 'Triumph' and 'Portugal' can be recommended. Also, these cultivars are good starting material in quince breeding and creating new cultivars of high cropping potential.

Keywords: *Cydonia oblonga*, vigour, yield, yield efficiency

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S2-P4

Some Growth and Reproductive Traits of Six Plum Cultivars

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An analysis of the vegetative growth and bearing within the tree canopy of six plum cultivars was conducted. The tree crown, angle of skeleton branches and annual shoot length was measured. The bearing potential was described by accounting the number of flower buds on spurs and annual shoots as well as the number of fruits on different parts of skeleton wood. It was found that the trees of cv. 'Bellamira' are the most vigorous. Crown volume of 'Jojo' and 'Stanley' is smaller in comparison to the other investigated cultivars. The main fruiting wood are spurs. Cultivars 'Jojo', 'Topgigant Plus' and 'Bellamira' distributed the basic part of fruits on one and two year old wood, whereas the fruits of 'Stanley' are along the entire length of the skeleton branches.

Keywords: *Prunus domestica* L., vegetative growth, fruiting branches, bearing potential

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S2-P5

Performance of Some Plum Cultivars under Agroclimatic Conditions of Plovdiv Region, Bulgaria

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Plum is a traditional fruit crop in Bulgaria. South Central region, represents 22.2% of the total area occupied with plum trees. In this study are presented the results of four years investigation on ten plum cultivars carried out at the Fruit Growing Institute in Plovdiv. 'Stanley' was used as a standard. The observed phenological characteristics included flowering and fruit ripening. The cultivars 'Tophit Plus' and 'Toptaste' are the earliest flowering, whereas 'Topstar plus' is the latest one. Fruits of 'Topfirst' cultivar ripen at the beginning of July, those of 'Top' and 'Tophit Plus' in September and all the rest in August. According biometrical analyses, fruit weight of 'Topgigant plus' and 'Tophit Plus' is over 60 g. The total soluble solid content in the studied cultivars varies from 15.7% in 'Top' cultivar to 24.75% in 'Toptaste'. Yield was determined and expressed in kg per tree. Over 30 kg per tree was harvested from the cultivars 'Stanley', 'Jojo', 'Topgigant Plus' and 'Tophit Plus'. The lowest yield was obtained from the cultivars 'Top', 'Topfive' and 'Toptaste'. In 2012, the percentage of flower buds destroyed by frost was evaluated. The lowest degree of damages was reported in the cultivars 'Tophit Plus', 'Topgigant Plus' and 'Mirabelle de Nancy' – below 10%, and the greatest damages – in 'Toptaste' – 51%. According the obtained results, the most suitable plum cultivars recommended to be grown in Plovdiv region, are 'Jojo', 'Topgigant Plus' and 'Tophit Plus', as well as the cultivar 'Bellamira' from the group of Mirabelle plum.

Keywords: *Prunus domestica* L., fruit characteristics, chemical composition, yield

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S2-P6

Introduction and Evaluation of Nectarine Cultivars in Crimea

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In 2015 the collection of Nikita Botanical Garden comprises 156 cultivars and forms of nectarine. It was noticed that Central Asian cultivars of nectarine (from Syria, Azerbaijan, Tajikistan, Uzbekistan) are characterized by fruit of medium size, rounded and ovate form, yellow or white pulp, predominantly fibrous consistence and cover coloration of 50 – 70%. Tasting assessment of fruits ranged from 3.0 to 4.8 points (according to the 5 point scale). The best pomological qualities within this group were demonstrated by cultivars 'Kzil Shalili', and 'Sorok let Uzbekistana'. All the cultivars have the medium and late terms of ripening. Fruits of West European cultivars (from Great Britain, Italy, Spain) vary from small to big, round form, with yellow or white pulp of fibrous consistence. Cover coloration of fruit was predominantly from 75 to 100% of the surface. Tasting assessment of fruits varied from 3.8 to 4.6 points. The best pomological qualities were demonstrated by cultivar 'Venus'. Eastern European cultivars and forms (from Czech Republic, Bulgaria, Russia, Ukraine, Moldova) are characterized by small and medium fruits, predominantly with yellow fibrous pulp and tasting assessment from 3.0 to 4.8 points. The best cultivars of this group are 'Kievskij', 'Skif', 'Hemus'. Among the cultivars of Chinese origin may be allocated only cultivar 'Kohinhinskij' that characterizes by big fruits with fine taste. Cultivars of North American origin (USA) are characterized by fruits predominantly medium of extra big size. Fruits are flat-round, round and ovate by their form. Cultivars with yellow pulp of fibrous consistence and intensive (75 – 100%) cover coloration of fruits are predominant. Tasting assessment of fruits ranged from 3.0 to 4.8 points. The best marketable qualities and taste features were demonstrated by cultivars 'Le Grand', 'Red Gold' and 'Big Top'. Thereby for nectarine breeding and improving taste and marketable qualities of fruits the most perspective way is to use the cultivars of North American origin.

Keywords: nectarine, introduction, breeding, cultivar evaluation, pomology

Acknowledgement: This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

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S2-P7

Evaluation of Apricot Cultivars under South Central Bulgaria Conditions

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Apricot fruits are preferred by consumers because of their attractiveness and good taste. Not all the regions in Bulgaria are suitable for apricot growing. This is the reason to evaluate some cultivars under the climatic and soil conditions of the Plovdiv area in South Central Bulgaria, which is not a typical apricot region. Twelve apricot cultivars were estimated in the present study. The following characteristics were studied: flowering and ripening period, fruit dimensions, and some fruit chemical data like total soluble solid content, total sugar, acidity and pH value. The susceptibility of flower buds to late winter frost was determined in 2012. According to the summarized data, the cultivars 'Harcot', 'Krupna Skopijanka', 'Lito', 'Harlayne', 'Bebeco' and 'Hungarian Best' showed good adaptability and are suitable for cultivation in the region of Plovdiv, but keeping in mind that the last two are known to be susceptible to Plum pox virus.

Keywords: *Prunus armeniaca* L., fruit characteristics, chemical composition, frost resistance

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S2-P8

Monitoring and Preservation of Old Cherry Varieties

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The cherries have the attractive fruits suitable for direct consumption and industrial processing. They were traditional fruit trees in the past and today are very popular too. Therefore, the maintenance of old native trees of this species is justified, both within the preservation of cultural heritage and as a part of biodiversity conservation. Project objectives are monitoring of old cherry varieties in the Slovak Republic, evaluation of their molecular variability, occurrence of economically important and emerging viruses of red stone-fruits and development of molecular techniques for sensitive and specific detection. At present researchers from Gene Bank of the Slovak Republic focus on the collecting activities and monitoring of the species belonging to *Prunus* genus. The nine localities of cherries occurrence in Slovakia were monitored in 2014 and 130 samples of plant material (flowers, young leaves on testing viruses) were obtained. Basic description and evaluation was carrying out according to Descriptor List for Cherries (ECPGR). From the all samples, 35 best genotypes were obtained which have been grafted on the appropriate rootstocks in the area of the Research Institute of Plant Production in Piešťany. All obtained samples were tested and characterized of Little Cherry Virus-1 (LChV-1) presence. The virus was recently detected in Czech Republic and Poland, which prompted the survey of its potential incidence in Slovakia. Activities concerned with the monitoring of the old cherry varieties will continue in 2015 year in the East region of Slovakia.

Keywords: cherries, genetic resources, virus, biodiversity, evaluation

Acknowledgement: This work is supported by the grant APVV-0174-12 from the Slovak Research and Development Agency.

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S2-P9

Rootstock Influence on Vigour, Fruit and Leaf Properties of Sour Cherry Cultivars

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One of the most important prerequisites for the successful sour cherry production is the adequate choice of the rootstock. The rootstock primarily affects the vigour of grafted cultivar which directly reflects on planting distance, growing habit and harvesting costs. In addition, the most important agricultural traits such as the flowering and ripening time, fruit set, yield, fruit size and quality can be strongly influenced by the rootstock. In order to regulate tree vigour in a better way, besides generative and vegetative rootstocks, interstocks can be used as well. One of the most commonly used interstock is low-vigour autochthonous sour cherry cultivar 'Oblačinska'. Therefore, the aim of this study was to determine how different rootstocks and the 'Oblačinska' as interstock affect the vigour, and fruit and leaf properties in different sour cherry cultivars. The trial included four rootstocks (wild cherry seedling, Mahaleb seedling, Colt and wild cherry seedling with 'Oblačinska' sour cherry as interstock) grafted with four sour cherry cultivars ('Meteor Korai', 'Rexelle', 'Heimanns Konservenweichsel' and 'Kelleris 14'). The variability of most properties, in addition to genotype, was very significantly influenced by rootstocks. Within studied cultivars 'Meteor Korai' had the highest, while 'Kelleris 14' showed the lowest vigour. At the same time, cultivar 'Kelleris 14' had the highest fruit weight and maximum leaf area. Regarding the influence of the rootstock, the highest average values of the majority of the studied traits were established on generative rootstocks, slightly less on the vegetative rootstock Colt, and the lowest on wild cherry seedling with 'Oblačinska' as interstock. Since the usage of 'Oblačinska' as interstock had significant impact on vigour reduction in the majority of studied cultivars, further research should be continued in this direction.

Keywords: Mazzard seedling, Mahaleb seedling, Colt, interstock, Oblačinska sour cherry

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S2-P10

Influence of Fruiting Twig Type on Fruit and Leaf Traits in 'Oblačinska' Sour Cherry Clones

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The 'Oblačinska' sour cherry (*Prunus cerasus* L.) is an autochthonous and heterogeneous cultivar showing high variability in traits related to the composition of fruiting twigs. The differences observed between fruits and leaves not only among different clones but between different fruiting branches show that there is variability for some physical parameters among the fruits and leaves of the same tree which later affects productivity level. So, the aim of this study was to determine the effect of the type of the fruiting branch (spurs and shoots) to fruit and leaf traits. Plant material used in this trial comprised of 13 'Oblačinska' sour cherry genotypes. The study was done in four consecutive years at the Experimental Farm 'Radmilovac' that belongs to the Faculty of Agriculture, University of Belgrade. All studied traits were highly genotype and year dependent. The effect of the fruiting branch was found to be highly significant for stone weight, leaf size and leaf area, but not for fruit and chemical traits. Correlation analysis showed that studied traits are not correlated in the same way comparing spurs and shoots. The highest mismatch in the coefficient of correlation was shown between chemical properties on one side and morphologic traits of fruit and leaf on other.

Keywords: *Prunus cerasus*, clone, spur, shoot

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S2-P11

The Vigor Effect on Fertility and Fruit Quality Traits in 'Oblačinska' Sour Cherry Genotypes

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Clonal selection of 'Oblačinska' sour cherry showed significant differences within genotypes and pointed out the fact that there are differences in terms of vigor which provides the ability of cultivation under different systems for this cultivar. In this regard, the goal of this study was to examine the variability and correlation between vigor properties, yield components and fruit quality. Plant material used in this trial comprised of 41 'Oblačinska' sour cherry genotypes, while the experiment was done in three consecutive years at the Experimental Farm 'Radmilovac' that belongs to the Faculty of Agriculture, University of Belgrade. By applying multivariate statistical analysis such as Principal Component Analysis (PCA) the most important traits were singled out, and by Cluster Analysis (CA) studied genotypes were clustered. Observed differences between years of study for almost all examined traits, indicate a high influence of environmental conditions on these parameters. Also, significant or very significant, positive or negative, correlations were found between some properties. PCA analysis suggested that leaf size, fruit size, vigor, fruit set and soluble solids content could be sufficient for determination of genotypes. CA grouped genotypes in two clusters, where the second one was built of three sub-clusters. Genotypes with low vigor and high yield potential were proved to be interesting for following breeding programs and cultivation.

Keywords: *Prunus cerasus*, vigor, PCA, cluster analysis

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S2-P12

Evaluation of Some Almond Cultivars and Selections in Serbia

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This research was conducted to compare biological and pomological characteristics of 15 almond genotypes selected in Serbia with cultivars 'Marcona', 'Texas' and 'Troito'. Evaluation of blooming and harvest time, yield and pomological characteristics of nut and kernel was done during the five year period (2010 – 2014) in Surduk (Northern Serbia). Earliest blooming time was observed in selections 15/03 and 23/03 (March 26) and the latest in 'Texas' (April 5). The average time of harvesting was the last week of August and the first week of September. The highest yield per tree was found in 'Marcona' and 'Texas'. Fruit weight ranged from 3.83 to 6.20 g, kernel weight ranged from 0.64 to 1.33 g and kernel percentage from 13.4 to 32.3%. On the basis of all observed characteristics, selections 12/03, 24/03, 25/03, 28/03 and cultivars 'Troito' and 'Texas' can be recommended for growing in the region of Surduk, and for further observation in other parts of Serbia.

Keywords: *Prunus dulcis*, blooming, harvesting, yield, nut, kernel

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S2-P13

Evaluation of Semi-Erect Blackberry (*Rubus* subgenus *Rubus* Watson) Cultivars Grown in Serbia

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The main focus of our study was to investigate differences in ripening time, standard parameters of productivity (number of fruiting branches and fruits per cane, yield per cane and yield per bush) and fruit quality (fruit weight, index of fruit shape, soluble solids content – SSC and titratable acidity – TA), and also of nutritional value (total anthocyanins – TACY and total phenolic content – TPC) of two introduced semi-erect blackberry cultivars 'Lochness' and 'Triple Crown', and domestic cultivar 'Čačanska bestrna' as a prevailing one in blackberry plantations in Serbia. Results from this study showed that the earliest first picking date was observed in 'Lochness' (26th June), whereas 'Triple Crown' was the most late cultivar (16th July). 'Čačanska Bestrna' exhibited consistently higher values for parameters of productivity achieving significantly higher yields (5.94 kg/cane) in comparison to other studied cultivars. This cultivar is also characterized by the highest average fruit weight and index of fruit shape (9.67 g and 1.27, respectively). Significantly lower average fruit weight was recorded in 'Lochness' (5.65 g), whereas 'Triple Crown' had the lowest index of fruit shape (1.13) corresponding to conical forms. 'Triple Crown' also exhibited the highest level of SSC (13.5%), followed by 'Lochness' (12.3%). Čačanska Bestrna' had significantly higher TA (1.57%) in comparison to the other cultivars. Regarding the nutritional value of studied cultivars, 'Lochness' ranked the highest in TACY and TPC (69.1 mg of cyanidin-3-glucoside equivalent per 100 grams of fresh weight and 14.8 mg of gallic acid equivalent per gram of fresh weight, respectively). In general, introduced cultivars 'Lochness' and 'Triple Crown' demonstrated better outer and inner fruit quality traits than cultivar 'Čačanska Bestrna'. Furthermore, these cultivars could be considered as genotypes with enhanced consumer acceptability.

Keywords: cultivar, yield components, fruit weight, soluble solids, total anthocyanins, total phenolics

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S2-P14

Study of Adaptation of Five Introduced Varieties of Sweet Chestnut in Istria County (Croatia)

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In Croatia, in the County of Istria, there are about 150 ha of forest areas where sweet chestnut (*Castanea sativa* Mill.) is growing. Regional varieties are usually associated to the very small and small fruits, and are very susceptible to the chestnut blight and chestnut gall wasp (*Dryocosmus kuriphilus*). Due to that, our aim was to introduce new varieties of larger fruits and more resistant to pests and diseases (chestnut blight and gall wasp) and to determine their morphological characteristics. The experimental orchard was planted in Rovinj, within the company Skink Ltd., located in Valalta bb, with five different varieties of European × Japanese hybrids: 'Marsol', 'Maraval', 'Marigoule', 'Precoce Migoule', 'Bouche de Betizac' and two regional varieties: 'Istrian maroon' and "kostanj". During the growing seasons of 2013 – 2014, the growth stages and the resistance to the disease and pests were observed, and the measurements of weight and fruit dimensions were made. The variety 'Bouche de Betizac' showed the earliest maturation of fruits, while the latest one was the variety 'Maraval'. The most resistant variety against gall wasp and blight was 'Bouche de Betizac'. The heaviest fruits were measured at variety 'Marigoule' (22.7 g), and the lightest at variety of 'Istrian kostanj' (7.1 g). 'Marsol' and 'Bouche de Betizac' chestnuts were the biggest, while varieties 'Precoce Migoule' and 'Istrian kostanj' had the smallest fruits. Due to the favourable climate, the extended production was present at the end of October, giving fruits within varieties 'Marsol' and 'Bouche de Betizac'. Based on the current research in environmental conditions of western Istria, we can conclude that the introduced varieties proved to be better at monitored and measured parameters compared to the local population.

Keywords: *Castanea sativa* Mill., fruit, Istria, varieties, pest and disease resistance, sweet chestnut

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S2-P15

Strawberry (*Fragaria* × *ananassa* Duch.) cv. 'Rumba' Assessment for Cultivation in Northern Climatic Conditions

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Strawberry cultivar offer is large and varied. The assortment changes each year. There are options to choose the best cultivar according to different parameters. Overall, growers pay attention to the appearance and productivity, as well as eating quality. Dutch cv. 'Rumba' is one of the newest, but already is becoming increasingly popular for cultivation in different European countries and different production systems. To get the cultivar growers favor it must have a certain set of characteristics to not only enter the market, but also for some time stay in it. In order to evaluate the cultivar's 'Rumba' suitability for specific growing conditions, this study also includes cultivars of strawberries, which are already popular in cultivation – 'Honeoye' and 'Sonata'. The first is rather early and there are not many such cultivars so it is popular in growing. Cv. 'Sonata' has good yields and berry quality that consumers like. This study was conducted in different farming systems from year 2010 to the 2015 at LSIFG. Evaluated traits were potential and actual yields, fruit quality and fruit shelf life after harvest. Although the cv. 'Rumba' has early ripening time, it is not as early as the cv. 'Honeoye', but on average five days later. Cultivar's 'Rumba' potential yield is lower than the cv. 'Sonata' yield, but higher than the cv. 'Honeoye'. 'Rumba' has better berry quality than the other two cultivars and excellent fruit storage after harvest. During the study years this cultivar had no symptoms of frost damage. However, it is recommended to grow only in very good locations in Latvia, since it tends to be destroyed by frost, as reports by other growers show.

Keywords: open field, FVG tunnel

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S2-P16

Evaluation of Blackcurrant Cultivars for Use as a Table Fruit

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The objective of this study was to evaluate 12 perspective blackcurrant cultivars in relation to their suitability for table fruit production. Selected traits (fruit set, beginning of picking ripeness, length of cluster, weight of 100 fruits, fruit firmness and fruit taste) were evaluated in observed cultivars. Each cultivar was grown in experimental planting of RBIP Holovousy Ltd. and was represented with three individuals in two growing technologies – as two-stem spindle with support and shaped bush. Planting was covered with foil mounted on the construction. Foil cover was used to obtain higher fruit quality, to protect plants against negative climatic factors and to allow harvest in optimum time regardless on the weather conditions. Results showed in most cases more attractive fruits using the technology of two-stem spindle compared with shaped bush. The longest clusters were found in cultivars 'Lota', 'Triton', 'Fokus' and 'Ometa'. The best taste was detected in cultivars 'Ometa', 'Démon', 'Fokus' and 'Ceres'.

Keywords: *Ribes nigrum* L., growing technologies, fruit quality

Acknowledgement: This work was supported by project NAZV QI111A141. Infrastructure of project CZ.105/2.1.00/03.0116 was also used.

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S2-P17

Comparison of Gooseberry Cultivars in Relation to Their Suitability for Table Fruit Production

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The aim of this work was to evaluate average weight of fruits, yield parameters and the level of fruit infection caused by pathogen *Podosphaera mors-uvae* (Schwein.) U. Braun & S. Takamatsu in 21 gooseberry cultivars. Standard fungicidal protection was applied in experimental planting with two growing technologies – two-stem spindle with support and shaped bush. Each cultivar was represented with three individuals in both technologies. Planting was covered with foil mounted on the construction to obtain higher fruit quality. Controlled irrigation system and ground foil cover were also used. The highest average weight of fruits was found in cultivar 'Mucurines' in two-stem spindle technology and in cultivar 'Rodnik' in shaped bush technology. Cumulative yield of each cultivar was observed in the second and third year of cultivation. Average yield per year was calculated and expressed in grams per plant of each cultivar. The highest yield was found in cultivar 'Hinnonmaki Rot' in the bush variant. The highest value of this trait in two-stem spindle technology was detected in cultivar 'Karmen'. The absence of powdery mildew occurrence was found only in 4 cultivars ('Hinnonmaki Rot', 'Karát', 'Krasnoslavjanskij' and 'Rodnik') in both technologies and in another 4 cultivars in two-stem spindle technology ('Černý neguš', 'Mucurines', 'Reflamba', 'Remarka').

Keywords: *Grossularia uva-crispa* (L.) Mill., yield, growing technologies, *Podosphaera mors-uvae* (Schwein.) U. Braun & S. Takamatsu

Acknowledgement: This work was supported by project NAZV QI111A141. Infrastructure of project CZ.105/2.1.00/03.0116 was also used.

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S2-P18

Effects of Some Rootstocks on Phenological and Pomological Features of 'Siirt' and 'Ohadi' Pistachio Cultivars

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This study was done at the orchard of "Ceylanpınar State Farm" which is a very big governmental farm in Sanliurfa at Southeast Anatolia region. Four rootstocks (*P. vera* L., *P. khinjuk* Stocks., *P. terebinthus* L. and *P. atlantica* Desf.) were selected and two cultivars ('Siirt' and 'Ohadi') budded on them were selected. In this experiment phenological observations in spring and pomological analyses of harvested nuts were done. The effects of different rootstocks on flowering time and flowering period of cultivars were found. Generally the flowering period was longer onto *P. atlantica* rootstock. According to results of pomological analyses, the weight of fruits was higher in the cultivars budded on *P. atlantica* rootstock. The nuts length was higher in the cultivars budded on *P. vera*. The effectiveness rate of physical traits, such as splitting, blank and filled nuts, was varied either among rootstocks or cultivars. The effects of rootstocks and cultivars on weight, length, width and thickness were different on shelled nuts and kernels.

Keywords: pistachio, rootstock, phenology, pomology

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Section 3.

PHYSIOLOGY AND ECOLOGY OF FRUIT TREES

S3-O1

Effect of Varieties on Evaluation of Leaf Analysis of Apple Trees

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Leaf analysis is used as a standard method for determination of the nutritional status of apple orchards in the middle of vegetation. However, the differences among varieties are not taken into consideration in the evaluation of the results of leaf analysis. In 2010 – 2011 years, this study was performed on leaves collected from two different regions in Isparta where apple is cultivated for determining the effect of cultivars on evaluation of the results of leaf analysis. In the middle of vegetation, leaves were collected from 60 orchards which consist of 'Starking Delicious', 'Golden Delicious', 'Granny Smith' and 'Spur Delicious', and contents of N, P, K, Ca, Mg, Mn, Zn, and B were determined. The cultivars showed statistically significant differences in terms of N, P, K, Mg and B contents. According to the results of this study, it was determined that cultivars should be taken into consideration in the evaluation of the results of leaf analysis.

Keywords: apple, cultivar, leaf analysis

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S3-O2

In vitro Multiplication of Low Vigorous Pear Rootstock in Relation to Cytokinin Types

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The most important aspect of successful micropropagation, among other *in vitro* factors, is to use the optimal types and concentrations of plant growth regulators. With the aim of optimization of *in vitro* multiplication of pear rootstock 'Pyrodwarf' the effect of different cytokinins have been studied: benzyladenine (BA), isopentenyl adenine (2iP), kinetin (KIN) and thidiazuron (TDZ) at concentrations of 0.2, 0.4, 1, 2 and 3 mg/L, singly and combined with auxine, indole-3-butyric acid (IBA) at concentrations of 0.1, 0.5 and 1 mg/L. Murashige and Skoog (1962) was the basic medium used in all combinations. The following multiplication parameters were monitored: multiplication index, length of axial and lateral shoots. Some specific issues, such as colour, leaf and callus size, incidence of chlorosis or necrosis along with occurence of rhyzogenesis, were also monitored. The highest multiplication index was obtained on medium with 1 mg/L BA and 0.1 mg/L IBA, however the highest length of axial and lateral shoots was obtained on media also with 1 mg/L BA without and with 0.5 mg/L IBA, respectively. Generally, very poor multiplication was achieved on media with 2iP, KIN and TDZ whereas in many utilized combinations with 2iP and KIN, rhyzogenesis was induced. Obtained results suggest that the choice of cytokinins for the phase of multiplication (in regard to all monitored parameters) of 'Pyrodwarf' rootstock is limited to BA. However, KIN and 2iP in smaller concentration could be used for obtainment of sturdy and long shoots (elongation phase, prior to rooting), but also for rooting phase. Obtained results undoubtedly suggest that the cytokinins type and concentration suitable for micropropagation of woody plants may depend on plant species, i.e. are probably genotype dependent.

Keywords: 'Pyrodwarf' rootstock, cytokinins, *in vitro* multiplication, root induction

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S3-O3

Shoot Growth Pattern and Degree of Bud Differentiation in Apricot as the Basis of Fruiting Potential Modelling

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The degree of differentiation of apricot generative buds undergoing dormancy is quite varied and dependent on a number of factors, including climatic conditions, cultural practices, cultivar, etc. Differences in bud differentiation degree are particularly evident in different waves of long fruit-bearing shoot growth. The highest degree of bud differentiation is observed in the first growth wave, with the buds exhibiting higher resistance to low winter temperatures during physiological dormancy and ecological dormancy, as well as higher fruiting potential. However, in certain years, depending on climatic conditions at the beginning of the growing season and flowering, higher fruiting potential is realised from the generative buds in the second and third waves of growth. These buds have a lower degree of differentiation, and during their development at the beginning of the growing season they show delayed development, thus avoiding climate-related stress that adversely affects the buds in the first growth wave developing at an earlier stage. Histocytological analyses of the degree of differentiation of generative buds during the different waves of long shoot growth in two apricot cultivars under the environmental conditions of Banjaluka in 2011 and 2012 show variation in bud development dynamics depending on the wave of growth from which the buds arise. The degree of differentiation obtained had a very strong effect on fruit set and fruiting. Modelling agricultural and pomological practices for controlled induction of different growth waves for each cultivar under the specified environmental conditions requires setting limit values for the degree of differentiation of apricot generative buds during shoot growth waves to provide the basis for the control of fruiting under the defined agro environmental conditions.

Keywords: growth waves, generative buds, fruit set and fruiting

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S3-O4

Effects of (22S, 23S)-Homobrassinolide and Gibberellic Acid on Formation of Double Fruits in 'Bing' Sweet Cherry

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Two plant growth regulators (22S, 23S)-Homobrassinolide and gibberellic acid (GA_3) were tested on 'Bing' sweet cherry trees to determine their effects on formation of double fruits. The substances were applied with a handgun sprayer at transition stage from sepal to petal differentiation for a 2-year period. GA_3 was applied at the concentrations of 25, 50, 100 mg L^{-1} and (22S, 23S)-Homobrassinolide was applied at 0.05, 0.1, 0.5 mg L^{-1}. The effect of (22S, 23S)-Homobrassinolide and GA_3 treatments on the occurrence of doubling on buds, flowers and fruits were investigated. The results showed that the frequency of occurrence of double fruits in the first year was lower than in the second year. The percentage of doubling (buds, flowers and fruits) was increased by all applications of (22S, 23S)-Homobrassinolide. GA_3 decreased double ovaries during full bloom and the percentage of double fruits in the second year. In all the experiments (except for 25 mg L^{-1} GA_3) the frequency of double pistils at full bloom was lower than that observed in the buds in previous autumn.

Keywords: *Prunus avium*, double pistils, abnormal formation

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S3-O5

Effect of the Kaolin Application on the Almond (*Prunus dulcis* Mill.) Tree Performance

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With the increase in average temperature and water shortage that our planet is facing, leading to decreased tree growth and development, and ultimately to the reduction in productivity, different substances, such as kaolin, have been tested to reduce this problem. Kaolin is a clay particle film used to mitigate negative effects of water and heat stresses and its use may enhance the yield and influence the quality. Almond tree (*Prunus dulcis* Mill.) is one of the crops grown in the areas where the water supply is limited, being an interesting crop with a valuable growth potential in Portugal, but also in the whole Mediterranean basin. In this study the physiological and biochemical foliar responses of the late blooming almond variety 'Glorieta' to the water stress were evaluated before and after the application of the kaolin, during 2014. The field experiment was carried out in an almond orchard located in North Portugal (Lousa, Torre de Moncorvo) with 6-years old trees, all grafted on 'GF-677' rootstock. The leaf analysis included the quantification of photosynthetic pigments (chlorophylls a and b and carotenoids), soluble sugars, starch, total phenolic compounds, soluble proteins, and concentration of thiobarbituric acid reactive substances (TBARS). The relative water content, specific leaf area, succulence, tissue thickness, electrolyte leakage and cuticular waxes in leaves were also evaluated, as well as the yield. Significant differences were only observed in total phenolic content, total carotenoids and cuticular waxes concentrations, with higher values in control trees. In summary, kaolin application did not have significant effect on the almond tree performance, probably due to the high rainfall amount during the summer of 2014.

Keywords: abiotic stress, almond tree, kaolin application, *Prunus dulcis* Mill.

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S3-O6

Monitoring of Viral Diseases in *Ficus carica* Collection Plot of Nikita Botanical Gardens. Biotechnology and Physiology Base of Plants Cleaning up

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The common fig, *Ficus carica* L., family *Moraceae* is a subtropical fruit tree or shrub grown for its edible fruits. The climate conditions of the South Crimea give possibility to cultivate different subtropical horticulture plants, such as *F. carica*. Monitoring of phytopathogens in common fig collection plot (more than 100 cultivars and breeding forms) of Nikita Botanical Gardens the phytosanitatary status of fig collection was demonstrated. Some most detrimental viral pathogens of *F. carica* were identified. The aim of study was to improve the plants by using biotechnology and physiology methods. Surface-sterilized vegetative buds of 20 fig cultivars ('Smena', 'Medoviy', 'Limonno-Zheltiy', 'Sabrucia Rozovaya', 'Finikoviy', 'Violete', 'Fig Blanch', etc.) were introduced in conditions *in vitro* and cultivated on modified Murashige and Skooge medium, supplemented by ribavirin for chemotherapy. Explants were incubated in culture tubers with 5 ml gelled medium and kept in a growth chamber at 24±1°C under 16-h photoperiod and light intensity of 25-37.5 μmol m^{-2} s^{-1}. *In vitro* morphogenesis by single adventitious microshoots formation from buds was beginning. It was demonstrated that the regeneration rate of cultured explants, was depended on genotype of mother plant. The somatic embryos were regenerated from leaf cuts, but percent of developed plants was low. On the first stages of micropropagation from one explant (vegetative bud) 15 – 20 adventive microshoots were directly regenerated. The method of fig *in vitro* micropropagation has been established. Investigation of morphoanatomical structure of leaves and redistribution of fractional water composition has been showed the different adaptability of mother plants grown *in situ* and regenerated *in vitro* plants.

Keywords: *Ficus carica*, virus, micropropagation, *in vitro*, adaptability

Acknowledgement: This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

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S3-O7

Rooting Ability of Leafy and Leafless Cuttings of 'Tainung 1' Papaya (*Carica papaya* L.) Trees

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Papaya mainly propagates by seed, with the exception of China where cuttings and tissue culture are widely used. Seed propagation requires sexing for hermaphrodite plant that produces the fruit demanded by the market. Cuttings give 100% hermaphrodite plants. This study had the objective to develop a commercial protocol for 'Tainung 1' papaya cuttings that can be replicated by the farmers. Cutting thickness and leaf presence associated with the pre-conditioning of lateral shoots (source of cuttings) in the field grown bearing papaya trees were studied. Misting nursery under controlled condition with heated bed was used to root papaya cuttings. Randomized blocks with 20 replications for each thickness of cutting (length of 15 to 20 cm) – named thin / medium / thick, totaling 60 replicates per treatment were studied: T1 – cuttings with growing tips (GT) with leaves attached from decapitated trees (DT); T2 – cuttings without GT and leafless from DT (leaves were detached one week before collection to promote healing of cuts); T3 – cuttings with GT and leafless from DT (idem T2); and, T4 – cuttings with GT and leafless from non-decapitated trees (idem T2). All cuttings were treated with auxin, potted in coconut fiber, and kept for 30 days under misting with heated bed at 30°C. Rooting ability (RA) and root mass (RM) were measured. Thickness of cuttings did not show significant differences in all treatments. T1 with 91% RA gave the heaviest RM in contrast with T3 with 7% RA and the lightest RM. On the other hand, T2 and T4 gave 80% and 71% RA, respectively, not as many RM as T1 but enough for good rooting. Therefore, T2 and T4 cuttings, both leafless, were the most promising for mass production in the nursery since they allow higher density (double to triple) with less disease pressure when compared to T1.

Keywords: growing tips, thickness of cutting, rooting ability, root mass, nursery plant

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S3-O8

Planting of Fruit Nursery Trees and Vine Grafts in Serbia "The Serbian Planting Mode"

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In the South East Europe region, cambisols is the main soil type used for fruit and grape planting. The general attribute of this type of soil is a low level of available (range: from 0.1 mg/100 g to 5.0 mg/100 g; AL method by Egner-Rhiem), so that fertilization is needed to improve root growth after planting. Constrains and difficulties revealed to the efficient application of phosphorus is related to the acid reaction of this type of soil (average pH 4.5–5.5 in KCl) which decrease its availability. Also, the low mobility of this element in this soil profile contributes to lower efficiency of applied P mineral fertilizer during the standard planting procedure where the amount of added P is placed at the top of the planting hole after covering the root with soil. The great demand for phosphorous in the roots could be resolved by applying suitable liquid NPK fertilizer (10:52:10 – "starter") during the planting to achieve the real enrichment of in this depth zone with phosphorus. Two approaches have been explained: the use of liquid fertilizer during the process of standard fruit planting and the use of liquid fertilizer solution when digging holes for grafts by hydro-borer drilling equipment. Concerning that in Serbia over the 200 ha of vineyards and more than 100 ha of orchards have been successfully planted using this technique, this practical application has been named the "Serbian planting mode".

Keywords: planting, orchard, vineyard, phosphorus, liquid fertilizer, rhizosphere solution

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S3-P1

Hierarchy among Fruitlets in the Cluster of Apple

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Apple trees (*Malus domestica* Borkh.) form an abundance of flowers, but not all of them develop into a fruit. Although in first developmental stages apple trees shed the majority of fruitlets, this is not enough for optimal commercial yield. Abscission can be stimulated or inhibited by several technological measures, thereby influencing the factors that are important for crop quality. The advanced knowledge on the natural process of abscission is crucial for the implementation of these measures. In the process of abscission all fruitlets from the cluster do not drop at the same frequency. In our study we compared abscission potential depending on position of all 6 fruitlets along the peduncle – from central (position 1) to the basal one (position 6). Abscission started 4 weeks after full bloom and lasted for 6 weeks. In this time more than 70% of all fruitlets abscised. Fruitlets most rarely dropped from the central position (in less than 40% cases), while the lowest positions (positions 5 and 6) threw more than 80% of fruitlets. It is interesting that high abscission potential was observed on the position nearest to the central position 2, where abscission was higher than in lower positions 4 and 5. The disadvantage of position 2 was further confirmed at harvest. Fruits from the lateral position nearest to the central one were smaller and firmer in comparison to fruits from central and lower positions 3 and 4. This demonstrates the obvious dominance of the central fruit in comparison to lateral fruits, especially those nearest to the king fruit.

Keywords: apple, *Malus domestica*, king flower, cluster, shedding, quality

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S3-P2

Effect of Growth Regulators on the Sap Flow in the Apple Tree

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This research paper presents the results of a field trial performed in young orchard with apple cultivar 'Gala Galaxy', on the rootstock 'M9'. In November 2012, nursery "knip" trees were planted at the distance 3 × 1 m. In the first vegetation season (2013) the experimental plot was separated in a randomized block system of four treatments. For research 8 apple trees were taken (2 for each variant), which were treated with growth regulators in the stage of nursery trees production GerBA 2.5% (benzyl adenine) and Progebalin 2.5%, (gibberellins A_{4+7} + benzyl adenine). Besides, two other treatments were included: pinching (i.e. removal of terminal leaves) and control (untreated). The sap flow measurement was examined through sensors EMS 62 (EMS Brno, CZ) based on SHP (stem heat balance) method. Sensors were installed on the trunk of trees (12 mm thick). The measuring interval was every minute with 1 s warm-up and storing interval every 15 minutes during period July – September 2013. Also at the same time with portable meteorological station Minikin RTHi (EMS Brno, CZ) and other supported equipment vapor pressure deficit (VPD), potential evapotranspiration (PET), soil moisture, soil and leaf temperature were measured. By the results obtained, the treatments with GerBA 2.5%, and Progerbalin 2.5% has given higher values of sap flow (79.9 g/h and 78.09 g/h) in relation to other treatments, pinching and control (71.04 g/h and 70.09 g/h respectively). It is also noticed that strong correlation between sap flow, VPD, PET, soil moisture, soil and leaves temperature exist.

Keywords: sap flow, grow regulators, ecological factors

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S3-P3

Effect of Metaxenia on Pomological Traits of 'Topaz' Apple Cultivar

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Apple (*Malus* × *domestica* Borkh.) is a self-incompatible rosaceous tree species. Therefore in commercial orchards, cross-compatible cultivars of different *S*-allelic constitutions that flower simultaneously are planted together to allow successful cross pollination and satisfactory cropping. Recently, full attention has been paid to protection of the environment, contributing to a growing importance of integrated and organic cultivation methods in fruit production. Hence, growing cultivars resistant to pests and causal agents of the most serious diseases is one of the recent trends in modern apple production. The paper presents results of a three-year study of metaxenia effect on pomological properties of scab-resistant apple cultivar 'Topaz', whose fruits were obtained through two variants of cross-pollination ('Topaz' × 'Red Elstar' and 'Topaz' × 'Rajka') and open pollination ('Topaz' O.P.). The pomological traits of the 'Topaz' fruits that were obtained in the aforementioned pollination variants were determined based on the assessment of morphometric (fruit weight, height and width; shape index; stalk length; seed number) and chemical properties (soluble solids content; total, inverted sugars and sucrose content; total acids; pH value). The highest fruit weight, height and width (167.59 g, 55.40 mm and 71.77 mm, respectively) and number of seeds per fruit (11.11) in the 'Topaz' were achieved using 'Rajka' as the polliniser cultivar. The best quality of the 'Topaz' fruits, measured by the chemical composition, was found in the open pollination variant (soluble solids content – 12.50%; total and inverted sugars – 12.50% and 8.36%, respectively; total acids content – 0.54%). Overall, based on the assessed parameters, the cultivar 'Rajka' can be recommended as the most suitable polliniser for 'Topaz'.

Keywords: apple, metaxenia, polliniser cultivar, pomological properties

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S3-P4

Explants Growth of some Fruit Rootstock by *In Vitro* Culture

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The vegetative rootstocks are important for increasing orchard density, uniformity of trees and high yields. Micropropagation has played an important role in the production of disease-free plants and in the rapid multiplication of rootstocks with desirable traits. Successful micropropagation of many rootstocks is influenced by several factors including *in vitro* conditions. Experiments were performed at the plant tissue culture laboratory of Research Institute for Fruit Growing Pitesti-Romania, to optimize tissue culture protocol for explants growth of four perspective stone fruit rootstock selections: 'RoP8803001', 'RoP8802011', 'B 83/8', and 'Mirodad 3'. For establishment stage three hormone growth combinations: V1 (BAP 0% – IBA 0 %), V2 (BAP 0.5% – IBA 0.01 %), V3 (BAP 1.0% – IBA 0.1 %) were used. Two basic medium (BM) were used: BM 1 (MS Murashige and Skoog, 1962) and BM 2 (Quoirin and Lepoivre-QL, 1977 with vitamins - Linsmaier and Skoog-LS vitamins, 1965). The experimental results regarding explants growth, reveals that whatever the composition of the basic medium, the best hormonal combination was composed of BAP 1.0 mg/l and IBA 0.1 mg/l. The percentage of explants growth for this combination were very little different, depending on the two basic medium. However, higher values were obtained in the presence of BM2. The percentages obtained for all four rootstock selections were between 16.6% ('Mirodad 3') and 41.6% ('B 83/8'). The results show that these rootstock selections can be propagated by tissue culture.

Keywords: vegetative rootstocks, micropropagation, behavior

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S3-P5

Influence of Plum Rootstocks on the Dynamic of Proline Content in the Annual Shoots of Cultivar 'Victoria'

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Sharp temperature fluctuations, when thaws are changing with frost have been observed in the Baltic region with changing climate conditions more and more often. Therefore the question about rootstock influence on plum tree winter-hardiness is becoming topical and is essential for good overwintering of trees in such conditions. The content of proline is one of the physiological factors influencing wintering ability of trees. Its content in one-year shoots increases with decreasing of air temperature. The dynamics of proline content in one-year shoots during the wintering period was investigated during three wintering periods (2010/2011, 2011/2012 and 2012/2013) in two locations. Orchards were planted in 2001 in Pūre Horticultural Research Centre (Latvia) and in Polli Horticultural Research Centre (Estonia). Well known European plum cultivar 'Victoria' (*P. domestica* L.) was grafted on eight clonal rootstocks 'St. Julien A', 'Brompton', 'Ackermann', 'Pixy', 'GF8/1', 'G5/22', 'GF655/2', 'Hamyra' and eight generative propagated rootstocks 'St. Julien INRA 2', 'St. Julien d'Orleans', 'St. Julien Noir', 'Brompton', 'Wangenheims Zwetche', 'St. Julien Wädenswill', 'Myrobalan' and *Prunus cerasifera* var. *divaricata*. Plants were planted in orchard in 5 × 3 m spacing, three trees per plot, in four replications. Annual shoots samples were harvested four times per wintering period (at the end of October, December, January, and March). The content of proline in dry matter (mg g^{-1}) was determined using ninhidrin method. Significant differences between proline content in shoot samples harvested from trees on different rootstocks were not stated, whereas significant differences were stated between years and locations. From this we conclude that proline content is changing under influence of climatic conditions. The maximum content of proline was found in December and January depending on minimal temperatures.

Keywords: winter-hardiness, *Prunus domestica*, Latvia, Estonia

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S3-P6

Influence of Pollination Variant on Fruit Set in Plum (*Prunus domestica* L.)

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In the course of the reproductive process, there is a number of factors that make an impact on the fruit set. Apart from the presence of an adequate polliniser, the temperature fluctuations at the time of full bloom represent an important factor influencing the fruit set. The study of the fruit set in plum cultivar 'Pozna Plava', which tends to have low fruit set, was conducted in three pollination variants (open, cross- and self-pollination) over a two-year period. The cross-pollination variant was performed using the pollen of 'Presenta', 'Hanita' and 'Čačanska Najbolja' cultivars. The polliniser cultivars were tested by checking their germination *in vitro* on sucrose-agar plates. The average pollen germination in the aforementioned cultivars used in cross-pollination variant was over 40%, whereas it was under 18% in the 'Pozna Plava'. In both experimental years (2010 and 2011), the cross-pollination variant with 'Presenta' resulted in the highest initial (69.54% and 51.85%, respectively) and final fruit set (41.45% and 30.92%, respectively). In addition, high values of initial and final fruit set were recorded with 'Hanita' and 'Čačanska Najbolja'. Comparison between the cross- and self-pollination variants revealed that the self-pollination variant resulted in lower fruit set in both years. The lowest initial and final fruit set in both years was recorded in the open pollination variant (12.28% and 5.14% in 2010; 0.79% and 2.83% in 2011). The average mean daily temperature in the first ten days from the beginning of full bloom was 14.03°C in 2010, compared to 10.63°C in 2011. The obtained results were shown a clear impact of the pollination variant on the fruit set, as well as an evident impact of temperature fluctuations during the first ten days from the beginning of full bloom on the progamic phase.

Keywords: plum, pollination variant, fruit set, temperature

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S3-P7

Growth Responses to Water and Temperature Stress in Nectarine

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Diel growth dynamic is one of the most significant interest areas of plant-water relations, with practical applications for irrigation scheduling. In the present study, we determined the effects of two irrigation regimes (well-watered (WW) and water-stressed (WS)) on branch growth diel dynamic. Dendrometers were placed on main branches of 10-year-old nectarine trees for both treatments, in a commercial orchard. The readings were monitored at 15 min. intervals. The amount of irrigation water was determined using evapotranspiration (ET) values, with full irrigation for WW and 25% water restriction for WS. During this period, the days that had the highest (hot day) and the lowest (cool day) evapotranspiration were taken as extreme days. The timing of the maximum diameter increment of the branch in both extreme days did not change notably with irrigation treatment and temperature. In the hot day, the maximum diameter of the branch was earlier compared to the cool day. However, the timing of minimum diameter showed a difference between water regimes on the cool day, with an earlier/later minimum on WW-Branch. The higher temperature in WW increased the maximum diel shrinkage in the branch compared to WS. As a whole, our study showed that for a given water regime, the diameter growth of a branch may be strongly altered by temperature.

Keywords: peach, *Prunus persica*, perennial plants, ecophysiology, drought, tree architecture

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S3-P8

The Effect of Temperature on Pollen Germination and Pollen Tube Growth of Apricot Cultivars

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The effect of three different temperatures (5, 15 and 25°C) on pollen germination and pollen tube growth *in vitro* was studied in six apricot cultivars: 'Goldrich', 'Hungarian Best', 'Laycot', 'Novosadska Rodna', 'Pisana' and 'Sylred'. Germination rate and pollen tube growth were determined on a culture medium containing 15% sucrose and 0.7% agar. Temperature significantly affected pollen germination of all studied cultivars. High germination rates (41-84%) were obtained at 15°C and 25°C. Germination rates at 5°C were significantly lower than at higher temperatures. However, germination rates at 5°C were significantly higher in early-flowering cultivars compared to late-flowering cultivars. The influence of temperature was more prominent on the pollen tube growth. The length of pollen tubes was six to twelve times higher at 15°C and 25°C in comparison with 5°C. The obtained results indicate differential cultivar response to the temperature during the pollination period.

Keywords: *Prunus armeniaca*, pollen viability, *in vitro*, pollen tube length

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S3-P9

Long-term Investigation Results of Low Temperatures Influence on Apricot Generative Buds

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Short rest period of generative buds in apricot plants makes them prone to significant damages or total loss during winter temperature fluctuations or spring frosts. Adapting to the environment is one of the main reasons for limiting the apricot plant introduction in different climatic zones. To solve this problem we have being investigated frost-resistance of generative buds in apricot cultivars of different origin for 34 years by the method of artificial freezing of branches in a cooling chamber. This method allows assessing cultivars during a year of studies under the influence of different temperatures considering their morphogenesis that increases effectiveness of the researches. In January (1981–1997) most of studied cultivars (68 – 100%) had generative buds at the stages of sporogenous tissue or microsporocytes initiation. It has been identified 37 cultivars and breeding forms ('Aviator', 'Semlak', 'Da-Huang-Hou', 84-951, 84-952 and others) with the smallest loss of the buds (0 – 13.5%). These genotypes are characterized with slow development that enables them to better retain buds from the negative impact of freezing temperatures at the early stages. In some cultivars buds retain their relatively high frost-resistance at the later stages of morphogenesis (microspore tetrads disintegration, forming of one celled pollen, etc) also. We studied frost-resistance of apricot generative buds at the later developmental stages. In our studies we affected the buds with different negative temperatures (from –6.5 to –20°C). It was identified 28 genotypes with the highest number of undamaged buds (2.1-13.4%). Among them 20 cultivars and forms ('Aviator', 'Nariadnyi', 'Semlak', 'Vynoslivyi', 84-951 and others) are characterized with frost-resistance of generative buds at both later and early stages of development. Thus, the results of long-term researches let to conclude the possibility of selection of genotypes with high adaptive potential and demonstrate the dependence of adaptation mechanism on the rates of morphogenesis.

Keywords: apricot, frost-resistance, inheritance, cultivars, selection forms, breeding, adaptation

Acknowledgement: This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

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S3-P10

Pollen Morphology of Some Sweet Cherry Cultivars Observed by Scanning Electron Microscopy

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The evaluation of pollen morphological characteristics can be an adequate method for identification of *Prunus* species and their cultivars. In this paper, morphology and ultrastructure of pollen grain were described for five sweet cherry (*Prunus avium* L.) cultivars ('Bing', 'Lapins', 'Sunburst', 'Stella' and 'Van') in two years (2011 – 2012) using scanning electron microscopy (SEM). All studied cultivars had isopolar and radially symmetric pollen grain with three colpate apertures. Length and width of pollen grain were the highest in cultivar 'Sunburst' (50.1 μm; 25.7 μm) and the lowest in cultivar 'Bing' (47.4 μm; 24.1 μm). Pollen shape in all studied cultivars was identified as prolate. Colpus length and mesocolpium width varied in a range of 40.5 – 44.9 μm, and 14.4 – 16.3 μm, respectively. All studied cultivars had striate exine ornamentation. Number of ridges per 100 μm^2 on the exine was the lowest in cultivar 'Sunburst' (24.3), and the largest in cultivar 'Bing' (30.4). Ridge and furrow width varied in a range of 0.28 – 0.35 μm, and 0.26 – 0.30 μm, respectively. Pollen grains examination by SEM indicated that several morphological parameters (size and exine characteristics), along with other morphological characteristics of the leaves and the fruits, can be used to distinguish different sweet cherry cultivars.

Keywords: *Prunus avium*, pollen grain, exine pattern, scanning electron microscopy

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S3-P11

A Study to Identify Suitable Pollinizers for '0900 Ziraat' Sweet Cherry Cultivar

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Sweet cherry (*Prunus avium* L.) is one of the most important temperate fruit trees and it is a self-incompatible species. Several studies have conducted to determine the sexual (in)-compatibility using fluorescence microscopy techniques and molecular methods. In this study three cherry cultivars, 'Beyaz Omeroglu', 'Karakiraz' and 'Noble' were used as pollinizers for '0900 Ziraat' cultivar grown in Korkuteli region, Antalya. Additionally, fruit set ratios for open pollination, self-pollination and cross-pollinations with the 3 cultivars on the recipient '0900 Ziraat' cherry cultivar were determined. Pollen viability rates differed according to the stain test. The highest pollen viability rate (79.49%) was found in 'Beyaz Omeroglu' variety and the lowest (63.59%) was determined in 'Noble' variety. The highest pollen germination (49.23%) was observed in 'Beyaz Omeroglu' while the lowest pollen germination (41.23%) was found in 'Karakiraz' variety. Cross-pollination studies revealed that pollen tubes reached to ovary in 96 and 120 hours after pollination for 'Beyaz Omeroglu' and 'Noble' varieties respectively. However, in self-pollination the pollen tubes did not reach to ovary of '0900 Ziraat' cultivar. Therefore, fruit set was the highest (22.25%) for 'Beyaz Omeroglu', while it was 10.12% and 4.24% for 'Noble' and 'Karakiraz' respectively. These results indicating that 'Beyaz Omeroglu' and 'Noble' cherry varieties are good pollinizers for '0900 Ziraat' cultivar.

Keywords: *Prunus avium* L., pollen viability, germination, pollination, pollinizer, fruit set

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S3-P12

The Effect of Plant Hormones on Pollen Germination and Pollen Tube Growth of Almond Cultivars

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In this paper, the effect of two plant hormones (auxin – IAA and gibberellin – GA_3) on pollen germination and pollen tube growth *in vitro* were investigated in five cultivars of almond during 2014 and 2015. The following cultivars were investigated: 'Tuono', 'Nessebar', 'Ferragnes', 'Ikar' and 'Exinogard'. Germination rate and pollen tube growth were determined on a culture medium containing 15% sucrose and 0.7% agar. Pollen germination in the control variant (without application of hormones) ranged from 23.56% ('Ferragnes') to 51.81% ('Tuono'). Plant hormones mainly influenced an increase in pollen germination, except for 'Ikar' and 'Exinogard' cultivars where there was a less decline in pollen germination treated with gibberellin. The more pronounced effect of plant hormones was manifested on the length of pollen tubes. Thus, in the pollen treated with auxin length of pollen tubes increased by 23 to 86%, and in pollen treated with gibberellins for 6 to 22%, depending on the cultivar. The exception was only the cultivar 'Nessebar' in which the gibberellin influenced the decrease in the length of pollen tubes. Based on the above mentioned, it can be concluded that auxin and gibberellin influenced the increase of pollen germination and pollen tube length in most cultivars, so they can be recommended for application in commercial plantations in order to speed up the fertilization and therefore provide better yield of almond cultivars.

Keywords: *Prunus dulcis*, auxin, gibberellin, pollen germination, pollen tube length

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S3-P13

Fruit Quality and Leaf Photosynthesis of 'Ortanique' and 'Minneola' Mandarin Hybrids as Affected by Branch Girdling or Ringing

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The effects of girdling and ringing on fruit quality and leaf photosynthesis in two late ripening mandarin hybrids 'Ortanique' and 'Minneola' were investigated. The treatments of either girdling or ringing were carried out on December 20 in two different branches of each experimental tree (four replications per variety and treatment). One branch per tree was used as control (neither girdled nor ringed). Leaf photosynthetic rate, stomatal conductance and transpiration rate were simultaneously measured once, 50 days after the treatments. Furthermore, three fruit harvests were conducted, i.e., 50 (February 8), 70 (February 28) and 97 (March 27) days after the treatments. At each harvest date, fruits and their juice were analyzed to determine various quality parameters, such as fruit weight, length and diameter, rind thickness and juice content as well as total soluble solids (TSS), titratable acidity (TA), maturity index (TSS/TA), pH, antioxidant capacity and total phenols and flavonoids in juice. Using a chroma meter, the external and internal color of fruits was determined. According to the results, leaf photosynthetic rate was either not affected (Minneola-girdling) or decreased significantly (Ortanique-girdling, Ortanique-ringing, Minneola-ringing). Similarly, leaf transpiration rate and stomatal conductance was either not affected (Ortanique-ringing) or decreased significantly (Ortanique-girdling, Minneola-girdling, Minneola-ringing). Regardless of the harvest date, neither girdling nor ringing affected significantly the main fruit quality parameters in none of the two studied varieties, with only some minor exceptions. The most important exceptions were the increase of 'Ortanique' fruit weight and diameter due to ringing at 70th day as well as the negative effects of ringing in maturation index (50th day) and fruit diameter (97th day) in 'Minneola'. In conclusion, the late-winter application of girdling or ringing did not improve either the leaf photosynthetic activity or the main fruit quality parameters in none of the two studied varieties.

Keywords: tangelo, tangor, gas exchange, stomatal conductance, transpiration, fruit color, phenols, antioxidants, flavonoids, maturity index

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S3-P14

Effects of Fish Food and Faeces Waste Applications on Plant Growth and Physiological Properties in Sour Orange Seedlings

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Recycling solid waste materials occurring in agricultural production is an important issue regarding protecting environment and resources for sustainable economic development. The aim of this study is to investigate the effects of fish food and faeces waste on the sour orange seedlings and its possibilities to use as a fertilizer on the sour orange seedlings. The solid wastes of 0, 50, 100 and 200 g doses were administered to sour orange seedlings which were planted in pots. At the same time, each different solid waste dose mentioned earlier was irrigated with different amounts (0, ½ and 1 doses) of Hoagland nutrient solutions. In the study, the plant height, stem diameter, leaf dry weight (%), the amounts of chlorophylls a, b and carotenoids, as well as proline were analysed. The results produced the plant height from 43.1 to 96.5 cm, stem diameter from 4.57 to 8.82 mm, leaf dry weight 38.9 – 48.3%, chlorophyll a 0.451 – 0.911 mg/ml, chlorophyll b 0.154 – 0.304 mg/ml, carotenoids 0.159 – 0.243 mg/ml, proline 1.247 – 2.604 μM/g. The solid waste application showed an increase in all parameters except proline level according to the control group. The 100 and 200 g dose groups decreased the proline level with regard to the control group. The study showed that the application of solid wastes has a positive impact on the growth and physiology of sour orange seedlings.

Keywords: *Citrus aurantium* L., plant growth, proline, solid waste

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S3-P15

The Effects of Pollination Type on Fruit Set, Productivity and Fruit Quality of Persimmon Cultivars

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The study was carried out in the Genetic Resources Area of The Black Sea Research Instution. As a female cultivar, 8 persimmon cultivars ('Kaplan', 'Ayder', 'Yeşilırmak', 'Onur', 'Akbulut', 'İrem', 'Türkay', 'Çoruh 1') that registered by the instution and 'Fuyu' as standard cultivar were used. In this study, open-pollination was compared to the treatment of isolation. In these treatments, fruit set and flower drop were determined by comparing the number of flowers and number of fruits. Number of harvested fruits, fruit weight and soluble solids content were also determined. In open-pollination treatment, the average fruit set, flower drop, the number of harvested fruit, average fruit weight and total soluble solids were found as 86.10%, 13.9%, 40.51, 96.14 g and 16 %, respectively. In isolation treatment the average fruit set, flower drop, the number of harvested fruit, average fruit weight and soluble solids were found as 61.10%, 38.90%, 25.5, 130.83 g and 18%, respectively.

Keywords: *Diospyros kaki*, persimmon, pollination, flower drop

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S3-P16

Germinability and Germination Rate of Loquat Seeds as Affected by the Removal of Perisperm and/or Different Parts of Cotyledons

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The purpose of this study was to investigate the effects of seed coat (perisperm) removal as well as the excision of a part of cotyledons on the germinability and germination rate of loquat seeds. Two experiments were carried out. The four treatments of the first experiment were: (i) control-intact seeds, (ii) seeds without coats, (iii) excision of 1/3 of the seed coats and cotyledons from the opposite of the radicle side, and (iv) excision of 1/3 of the cotyledons from the opposite of the radicle side and removal of seed coats. Each treatment had six replications with 20 seeds per replication (480 seeds totally). The five treatments of the second experiment included the complete or the partial (1/2) removal of the seed coats: (a) control-intact seeds, (b) seeds without coats, (c) seeds with removed coats from the ½ of the seed surface, ¼ right and ¼ left of the longitudinal axis of the seed, (d) seeds with removed coats from the ½ of the seed surface nearby the radicle, (e) seeds with removed coats from the ½ of the seed surface from the opposite of radicle side. Each treatment had four replications with 24 seeds per replication (480 seeds totally). According to the results of the first experiment, the complete removal of seed coats increased the germination rate of both intact seeds and of those in which a portion of cotyledons was excised. Moreover, cotyledons excision resulted in retarded germination, regardless of the presence or the absence of seed coats. The results of the second experiment showed that even the partial excision of seed coats affected positively both the germinability and the germination rate, compared to the control-intact seeds. In conclusion, the role of perisperm (seed coats) in the germination procedure of loquat seeds seems to be important.

Keywords: seed coats, seed testa, *Eriobotrya japonica*, plant propagation, sexual propagation

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S3-P17

Salinity-induced Changes in Leaf Photosynthesis, Chlorophyll, Proline, Hydrogen Peroxide and Malondialdehyde in Loquat Plants

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The effect of high salinity on various physiological and biochemical parameters in loquat (*Eriobotrya japonica* Lindl.) leaves was investigated in the present study. For this purpose, three-year-old loquat seedlings were cultivated in an inert medium, consisted of sand and perlite (1/2, v/v), and fertigated thrice a week with a full strength Hoagland's nutrient solution containing either 0 mM NaCl (control treatment) or 80 mM NaCl (salinity treatment). Five plants (replicates) were used per treatment. After 81 days of exposure to salinity, leaf gas exchange parameters, i.e. photosynthetic rate, transpiration rate, stomatal conductance, intercellular CO2 concentration and carboxylation efficiency (ratio between photosynthetic rate and intercellular CO2 concentration), were measured using a portable photosynthesis system. Leaf chlorophyll content was also measured using a portable chlorophyll meter. Furthermore, leaf samples were analyzed for proline, hydrogen peroxide and malondialdehyde (MDA). Based on the statistical analysis of the data, salinity caused significant reductions in photosynthetic rate, transpiration rate and stomatal conductance. Although there was no significant difference between control and salt-treated plants concerning the concentration of CO2 in mesophyll, a dramatic decrease of carboxylation efficiency was observed due to salinity. With regard to proline, H_2O_2 and MDA, their concentrations in the leaves of plants treated with 80 mM NaCl were significantly higher than those of control plants (0 mM NaCl). On the other hand, leaves of NaCl-treated plants had higher chlorophyll content (as indicated by chlorophyll meter readings) compared to control plants. Overall, both stomatal and non-stomatal factors were responsible for the reduction of photosynthetic rate in leaves of loquat plants grown under saline conditions.

Keywords: *Eriobotrya japonica*, gas exchange, stomatal conductance, transpiration rate, photosynthetic rate, carboxylation efficiency

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S3-P18

Salt Resistance of 'Uzun' and 'Siirt' Pistachio Seedlings

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Pistachio is an important fruit species of Southeast Anatolian Region of Turkey, and it has a potential for arid and semi-arid areas. It is known that pistachio trees are tolerant to salinity. Pistachio trees can grow in the high saline soils which are not suitable for growing of other plant species. The salinity has negative effects on growth, photosynthesis and morphological changes of the leaves. Irrigation has been started with Sourtheast Anatolian Project, and salinity has been appeared in the lower part of the Harran Plain in this region. Pistachio trees have been taken part among the saline resistant plants. Therefore, it is thought that, pistachio may be produced at the saline areas. Aim of this study is determination of salt resistance of 'Uzun' and 'Siirt' pistachio seedlings using as *Pistacia vera* rootstocks in Turkey. For this purpose, vegetative features and physical properties of seedlings were determined in the study. For this purpose, 0, 800, 1600, 2400 and 3200 mg NaCl/kg was applied to the soil when the seedlings of 'Uzun' and 'Siirt' cultivars reach to 6-leaf. According to the results obtained from this study, it is determined that seedlings of 'Siirt' cultivar were more resistant than 'Uzun'.

Keywords: rootstock, pistachio, *Pistacia vera*, salinity

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S3-P19

Nutrient Status of Banana (*Musa acuminata* cv. 'FHIA-01') Plants as Affected by Boron Excess

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A greenhouse experiment was carried out to study the effects of high boron (B) on the concentrations of various mineral elements in leaves, pseudostem and root of 'FHIA-01', a cold- and wind-tolerant banana cultivar producing higher quality fruits in sub-tropical than in tropical conditions. The experiment was performed under hydroponic conditions. The plants were grown in plastic pots containing an inert substrate consisted from sand and perlite (1/2, v/v). They were fertigated thrice a week with a full strength Hoagland's nutrient solution containing either 25 (control) or 400 (B excess) μM B. Five plants (replicates) were used per each B treatment. Eighty three days after the beginning of B treatments, the leaves, the pseudostem and the root of each experimental plant were separately collected, oven dried and milled to a fine powder. Afterwards, the concentrations of B, K, Ca, Mg, Fe, Mn, Zn, Cl and Na were determined using standard methods. Boron concentrations in all plant parts were significantly increased, as B concentration in the nutrient solution increased from 25 to 400 μM. Regardless of B treatment, significantly higher B concentrations were found in leaves than in pseudostem and root. Furthermore, significantly lower concentrations of K, Mn and Cl and higher of Ca and Mg were found in the leaves of control plants than in those treated with 400 μM B. Concerning the nutrient status of pseudostem, B excess resulted in an increase of the concentrations of K, Mn, Cl and Na. Finally, the concentrations of all studied nutrients in plant roots were similar in both treatments (25 and 400 μM B,) aside from B and Cl that were significantly increased under B excess conditions (400 μM B).

Keywords: plant nutrition, abiotic stress, boron toxicity, leaves, pseudostem, root

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S3-P20

Contents of Macro and Micronutrients in Leaves of Lychee (*Lichi chinensis* Sonn.) cv 'Bengal' in Different Physiological Stages

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Cultivated area of lychee (*Lichi chinensis* Sonn.) has increased very fast in the Brazilian fruit market due to the excellent demand of this tasteful fruit. Therefore, the answers for the best pruning and nutrition techniques in the management of lychee production have been largely required, although the literature is very poor on these issues. Former studies have shown different concentrations in leaves of lychee, but few of them discuss the relation between contents of macro and micronutrients in leaves of lychee 'Bengal' in different phenological stages (phenophases) and periods. The objective of this paper was to evaluate the concentration of macro and micronutrients in leaves of lychee cv 'Bengal' in different phenophases and periods: P0 = after postharvest pruning and the sprouts out, in January; P1 = mature sprouts, April to May; P2 = floral induction, May to June; P3 = full bloom, July to August; P4 = fruit set, September to November; P5 = harvest, December). The experiment was carried out at commercial orchard of Rio das Pedras farm, in Jundiaí-SP. It was used a randomized block design with 6 treatments (phenophases and periods), 4 replications and 4 plants per parcel totalizing 96 plants in the whole experiment. Leaf dry matter – LDM (g/kg), macro (g/kg) and microelements (mg/kg) were analized at different phenophases. Collected data were submitted to statistic analysis of variance and means to Tukey test at 5%. Macro and micronutrient concentrations varied among phenophases and periods showing a tendency for reduction of their contents from the phenophase P0 to P5, while the highest dry matter of leaves was in the phenophase P5 with 0.0290 g/kg.

Keywords: phenophases, leaf analysis, leaf dry matter, nutrition

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S3-P21

Effect of Plant Growth Regulators on Enhancing Pollen Germination in Grapevine Cultivars

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In the present report, we described the effects of naphthalene acetic acid (NAA), gibberellic acid (GA_3), and epibrassinolide on *in vitro* pollen germination in *Vitis vinifera* L. The basic media contained 1% agar and 20% sucrose. Pollen germination of cv. 'Amasya beyazı' was not affected by the treatments and the germination ratio varied between 6.16% (1.0 mgL^{-1} NAA) and 35.98% (50 mgL^{-1} GA_3). The stimulating effect of GA_3 and epibrassinolide was noticeable in cultivar 'Müşküle'. Concentration of 25 mgL^{-1} GA_3 had the highest effect on increasing the pollen germination of cultivar 'Kozak Beyazı' compared to the NAA, epibrassinolide and the control. The results showed that the response of the pollen grains were cultivar specific and substance specific. In general, NAA was the growth regulator that least enhanced the germination of grapevine pollen.

Keywords: pollen germination, grapevine, epibrassinolide, gibberellic acid, NAA

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S3-P22

Heat Requirements for Red Grapevine Cultivars in the Wine-producing Region of Sremski Karlovci

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Heat requirements for four major phenological stages (budburst, flowering, veraison and harvest) were assessed in 8 grapevine cultivars grown in the Sremski Karlovci region by growing degree-days method (GDD) and using base temperature of 10°C. Temperature and phenological data covering the period 1986–2007 were used to conduct the study. The accumulated GDD for the beginning of budburst ranged from 70 ('Gamay' and 'Limberger') to 92 ('Cabernet sauvignon'). The heat requirements for the beginning flowering varied between 338 GDD in 'Gamey' to 398 GDD in 'Probus'. The smallest heat requirements to reach the beginning of veraison was observed in 'Portugizer' (937 GDD) and the greatest in 'Probus' (1117 GDD). The GDD for harvest spanned the range from 1555 in 'Portugizer' to 1649 in 'Prokupac'. A greater variation in GDD was found between years for a single cultivar than among cultivars within individual years for all examined phenological stages. Among phenological stages, the greatest inter-annul variation in terms of coefficient of variation was displayed for the beginning of budburst.

Keywords: *Vitis vinifera*, growing degree-days, budburst, flowering, veraison, harvest, Serbia

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S3-P23

Climate Change Impact on Grape Growing in Serbia

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Serbian grape and fruit production in general is mostly based on relatively small-scale farms with localized terrain and climate features. Climate change analysis and impact studies significantly contribute to the future strategic planning in economic development, and thereby must be done with high level of confidence, which considers cooperative work of the climate research and user community. During the last decade, climate change research in Serbia progressed in accordance with the latest global climate research topics and available computer resources, which are unconditional priority for the quality of the initial data. Stepping stone for the climate change research is numerical simulation of the climate, past and future. Use of these results in agricultural impact studies requires special treatment of the data before serving them to the user community. First, model data underlies to the quality assessment and second, data should be subjected to the model bias, i.e. model systematic error, reduction. In this paper are presented latest results of the high-resolution regional climate model simulation, using NMMB model forced with RCP8.5 IPCC scenario (2013). Model results are evaluated using daily observations of the air temperature and precipitation. Besides presenting basic climate change analysis using delta approach (difference between climate average future and past values), bias correction of the data is done for the purpose of their use in impact studies related to the fruit growing in Serbia. Outcome of the data treatment for model bias reduction is creating database of the high-resolution daily climate simulation data for the 21st century available for the further use in agriculture as well as in other sectors of economy. Usefulness of these data is demonstrated with analysis of the basic climate indices change during the 21st century, which provides assessment of the heat and water availability change, shift in the growing season dates, and risk of the temperature extremes.

Keywords: climate change, climate models, grape growing

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Section 4.

FRUIT GROWING TECHNOLOGIES

S4-O1 (Invited lecture)

Modern Apple Fruit Production

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Economically successful and environmentally conscious apple production must consider several parameters. The bases of successful production are optimal environmental conditions and soil, which can be ameliorated with appropriate technological measures. Physiological demands and potentials of specific soil-cultivar-rootstock combinations must be understood to optimize orchard planning, control vigor and achieve abundant flowering. Planting system and training form must lead to ideal conopy light relation and energy capture. Establishing new orchard and its maintenance in juvenile and full-bearing phases shall be discussed in terms of main technological measures, soil management, pruning and training, plant nutrition, irrigation, fruit thinning, fruit quality improvement etc. Results of our studies as well as international data will be presented.

Keywords: technology, training system, pruning, nutrition, irrigation

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S4-O2

Sustainable Orchard Management in Semi-arid Area to Improve Water Use Efficiency and Soil Fertility

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Climate changes (mainly increased temperature and precipitation changes) will have agricultural consequences due to the interrelations between climate and soil degradation, land and water use, landscape changes. Improvement of orchard management practices aimed at increase soil fertility traits (e.g. soil organic carbon, microbial community, porosity) will be beneficial also for improvement of water use efficiency at farm scale through improved soil water holding capacity. This paper mainly focuses some effects of changed soil management practices in a semi-arid environment from conventional (soil tillage, mineral fertilisers, burning of pruning residues) to sustainable (no-tillage, pruning residues and cover crop retention, compost application) on soil microbial biomass, organic carbon (SOC) and irrigation water. Results show that a 7/10-year period of changed practices significantly increased SOC concentration and soil microbial biomass at Mediterranean fruit tree orchards and that yield was improved by 30 – 50% as compared with that recorded in conventional managed orchards. The effects of carbon addition on reserves of soil nutrients (N, P, K, Ca, Mg) and on CO_2 soil emission are discussed.

Keywords: climate change, irrigation, mineral nutrition, soil carbon

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S4-O3

Fruit set of 'Jonagold': a Small Dose of Gibberellins or Regalis

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Flowering is a crucial period, because yield is based on a good fruit set. Even a lot of flower buds are not a guarantee of a good yield. The quality of the flower buds and the weather during and after flowering are very important factors. Consequently, growers want to exploit all possibilities that can contribute to a good fruit set, especially in a year with frost damage or when there are only few flower buds. A treatment with a low dose of GA_{4+7} can improve fruit set. But other prerequisites remain the presence of non-opened flowers, the availability of pollen and good weather. After bloom, an increase in fruit set can indeed be observed after a treatment with GA_{4+7}, but often this is lost for the most part during June drop. Therefore, we also did trials with Regalis (Prohexadion-Ca). Regalis inhibits gibberellin formation, but acts also as an anti-ethylene agent when it is sprayed between 2 and 4 weeks after full bloom. Regalis can reduce June drop, but the moment of spraying is important and the effect is only short (4 to 5 days). Therefore, we recommend to spray 2 times at a rate of 0.5 kg/ha 2 and 3 weeks after full bloom. The treatments must be done before the occurrence of stress. On parcels in an off-year or after frost damage, it is also possible to spray twice with 0.5 or 1 kg/ha of Regalis at the beginning of bloom and 3 weeks after full bloom to reduce shoot growth, so there is less competition for nutrients. Between beginning of bloom and full bloom one must also spray a small dose of GA_{4+7}. There should be at least 3 days between spraying with Regalis and GA_{4+7}. The best strategy for parcels of 'Jonagold' with a difficult fruit set depends on the situation, which will be explained in more detail.

Keywords: GA_{4+7}, prohexadion-Ca, anti-ethylene agent, June drop

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S4-O4

Branch Induction via Prolepsis in the Nursery

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Branching in fruit trees is mostly cultivar-dependent. However, the branching habit of genotypes might be altered by training methods. This study has been carried out to investigate the tree quality of different methods focused on proleptic and sylleptic branching in the apple nursery. 'Golden Reinders'/'M.9' combination was used as a plant material. Knipboom tree for syllepsis and fruitful tree for prolepsis were chosen. The treatments employed randomized complete block design with at least 3 replications including 75 plants. During the years 2010 and 2011, the data were collected for tree quality (branch character, tree height, spur and brindle, tree weight, root: shoot ratio, total leaf area etc.) and physiological criteria (total carbohydrate, nutrients etc.). Fruitful tree significantly increased the number of branches (>25 cm) in comparison to knipboom tree. Fruitful tree produced 7.1 branches/tree in the first year and 7.0 branches/tree in the second year of the trial. The best results for branch crotch angle, spur number, brindle number, trunk diameter and tree height were obtained from fruitful tree treatment in both trial years. Physiological criteria that were represented in percent were not affected by treatments. However, it was concluded that fruitful tree with a more total leaf area may be achieved by more nutrient content. In conclusion, we could say that branching methods addressed on proleptic or sylleptic branching have a strong effect on tree quality in the nursery. Proleptic branching e.g. fruitful which is not a widespread method in the nurseries found to be a successful method for 'Golden Reinders'/'M.9' combination to promote many tree quality and physiological characteristics in the nursery tree.

Keywords: acrotony, basitony, mesotony, heading, syllepsis, tree architecture

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S4-O5

Effects of Fertilization on Yield, Fruit Quality and Return Bloom of Young Apple Trees

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When establishing an apple orchard it is important to stimulate the growth of young trees to fill up their allotted space in the row and minimize the time to come into full production with high quality fruit. In May 2012 two-year old 'Summerred'/'M.9' kniptrees were planted at the experimental farm at NIBIO Ullensvang, western Norway. The planting distance was 1 × 4 m (2500 trees per ha). Three fertigation schemes were established (zero; low – 0.15 g N per m row per day, and high nitrogen – 0.30 g N per m row per day) and two crop loads (low and high). The year after planting the crop loads were limited to zero and five apples per tree. In the third leaf the crop loads were adjusted by hand to 15 apples and 30 apples per tree for the two crop levels, respectively. The experimental design was a randomized blocks with four replications and 10 to 12 trees per treatment. Soil managements were grass in the alleyways and 1-m wide herbicide strips along the tree rows. Soil water was monitored and leaf and soil samples were collected during the season. At harvest, yield and fruit quality were registered. No significant effects of N-fertigation on soil NO_3^-, NH_4^+ or N-min contents were found. However, N-fertigation increased the leaf nitrogen content the whole season and leaf – N were ≥ than the standard adequacy range (1.5 – 2.0%). The trees reached the final height of 3 m in the third leaf. Trunk circumference and number of branches per tree increased from second to third leaf, but were not significantly influenced by the N-fertigation. In the third leaf the high crop trees yielded 7 kg per tree (17.5 tons per ha) and the low crop load 4 kg per tree. Fruit weights were negatively correlated with the crop loads. Small differences in fruit quality attributes were found. Return bloom was not affected after the second leaf. However, the high crop load in the third leaf clearly reduced the amounts of return bloom in 2015, irrespective of the amount of N-fertigation.

Keywords: *Malus domestica*, nitrogen, irrigation, tree growth

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S4-O6

Homobrassinolide for the Production of Shipping Quality of Sweet Cherries

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Homobrassinolide (HBR) belongs to a group of about 70 brassinosteroids that are ubiquitous to higher and lower plants. It is registered with U.S. Environmental Protection Agency. We are evaluating its growth-promoting effects on fruit crops including cherries. Cherry growers are reluctant to apply GA_3 on blush and early-mid-maturing cultivars due to its delaying effects on fruit color development and harvest timing. The objectives of this study are to determine the effect of a pre-harvest spray of homobrassinolide (HBR) on fruit quality at harvest and after storage/shipping and maturation of 'Rainier' and 'Bing', and the response of fruit growth, fruit size, yield, and return bloom to HBR. We noticed the following significant findings: (1) HBR at 1 ppm applied at straw color stage increased fruit firmness (FF) of 'Rainier' (numerically) and 'Bing' significantly ($p < 0.05$) without delaying color development and maturation. HBR did not significantly affect fruit size, pedicel pull force, soluble solid content (SSC), or titratable acidity (TA) at harvest or after storage/shipping. (2) HBR and GA_3 tended to reduce fruit bruising and pedicel browning incidences but not at a statistically significant level after 3 weeks of cold storage. These results as well as the return bloom will be presented.

Keywords: Homobrassinolide, cherries, shipping quality, fruit firmness

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S4-O7

Stone Fruits in Turkey: A Brief Overview

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Turkey is country of origin of many fruit species such as cherry, apple, plum, chestnut, walnut and hazelnut. These species are native to some parts of Turkey. Turkey is one of the most important countries in the world in terms of fruit production. It is one of the world's leading countries in the production of stone fruits such as apricot, cherry (sour and sweet), peach and plum. For example, Turkey is the first country in the world for apricot and sweet cherry production with 780,000 tons and 494,325 tons, respectively. Turkey is also a leading country in the world for the export of cherries and apricots. In this review production, exportation, diversity and growing of stone fruits in Turkey will be discussed.

Keywords: stone fruit, apricot, cherry, peach, nectarine, plum, Turkey, growing, production

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S4-O8

Development and Extension of Walnut Propagation in Iran

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Persian walnuts (*Juglans regia* L.) are widely grown in in Iran, as the center of origin of this tree. Propagation of this species is very difficult compared to other fruit and nut trees. Different types of grafting (epicotyl grafting, side stub grafting, omega grafting, whip and tongue grafting, saddle or "V" grafting, patch budding, chip budding, shield budding and topworking) and tissue culture (propagation by micro shoots or somatic embryogenesis) techniques have been studied intensively in last 25 years in Iran. In these studies, effect of grafting type and time under different conditions (greenhouse, outdoor and shade house) on callus quality, graft-take, survival and growth of the scions have been studied. Several experiments have been conducted on optimization of micro-propagation steps such as establishment, proliferation, rooting and acclimatization of walnut. Successful techniques were trained to the growers and agricultural experts. As a result of these efforts, several walnut grafting nurseries and walnut tissue culture labs have been established which propagate walnut cultivars and rootstocks commercially for local and international markets.

Keywords: *Juglans*, grafting, budding, micropropagation, topworking

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S4-O9

Application of Hot Callus and Epicotyl Grafting Methods in Walnut Propagation in Bulgaria

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Experiments with the application of new hot callus and epicotyl grafting methods were carried out at the Fruit Growing Institute – Plovdiv, Bulgaria. The paper treats the use of both methods in walnut propagation under production conditions. All the elements and principles of the technological process are described in details. One year old seedlings of *Juglans regia* L. were used as rootstocks. Grafting was performed with cultivar 'Izvor 10'. The percentage of the successfully propagated plants depended on the grafting method. The results showed that the successfully propagated walnut plants were 85.5% in the hot callus method and 71.0% in the epicotyl grafting. The conclusion was drawn that both methods are suitable for propagation of walnut in agricultural practice.

Keywords: walnut, *Juglans regia* L., propagation, epicotyl grafting, hot callus

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S4-O10

Strawberry Culture in Turkey

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Turkey strawberry production consistently increased since beginning of strawberry culture in 1970's. In the last 10 years, strawberry production has shown a dramatic increasing from 150,000 t (2003) to 376,070 t (2014), making Turkey third big strawberry producer country in world after ABD and Mexico. Main strawberry producing regions in Turkey are Mediterranean (52%), Marmara (24.7%), and Aegean (15.7%). In Mediterranean Region, Mersin city has met 35% of total production. Aydın, Antalya, Bursa and Konya cities follow it. Strawberry export of Turkey also increased year by year. 11,870 t of 24,774 t (2013) strawberry export was made in Russian Federation. The protected strawberry culture is getting popular. 1/3 of the current production comes from high tunnels followed by mini tunnels. Annual hill plastic culture system is a common practice in Turkey's strawberry growing. The strawberry nurseries are generally located in Central Anatolia Region mostly around Cappadocia. Frigo plants are still dominating in production. However Turkey has not a big strawberry breeding program, there are several strawberry cultivars bred and registered in Turkey. In recently years 'Camarosa' and 'Sweet Charlie' strawberry cultivars are replaced by cultivars such as 'Rubygem', 'Festival', 'Albion', 'Florida Fortuna', 'Palomar', 'Florida Elyana'. Soilless culture in strawberry growing is also developing in Turkey. In this article, it will be presented current status of strawberry growing, developments in strawberry growing technics and seedling sector, and future projection in strawberry growing in Turkey.

Keywords: Turkey, strawberry, growing, developments, cultivars

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S4-O11

Greenhouse Cultivation of Banana: Very Favorable Crop in Turkey

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Banana has been grown economically in Turkey for over a century. At present, the total banana growing area of Turkey has reached up to 5,000 ha of which more than 2,500 ha are under protected cultivation. Presently, banana production in Turkey is around 215,000 tons, whereas the total consumption is over 400,000 tons. Therefore, Turkey has to import nearly 200,000 tons bananas from overseas. Protected cultivation of banana is unavoidable in order to cover total consumption from local production. Although greenhouse construction is costly, banana farmers prefer greenhouse cultivation due to the banana plants bear fruits in the same year after planting, higher yield and also low labor cost. The objective of this study was to evaluate 'Dwarf Cavendish' cultivar and local type 'Azman' which is grown in subtropical conditions under unheated plastic greenhouse. The study was conducted between 2014 and 2015 in Alanya in the province of Antalya. The planting density was 1,850 ha^{-1} and drip irrigation system was used. Plant morphological features (plant height, stem circumference and height, bunch stalk circumference), yield components (number of hands, number of fingers, finger circumference, and finger length and bunch weight) and fruit qualities (peel thickness, the peel and pulp ratio, soluble solid content) after ripening were determined. The plant height, stem height, number of hand, bunch weigh and finger features were the most variable traits. 'Dwarf Cavendish' produced the shortest plants and pseudostem height. Bunch weight and finger features in 'Azman' were found to be superior to 'Dwarf Cavendish'. As 'Azman' type produced higher yield (69.3 tons/ha/year) than 'Dwarf Cavendish' cultivar (52 tons/ha/year), 'Azman' is recommended for cultivation in unheated greenhouse.

Keywords: banana, greenhouse cultivation, morphological features, yield, quality

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S4-P1

Evaluation of Apple Cultivars and Hybrids in a Fruit Nursery

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The study was conducted in 2011–2012 in the fruit nursery of Institute of Agriculture – Kyustendil. The main aim of this paper was to check quality of nursery trees of introduced apple cultivars and selected hybrids, grafted on 'MM 106' rootstock.The grafting was made on dormant bud in July at 15 cm from the ground. During the research the following indicators were measured: percentage of intercepted and developed buds, growth dynamics of the grafted cultivars, number of plants with syleptic shoots, number and length of the branches. Percentage of standard and non-standard trees was obtained according to the norms of the Bulgarian State Standard. It was established that 'Hybrid № 6' and 'Rubin' had the highest percentage of intercepted buds, while 'Red General' and 'Pinova' had the lowest. 'Remo', 'Free Red Star', 'Melfree', 'Gold Millennium', 'Reandra', 'Primera', 'Hybrid № 6' and 'Red General' had stronger growth and 'Brina', 'Pacific Rose', 'Longfeng', 'Hongro', hybrid Pinova × Fuji, 'Goldrush', 'Yanga 1' and 'Renora' had less growth, compared to 'Granny Smith' and the rest of cultivars. 'Granny Smith', 'Longfeng', 'Yanga' and the 'Pacific Rose' showed a tendency to form syleptic shoots in the nursery. The greatest percentage of standard planting material was obtained from 'Hybrid № 6', 'Granny Smith' and 'Rubin' and the least from 'Brina', 'Pacific Rose' and hybrid Pinova × Fuji.

Keywords: apple, fruit nursery, MM 106, growth

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S4-P2

Effect of 6-BA+GA_{4+7} and Nitrogen Fertigation on Feathering of 'Golden Reinders' Apple Nine-month Nursery Trees

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The apple (*Malus domestica* Borkh.) cultivar 'Golden Reinders' was used to study the effects of mixture of 6-BA and GA_{4+7} (Progerbalin) and nitrogen fertigation on improving branching of nine-month old nursery trees grafted on 'M9' rootstock. Progerbalin was applied 3 times in June, weekly, in concentration of 0, 500, 1000, 1500 i 2000 mg/L to the upper third of trees. Nitrogen (N) was injected weekly at total amount of 50, 100, 150 and 200 kg/ha for season. Trunk cross section area (TCSA), height of nursery tree and the number and quality of lateral branches were measured and evaluated at the end of October 2013. Obtained results indicated that nursery trees without Progerbalin treatment expressed significantly lower TCSA in comparison to the other treatments, whereas treatments with increased amounts of N influenced significantly higher values of TCSA. Nursery trees were significantly higher in Progerbalin treatments only when amounts of applied N were above 100 kg/ha. It was not confirmed N influence on height of nursery trees if those were not subjected to Progerbalin treatment. Number of lateral branches was increased in the treatments with Progerbalin, whereby any increase in its concentration significantly increased the number of lateral branches. The same trend was observed with applying higher amounts of N. Treatment with 200 kg N per ha had 3-fold higher number of lateral branches, whereas treatment with 50 kg N per hahad only 1.2-fold higher number in comparison to the treatment without N. Significant interaction effect between Progerbalin and N confirmed in this study indicates that Progerbalin treatment has no effect on number of lateral branches without N application. More specifically, Progerbalin concentrations above 1500 mg/L had no significant effect on number of lateral branches per nursery trees when N amounts were higher than 100 kg N per ha.

Keywords: plant growth regulator, nitrogen fertilization, nursery tree quality, lateral branches

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S4-P3

Enhancing Feathering of One- and Two-year-old Nursery Trees of 'Granny Smith' Apple Cultivar Using Benzyladenine and Gibberellins

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Synthetic cytokinin 6-benzyladenine (BA) when applied either alone or in combination with gibberellins (GA_{4+7}) plays an important role in the production of well-feathered apple nursery trees and in overcoming apical dominance. This paper presents the effects of BA and BA+GA_{4+7} on the feather formation on one- and two-year-old "knip-boom" nursery trees of apple cultivar 'Granny Smith'. In one-year-old trees the solutions of BA and BA+GA_{4+7} corresponding to the concentrations of 250, 350 and 450 µl l^{-1} of active ingredient (BA) were applied three times at 7-day intervals during vegetative period. In two-year-old 'knip-boom' trees application of 300 µl l^{-1} BA, followed by 400 µl l^{-1} of GA_{4+7}, were applied once, two or three times at 7-day intervals during vegetative period. Our findings indicate that increasing the BA concentrations (250-450 µl l^{-1}) leads to a decrease in the total number of feathers. On the other hand, GA_{4+7} applications eliminate these negative effects. In addition, in one-year-old trees BA+GA_{4+7} at 450 µl l^{-1} induced the occurrence of longer feathers compared to BA applied alone. The positive influence of GA resulted in greater feather length. This effect was especially pronounced in two-year-old trees when GA_{4+7} was applied two or three times. The treatments did not have any negative effects on tree height and trunk diameter.

Keywords: 6-benzyladenine, gibberellins, feathers, apical dominance

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S4-P4

Fruit Quality and Productivity of Apple cv. 'Braeburn' Depending on the Training System

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The influence of different training systems (slender spindle, northern Holland spindle, solax and "V" system) on the productivity of the apple (*Malus domestica* Borkh.) cultivar 'Braeburn' have been evaluated. Research was conducted at two experimental orchard located in Skopje and Resen during 4 consecutive years. The trees were grafted on 'M9 T337' rootstock. The planting distance was different and according to the training system. For slender spindle and solax the planting distance was 4 × 1.5 m (1667 trees/ha) and for northern Holland spindle and "V" system it was 4 × 1 m (2500 trees/ha). Following parameters were evaluated: vegetative characteristics of the trees, yield, and yield efficiency and fruit quality. The results showed statistically significant differences between years, location and between different training systems. Concerning the productivity, the trees grown under the slender spindle system had the highest yield, whereas the ones from the "V" system had the lowest. Expressed per hectare, the northern Holland spindle system was the most productive. The solax system had the lowest yield per ha. The trees on solax training system had the highest yield efficiency, while the lowest was observed on slender spindle system. The highest values for the fruit weight were obtained at northern Holland spindle, whereas the ones from the solax training system were the lowest.

Keywords: *Malus domestica*, yield, yield efficiency, growing system

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S4-P5

The Influence of Mechanical Thinning on Fruit Quality and Constant Bearing of 'Jonagold' Apples

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In the Fruit-growing Centre Maribor the influence of mechanical thinning with the device "Darwin 200" on the fruit quality and constant bearing was monitored in the years 2013 and 2014. Trees with different flower abundance were selected: in the year 2013 from 40 till 140 flower clusters per tree and in 2014 from 150 till 350 flower clusters per tree). "Darwin 200" device was used at the constant speed of 6 km/h and different axle rotation speed (200, 240, 270 and 300 rotations per minute respectively). 55 days after full bloom hand thinning was performed. Different quality measurement (size and colour classes) as well as the number of flower clusters in the succeeding year confirmed that the combination of the number of flower clusters and the rotation speed were crucial for achieving appropriate fruit quality. Hand thinning had a good effect on fruit quality and constant bearing when the number of flower clusters per tree was up to 80. A quality yield and constant bearing was achieved by mechanical thinning and additional hand thinning at the following combinations: 80 till 120 flower clusters per tree thinned with axle speed of 220 till 240 rotations per minute, at 120 – 180 flower clusters/tree and 240 – 270 rotations per minute as well as at 180 – 250 flower clusters and 270 rotations per minute. At more than 250 flower clusters per tree a constant bearing couldn't be achieved. At axle speed of 300 rotations per minute the trees were damaged and with speeds bellow 200 rotations per minute constant bearing couldn't be achieved. We were able to show in our experiment that mechanical thinning with additional hand thinning can be an effective tool for stable bearing from year to year.

Keywords: hand thinning, mechanical thinning, flower clusters, fruit quality

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S4-P6

Influence of Chemical Thinning on Yield and Fruit Quality of Apple in Second Leaf

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This experiment was designed to investigate effects of chemical thinning on fruit set, yield, return blooming and fruit quality of apple cultivars 'Golden Reinders', 'Gala Royal Beaut', 'Red Cap' and 'Red Jonaprince' in 2014 year. The orchard was established in spring 2013 with high-quality 2-year-old nursery trees that contained 7 or more lateral branches (except cultivar 'Red Cap'). Planting distance was 3.2 m between the rows and 0.83 m within the row. For chemical thinning were used: auxine naphthaleneacetic acid (NAA), cytokinin 6-benzyladenine (6-BA), insecticide carbaryl ("Sevin") and photosynthesis inhibitor metamitron ("Brevis") and their mix combinations of sprays. All applied products had significant effect to chemical thinning of fruits, especially "Brevis" and combinations of "Brevis" with NAA and 6-BA. In comparison to the control trees all treatments had influence on size of fruits. The highest effect on the return blooming was recorded in cultivars 'Golden Reinders' and 'Red Cap'.

Keywords: chemical thinning, apple, yield, return bloom

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S4-P7

Growth Regulation of Apple Trees by Prohexadion-Ca Application in a Nordic Climate

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Prohexadion-Ca, an acylcylohexadione, is a plant growth retardant jointly developed by BASF, Germany and Kumiai Chemical Industry, Japan. In 2012, a trial on mature 'Aroma'/'M 9' apple trees growing in the experimental farm at NIBIO Ullensvang, western Norway was initiated. Each plot consisted of single trees, spaced 2 × 4 m and limited to 2.5 m height. The trees were treated with prohexadion-Ca (trade name Regalis®, 10% prohexadione-Ca as active ingredient) 10 days after full bloom (June 6) and one month later (July 5), using concentrations of 125 g and 250 g per ha, totally five treatments included untreated control. Treatments were applied to individual whole trees in a randomized complete block design with four replications and grouped according the number of flower clusters and tree trunk circumference. The experimental trees were sprayed to the point of run-off with a hand sprayer (2.5 l per tree). On each tree 5 shoots from fruiting spurs and five shoots from non- fruiting spurs were tagged. The length of each shoot was measured on July 4 and at the end of the growth season when the growth had stopped (August 31). The prohexadione-Ca treatments reduced the shoot growth of bearing apple trees. Treatments with 125 g and 250 g of active ingredient gave about 50% growth reduction of new shoots. One treatment with 250 g right after bloom or two treatments with 125 g with one month apart gave similar growth reduction. Prohexadion-Ca had little effect on yield and fruit quality. The carry-over effect the year after was registered.

Keywords: *Malus domestica*, fruit quality, yield, shoot growth

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S4-P8

Effects of Shading Nets on Sunburn of 'Granny Smith' Apple Cultivar

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Sunburn causes some damage to apple orchards and it results from heat stress to the fruit leading to injury of the affected cells. Leaves and fruits of agricultural crops can be sprayed with suspensions, or over-tree sprinkler system and shade net can be used for reduce sunburn on fruits. A net shield is a good option for protection of apple trees against damage by hail, strong wind, and birds. Also, it reduces sunburn and russeting of fruits, provides better color and skin uniformity. This study was carried out in 'Granny Smith' commercial orchards to determine the effects of different light transmissions shade nets on fruit sunburn and quality. The experiment was conducted in commercial apple orchards in Denizli, west part of Turkey during two consecutive years (2012-2013). Shading net reduced fruit sunburn. Fruit sunburn ratio was 24% under open sky (without net) condition. Black or white nets reduced sunburn of fruits without negative effects on fruit quality and maturation.

Keywords: *Malus communis* L., shading, net, sunburn, fruit quality

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S4-P9

The Effects of Anti-Hail Net in Protection of Pear Orchard after Hail Occurrence

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The use of anti-hail net is considered as one of the most effective ways to protect orchards from the hail. The effect of crystal (transparent) anti-hail net on the protection of fruits from hail, fruit quality, differentiation of flower buds, and growth of the trees after hail incidence were evaluated at the pear orchard with cultivars 'Bartlet' and 'Red Bartlet'. Experiment was carried out in net-covered and uncovered pear orchards located in north-eastern part of Macedonia during 2014 – 2015 years. The experimental orchard was established in 2010, with a planting distance 3.2 × 1.3 m. From each variant 60 trees in three repetitions were evaluated. After occurrence of the hail, results show high damages on the fruits on uncovered trees in both varieties. Percentage of fallen fruits on uncovered trees ranged from 40% in 'Bartlet' to 48% in 'Red Bartlet'. Only 5 to 8% of the fruits were undamaged. Most of the fruits have tree or more hits per fruit. On the covered trees maximum protection from the hail was obtained. Significant differences concerning damage of sunburn, growth of the trees and differentiation of flower buds were determined between covered and uncovered trees in both varieties. Higher differentiation of flower buds, fruit set and productivity had trees covered by anti-hail net. In both evaluated cultivars anti-hail protective net demonstrated its efficiency for fruit protection against hail, increased fruit quality and productivity in the same and in the next production year.

Keywords: *Pyrus communis* L. hail, damages, yield, growth, flower bud differentiation

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S4-P10

Regulated Deficit Irrigation Combined with Mulching Influences the Vegetative Response of Young 'Williams' Pear Trees

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Experiments related to deficit irrigation and particularly regulated deficit irrigation or partial rootzone drying depend heavily on weather conditions. This field experiment was designed and continued in second year to assess the vegetative response of young 'Williams' pear trees to regulated deficit irrigation (RDI), mulching and their combinations. Using a water budged methodology, four levels of irrigation, specifically 100% of evapotranspiration as control and deficits of 80%, 60% and 40%, were applied to 10 trees during the season, 5 of which were mulched by a 10 cm layer. The experiment was conducted in Kosovo (Dukagjini Plain) during 2014 on a pear orchard of 10 ha in fourth year using a nested experimental design. Using ANOVA two-way with post hoc testing during our second year of experiment we found significant changes in a series of vegetative parameters. Irrigation levels significantly influenced leaf surface and area, leaf area index (LAI) and canopy volume, while mulching significantly influenced on shoot length and the first measurement of trunk diameter. RDI and mulching had a combined effect on first and second measurement of trunk diameter, number of leaves, leaf area, LAI, number of shoots and canopy volume. Considering the young age of trees and long – term consequences of water stress, the experiment is continuing yet.

Keywords: young trees, *Pyrus communis*, water stress, wood chips

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S4-P11

The Influence of Planting Density on Fruit Characteristics of Peach and Nectarine

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The objective of this study was to determine the fruit characteristics of peach and nectarine cultivars in a new training system (Sloping Leader). High-density orchard (2800 trees per ha) was established by planting vineyard peach seedlings at a 3.5 × 1 m tree spacing. Grafting was performed at a height of 50 cm. The central leader was bent at the angle of 65°. The standard experimental plot was planted with nursery trees and two training systems: Fusetto (4 × 2 m) and Open Vase (4 × 4 m) were applied. The influence of three different planting densities on fruit characteristics of three peach cultivars: 'Early O'Henry', 'Sunprince', and 'Autumn Glo', and two nectarine cultivars: 'Vincanka' (clone of 'Stark Redgold') and 'Max 7' was studied during a three-year period (2009 – 2011). The following fruit characteristics were studied: fruit weight and dimensions, as well as fruit overcolour. A small tree spacing showed negative influence on fruit size of peach cultivars 'Early O'Henry' and 'Sunprince' and nectarine cultivar 'Max 7'. Unlike, in cultivars 'Autumn Glo' and 'Vincanka' differences in fruit size between planting densities were not significant.

Keywords: high density planting, sloping leader, peach, nectarine, fruit weight

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S4-P12

Effect of Biostimulator Treatments on *Prunus mahaleb* L. Stockplants and Rooting Rate of Cuttings

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Stockplants' shoot production and cuttings' quality is essential for propagation efficiency. It is commonly accepted that environmental factors and pretreatment of stockplants impact the rooting ability of cuttings. The aims of this trial were testing the effect of biostimulators and fertilizers on *Prunus mahaleb* L. stockplants and their cuttings after rooting process. The treatments were applied on stockplants of 'Bogdány' and 'Magyar', clonal mahaleb rootstocks. The tested plant growth regulators (PGRs) are the following: Kelpak (0.2%), Wuxal Ascofol (0.2%) and Pentakeep-V (0.05%). Kelpak is an *Ecklonia maxima* (seaweed) extract, where the cytokinin and auxin capacity is important. The Wuxal Ascofol is a biostimulator with added micronutrients and with *Ascophyllum nodosum*, what gives the content of cytokinin, auxin and gibberellin. The Pentakeep-V holds 5-aminolevulic acid (ALA) in 0.3% concentration, what is considered as the precursor in chlorophyll synthesis. In this experiment these PGRs were applied on the stockplants in the above concentration once a week during four weeks. The first spraying was on first week in May. One week after last spraying, on first week of June the cuttings were cut. The cuttings size was uniform (20 cm long with three leaves cut in halves). Before preparation of cuttings, the shoots total fresh weight, the number and fresh weight of appropriate shoots, and starting weights of cuttings were measured. After 8 weeks of rooting period, the number of rooted cuttings, the fresh and dry weights of rooted cuttings were measured. The results show that Kelpak pretreatment is the most effective in improving the productivity and shoot quality of mahaleb stockplants. Kelpak and Pentakeep-V pretreatments did not affect the rooting rate but increased the dry mass production during the rooting of cuttings. The Kelpak pretreatment increased the root mass production on rooted cuttings, while Pentakeep-V increased the shoot weight on rooted cuttings.

Keywords: cuttings' quality, dry weight increment, leafy cuttings, mist propagation, stockplant productivity

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S4-P13

Effect of Grafting Time, Irrigation Regime and Cutting back on Grafting Success of Walnut

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Iran is one of the centers of origin of Persian walnut and vegetative propagation of superior genotypes of walnut populations is very important in this country. To improve walnut grafting success a two years experiment was conducted in two consequence years in Qazvin province. The experiment was set as a randomized complete block design. Grafting time, date of cutting back and interaction effect of year and irrigation regime had the significant effect on grafting success. The best grafting healing and survival (83.3%) was obtained in the last week of June with irrigation intervals of 7 days and cutting back of the rootstock at 60 cm above the ground. At present, this method is being used by the commercial nurseries.

Keywords: *Juglans regia*, grafting, irrigation, rootstock, nursery tree

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S4-P14

Sweet Cherry Fruit Quality under Fertigation

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It is generally accepted that nitrogen fertilization must be ceased a month before the cherry fruit ripening, because of the nitrogen's negative effects on the fruit quality. On the other hand fertigation, an indispensable element of the intensive cherry production, requires frequent fertilizer applications and any breach of the regimes of nutrient supply may become limiting to both growth and yield of cherry trees. The objective of this study is to investigate the effect of fertigation on fruit quality under both continuous and interrupted fertilizer supply during the month before fruit harvesting. For this purpose, an experiment was set up with 'Burlat'/Mazzard and 'Lapins'/'Gisela 5' combinations (twelfth and thirteenth leaf) in the conditions of fertigation, respectively through microsprinkling and drip irrigation, ceased one month before fruit harvesting. Results were compared with ones from a drip-irrigated control, where the fertigation (including nitrogen) was continuous. Fruit quality was estimated based on measurements of mass, height, width, thickness and firmness (by penetrometer with 6 mm diameter), as well as by analyzing fruit flesh for content of N, P, K, Ca, Mg, Fe, sugars, acids, vitamin C, juice pH, and dry mass. Before the second experimental vegetation, the trees of the 'Lapins'/'Gisela 5' combination were aggressively pruned in order to provide proper leaf-to-fruit balance. According to the obtained results, there were no significant differences between the variants with and without interruption of the nitrogen supply before fruit harvesting. Hence, fertigation, and especially with nitrogen, may be applied continuously without negative effects on the cherry fruit quality.

Keywords: fertilization, nitrogen, timing of applications

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S4-P15

The Effects of Different Chemicals on Yield and Quality of 'Sweet Ann' Strawberry Seedlings Grown in Cappadocia Region (Preliminary Results)

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Turkey has the third place in world strawberry production. The country has achieved this rank in short time with persevering and patient works of universities and research institutes. Increased productions has also brought together a distinctive need for high-yield and quality strawberry seedlings. Sufficient numbers and quality are being tried to be achieved in strawberry seedling production of Turkey. The present study was conducted to investigate the effects of some chemicals on yield and quality of strawberry seedlings. 'Sweet Ann' strawberry cultivar was used as the plant material of the study. The effects of 4 different treatments (humic acid, IBA/NAA, trace element fertilizer, glycine amino acid) on yield and quality of strawberry seedlings were investigated in three replications. Soil analyses were performed over the experimental plots before the plantation of seedlings and 50 kg 15-15-15 (N-P-K) chemical fertilizer was applied to plots as base fertilizer. Seedlings were planted during the first week of May 2014 and chemical treatments were implemented when the initial stolons of the plants were ready for rooting. Treatments were applied 4 times in 15-day intervals. The results of the first year revealed that entire chemical treatments had significant positive impacts on yield and quality parameters [number of plantlets, classification (%), plant height, root length, fresh weight and dry weight] of 'Sweet Ann' strawberry seedlings. Especially Glycine Amino Acid distinctively increased the number of plantlets. It was concluded herein that combined application of those chemicals may provide more efficient outcomes.

Keywords: strawberry, IBA+NAA, glycine amino acid, humic acid, microelements

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S4-P16

Effects of Different Growing Systems and Cultivars on Plant Growth, Fruit Quality and Yield of Strawberry in Soilless Culture

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In Turkey, along with conventional methods of strawberry production, soilless culture is being done intensely. Especially along the Mediterranean coastal area, short day varieties with plasticulture are grown in soilless culture in an attempt to increase earliness and total yield. In greenhouses which are used for soilless production, plant numbers per area are being increased by using different growing systems which also helps to maintain the quality of plants. In this research, the effect of soilless production systems with different types of greenhouses on plant growth, yield and fruit quality are being observed. Three different cultivars of strawberry ('Camarosa', 'Candonga', 'Rubygem') were grown with three different systems: plastic high tunnels, single and double shelf systems in modern construction greenhouses. The production was conducted in accordance with 'Good Agriculture Practices' and yellow and blue sticky traps were used for pest management. Cocopeat was used as substrate in horizontal bag cultures. As a result of the research, modern greenhouse applications were found to be advantageous with respect to the earlier flowering and harvest dates, but yield per plant did not differ significantly among the treatments. There were differences between the treatments for fruit quality traits (fruit weight and soluble solids). In result, the 'Rubygem' cultivar was found to be superior with respect to soluble solids content; whereas 'Candonga' cultivar was found to be the best with respect to fruit size.

Keywords: strawberry, plastic high tunnel, modern greenhouses, shelf systems, cultivars

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S4-P17

Effect of Soil Maintenance Systems on Phenological Traits of Black Currant (*Ribes nigrum* L.) Cultivars

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This experiment was set up to evaluate the effect of different soil maintenance systems on phenological traits (beginning of leaf unfolding, full leaf unfolding, inflorescence emergence, beginning of flowering, full flowering, beginning of berry set and berry ripening) in black currant (*Ribes nigrum* L.) cultivars. The research was conducted in the experimental orchard of the Fruit Research Institute, Čačak, West Serbia, during 2012 – 2014. Three soil maintenance systems were used: I – bare fallow i.e. continuous tillage; II – sawdust mulch, and III – black polyethylene foil mulch. Six black currant cultivars were involved, including 'Ben Lomond', 'Ben Sarek', 'Titania', 'Čačanska Crna', 'Tisel' and 'Tiben'. The earliest beginning of the phenological stages was observed in cultivars under foil mulch treatment, and the latest in cultivars under bare fallow treatment. Under all treatments and in all years, the phenological events were the earliest in 'Čačanska Crna' and 'Tisel'. Leaf unfolding was the latest in 'Titania'. The other growth stages were the latest in 'Ben Lomond'.

Keywords: cultivar, black currant, bare fallow, sawdust, foil, phenological traits

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S4-P18

Nitrogen Effectiveness on Blueberry Cultivar 'Chippewa' Yield and Quality

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Research on mineral nutrition for high-bush blueberries in Latvia is at a very early stage. Our studies were devoted to nitrogen – plant nutrient with high mobility and significant impact on vegetative growth and yield formation. The field experiment was started in 2012 in plantation established 3 years before. Experimental plots with blueberry cultivar 'Chippewa' were arranged on gently slope. Original topsoil's reaction was pH in KCl 6.11 – 6.41, organic matter content 20 g kg^{-1}. Five experimental plots, each of them consisting from 8 bushes, were set up. The aim of research was to determinate different fertilizer treatments impact on: mineral nitrogen (NH_4^- and NO_3^+ form) in the soil and this effect impact on plants vegetative and reproductive development, as well as mineral nutrition in the leaves, yield and berry quality of the blueberry cultivar 'Chippewa'. Soil reaction was determined potentiometrically, organic matter in mineral soil according to the Tyurin's method, in organic materials – by dry combustion, and total nitrogen using Kjeldahl method. Samples of leaves from each experimental plot were taken during the vegetation for NPK and Fe, Mn, and B nutrition diagnosis. Research showed that different nitrogen fertiliser applications significantly influenced yields and biochemical content in the berries. Optimal mineral nutrition status in the blueberry leaves was at nitrogen fertilizer application rate of 80 kg ha^{-1}.

Keywords: fertilisation, nitrogen forms, blueberry cultivation, quality of berries

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S4-P19

Evolution of Factors Affecting Mechanical Olive Harvesting

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Harvest efficiency is defined as the percentage of fruits harvested by total production. The percentage of fruits harvested is less than 100% when working with trunk shakers to detach olives. It is important to increase the percentage of fruits harvested in order to increase farmers' income. This objective can be achieved knowing the evolution of the main factors affecting fruit detachment. Fruit removal force (FRF), fruit weight (P) and the ratio between them are important for harvest efficiency. Field trials took place for two years (2013 – 2014) in Vilariça Valley, Portugal Northeast in an olive orchard with 'Cobrançosa Transmontana' cultivar. It was adopted a mechanical harvesting system based on a trunk shaker to detach fruits, and an inverted umbrella to collect fruits. Elementary operation times were measured in seconds to evaluate work rates. Fruit removal force (FRF) and fruit weight (P) was measured in the ripening period, to evaluate their evolution. In this paper are presented: a) preliminary results of the ratio FRF (fruit removal force) / (P) fruit weight evolution on the ripening period; b) results of the equipment work rate (trees/hour). The ratio FRF/P has predominantly descendant values in the weeks before harvest, from 140 to 80 as a result of a FRF downward variation between 4.9 N – 2.94 N and a upward variation of P, between 0.0294 N to 0.0637 N. The FRF/P ratio stabilize the decline in the last week of November, just before harvesting, registering in some cases a slight increase in consequence of FRF increase higher than P increase (contrary to the tendency of previous weeks). Equipment work rate has values between 53 and 57 trees per hour, confirming previous results.

Keywords: olive mechanical harvesting, trunk shaker, efficiency

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S4-P20

The Effects of Irrigation on Leaf Nutrient Content in Pomegranate 'İzmir 1513'

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Pomegranate (*Punica granatum* L.) is a characteristic species of the Mediterranean area whose use and culture have longstanding tradition. It is well adapted to the growth conditions in Turkey and Mediterranean countries and is frequently found growing in wild or semi wild conditions. Pomegranate is known as a drought tolerant crop, but regular irrigation is mandatory in commercial production. Water levels and optimal irrigation regime depend on some factors as soil type, tree size, physiological phase of tree and potential evaporation. Irrigation frequency and amount affect nutrient uptake of the trees. In this study leaf nutrient content of cultivar 'İzmir 1513' was determined under different irrigation amounts during two consecutive years. Three water amounts (0, 50 and 100% of estimated evapotranspiration) were applied to trees with drip irrigation. Leaf content of nitrogen, phosphorus, potassium, iron, manganese, zinc and copper was not affected, but calcium and magnesium increased with higher amount of irrigation water in the first year. In the second year, calcium, magnesium, phosphorus and manganese were changed with irrigation levels.

Keywords: irrigation level, leaf nutrients, pomegranate, *Punica granatum* L.

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S4-P21

Determination of Optimum Period of Pomegranate (*Punica granatum* L.) Rooting with Softwood Cuttings

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Pomegranate is mostly propagated by vegetative means that includes propagation with cuttings (hardwood and softwood). Though the nursery propagation prefers use of hardwood cuttings as the most optimum ones for pomegranate propagation, this research intends to study results of pomegranate rooting by softwood cuttings. The aim of this research is to determine development of the root system of rooted cuttings of three different pomegranate varieties 'Sladunac', 'Glavaš' and 'Barski', in four different time periods. The experiment was set in the open field in the locality of Opličići, Čapljina (43°12ˈN 17°68ˈE), in 2013. At the end of growing season the rooted plants were taken out and measuring of developed root system was made. The following parameters were measured: percentage of rooted cuttings, average width and height of root system (cm), average length of growth (cm). The biggest average length and width of rooting system was registered in the variety 'Sladunac' and it was 14.6 cm, while average width was 5.9 cm. The shortest average length and width of rooting system was noticed in the variety of 'Glavaš', with average height of 8.3 cm, and average width of 4.6 cm. In relation to the rooting periods, it may be concluded that the highest average height (14 cm) and width (6.5 cm) of rooting system was observed in the second period. The lowest height was registered in the fourth rooting period (8.5 cm), while the lowest average height was observed in the first rotting period and it was 3 cm. The conducted research determined the most optimum period for taking of cuttings, and the best percentage rooting in relation to the variety.

Keywords: pomegranate, softwood cuttings, rooting, rooting system

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S4-P22

Effects of Male Bud Flower Removal on Yield and Quality of 'Dwarf Cavendish' Banana (*Musa* spp. AAA)

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Banana is commercially grown in Turkey both in open-field as well as under protected cultivation. The cultural practices are very similar in both banana growing systems. The removal of male buds after the completion of female flower is a routine cultural practice in many banana growing countries. However the farmers in Turkey have a divided opinion on this practice whether it improves the yield and quality of bananas. This study was conducted on 'Dwarf Cavendish' cultivar under open-field conditions in the subtropical area. The objective of the study was to evaluate the effects of the removal of male bud flowers in two different stages: firstly after completion of female flowers and secondly when hermaphrodite flowers are dried. The treatments were compared with control in terms of fruit filling, yield and fruit quality features. The experimental results showed that the number of days for fruit filling was reduced as compared to control in both treatments. The highest bunch weight (27 kg/bunch) was recorded when the male flowers were removed after the female flowers got dried. However fruit quality features, excluding total soluble solid content, were not affected significantly among the treatments.

Keywords: banana, open-field condition, male bud removal, yield, quality

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S4-P23

Foliar Application of Nitrogen at Petal Fall Stage Increased Fruit Set and Size of 'Bengal' Lychee

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Despite low fruit set and alternate bearing, the 'Bengal' cultivar dominates commercial lychee (*Litchi chinensis* Sonn.) production in Brazil. Intense early fruit drop is the most critical stage of fruit development from the grower's point of view. It is during this period that the greatest success in fruit set is obtained influencing final yield. The aim of this study, therefore, was to evaluate the efficacy of foliar application of nitrogen to enhance fruit set and size in 'Bengal' lychee. This experiment used 12-years-old 'Bengal' lychee trees planted with 8 x 6 m spacing in a commercial orchard in Rio Parnaiba, MG (19.25°S, 46.15°W, 1,180 m altitude). The experiment included four urea (45% N) treatments and an untreated control, each replicated on 12 individual trees per treatment in a randomized complete block design. On mid-September 2013 (±80% petal fall), trees were sprayed with a single foliar application of nitrogen as urea at doses: 00 (Control); 60; 120; 180; 240 grams per plant (g plant^{-1}) diluted in ± 8 liters per plant to give good leaf/panicle coverage when air-blasted with sprayer (Jacto Arbus 2000). Diameter and number of fruits were measured at weekly interval from October 5th to December 14th (harvest time). The treatment with 120 g plant^{-1} of urea increased fruit set and size significantly ($P \leq 0.05$). Thus, 120 g plant^{-1} of urea at petal fall stage may be a feasible tool to boost fruit set and size in 'Bengal' lychee.

Keywords: *Litchi chinensis*, urea, fruit drop, fruit growth, yield

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S4-P24

Training Systems Usage and Pruning Methods in Viticulture at Southeastern of Turkey

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Viticulture is one of the most important agricultural productions in Turkey. Annual grape production of 4 million tons from 468,792 hectares ranks Turkey on the 6th place among the world's leading producers. The Southeastern Anatolia region by providing 18% of Turkey's annual grape production is the second most important wine-growing region of Turkey. In the region which produce important amounts of grape, shapes of training varies compared to other regions because of the hot and arid climate conditions. In the region, grapes are mostly grown as "open – center" and "Serpene" training systems. "Serpene" is a location name. This method is using in arid and very hot climate conditions. But in recent years, pergola and "T" or "Y" shaped wire training systems has begun to be implemented. In irrigated vineyards grapes which are grown in Goble or "Serpene" training shape, produce 6 – 8 kg yield per tree. However, grapes grown in the wire training system produce 20 – 25 kg yield per tree. If the pergola system is used in the vineyards, 25 – 40 kg yields are produced per grape tree. Although pergola system is looking more efficient than "T" and "Y" shape wire systems, total grape production per hectare is lower than in "T" and "Y" shape systems because of the planting distances.

Keywords: viticulture, training, pruning

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Section 5.

FRUIT QUALITY, POST-HARVEST AND PROCESSING

S5-O1

Measures for Improving the Red Fruit Color

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Red coloration is an important quality parameter and consumers prefer fruits with intense color compared to poorly colored ones. Red fruit skin color is often associated with ripeness and some internal quality parameters such as sweetness, firmness, juiciness as well as with high content of health beneficial phenolic compounds which can contribute to a high market value of red colored fruits. The red-blue hues are linked with the accumulation of specific group of phenolics, the anthocyanins. The intensity of red color is defined by the ratio, the amount and type of anthocyanins, which accumulate in the vacuoles of the epidermal cells. The formation of anthocyanins and development of red coloration of fruits depends on various factors, among which lighting is crucial. Several technological measures can influence the lighting conditions in the orchard (pruning and training system, hail net, reflective mulch, living mulch). The fruit color can be affected also by other technological measures in either positive or negative way. In this aspect especially the use of various chemical products is important. In order to achieve better skin color different foliar products based on phosphorus and calcium can be used. Spraying apples with Phostrade Ca caused a significant increase of total sugars, anthocyanins and flavonols as well as positively affected color formation. On the other hand the use of Regalis (Prohexadione-Ca) sprayed in the same period temporary reduced the red color formation.

Keywords: anthocyanins, reflective mulch, Prohexadione-Ca, Phostrade Ca

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S5-O2

The Effects of Preharvest 1-Methylcyclopropane (Harvista) Treatments on Harvest Maturity of 'Golden Delicious' Apple Variety

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In this research, the effects of preharvest 1-Methylcyclopropane (1-MCP) (Harvista) treatments on fruit drop, fruit quality and shelf life of 'Golden Delicious' apple variety were studied. For this purpose, Harvista applications with 25, 50, 100 and 200 g/ha doses were applied to 'Golden Delicious' apple variety on dwarf tree orchard in Çanakkale Kepez region. Samplings were carried out on trees before and 7, 14, 21 and 28 days after applications respectively. Fruit drop rate, starch degradation, fruit skin colour, malic acid content, total phenolic compounds, fruit firmness and soluble solids content were evaluated after each sampling date as quality parameters. Furthermore fruits were kept at 20 – 22°C temperature and 50 – 60% relative humidity conditions as shelf life with determining the ethylene production. According to the results, Harvista applications with 100 g/ha and 200 g/ha treatment doses were found out as the most positive applications because of preventing fruit drops and minimized the changes of quality parameters. Harvest maturity could be prolonged for 21 to 28 days with these application doses.

Keywords: 'Golden Delicious' apple, 1-Methylcyclopropane (Harvista), application dose, fruit drops, quality parameters

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S5-O3

Efects of Calcium Concentration in Leaves and Fruits on Strawberry's (*Fragaria* × *ananassa* Duch) Postharvest Life

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The effect of calcium concentration in leaves and fruits on strawberry's fruits postharvest life is evaluated in this study. The experiment was performed in the savanna of Bogotá (Colombia), located at 4º42'28" N latitude and 74º13'58" W longitude, and an altitude of 2,546 m. This region has an average annual temperature of 14ºC, relative humidity (RH) of 70% and precipitation of 640 mm per year. It was used a commercial crop of the variety 'Ventana' (California University) that was planted on plastic mulch without the use of a greenhouse. In this study two frequencies of foliar spraying of calcium were evaluated: weekly (T1), and every two weeks (T2). A control treatment without calcium application (T3) was also applied. The experimental design used was the complete randomized blocks with three repetitions and three treatments. The spraying of 150 ppm started when the 90% of the plants were in the state 6.5 (scale BBCH). The fruits were collected at state 6 of ripening, then classified and packed in plastic containers of 250 g. Postharvest life was evaluated under refrigeration (2 ±1ºC and 90% of RH). The fruits that presented softening or Botrytis cinerea presence were discarded every two days. Significant differences in postharvest life between the treatments T1, T2 and T3 were found. Postharvest life was 19, 18 and 15.8 days for T1, T2 and T3, respectively. Calcium concentration in leaves did not show significant differences between treatments, but it were found significant differences in fruits between treatments, with grater values for T1 and less for T2. The results confirm the role of calcium on postharvest life. Correlations between the role of calcium concentration in fruits and leaves were not found.

Keywords: postharvest life, calcium, foliar spraying, strawberry

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S5-O4

Characterization of the Vitamin E Biosynthetic Pathway in Olive Fruit

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Vitamin E is recognized as α potent lipophilic antioxidant, but its biosynthetic pathway has not been studied thoroughly in olive fruit. The goal of this study was to generate the complete map of biosynthetic pathway of vitamin E in olive fruit through a holistic approach that encompasses both molecular and analytical approaches in successive developmental stages, with special reference to the latest on-tree ripening stages. Fruit material (cv. 'Koroneiki') was collected from the Mediterranean Agronomic institute of Chania, Crete during seventeen successive developmental stages [6 – 38 weeks after flowering (WAF)], spanning from the middle of June until the end of December 2006. For the molecular analysis, real-time RT-PCR was performed using *UBQ2* as a reference gene. Our results showed differential gene expression levels for the investigated genes that are part of the biosynthetic pathway of vitamin E. In particular, larger degrees of gene regulation (up-and down-regulation) were recorded for the first and intermediate genes in the biosynthetic pathway (namely *VTE5*, Geranylgeranyl reductase, *HPPD*, *VTE2*, *HGGT*, and *VTE3*) as opposed to the remaining genes (*VTE1* and *VTE4*). Cchromatographic data showed that the first and intermediate stages of development have higher levels of metabolites compared with the final stages (starting from 24 WAF) of ripening of olive fruit. The levels of α-tocopherol were greater than the other tocopherols. In regard with tocotrienols, only γ-tocotrienol was detected at low levels. Overall, olive fruit (cv. 'Koroneiki') contain significantly higher levels of tocopherols and tocotrienols (Vitamin E) until the 22nd WAF as compared with later stages, correlating with expression profile of *VTE5*.

Keywords: Olive, fruit, vitamin E, tocopherols, biosynthesis, gene expression

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S5-P1

Changes in Asian and European Pear Cultivars Fruit after Harvest in Various Storage Conditions

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Asian pears are characteristic for high variability of postharvest ripening among varieties. They cannot be classify neither as climacteric nor as non-climacteric species. Six Asian pear cultivars (*Pyrus pyrifolia* Nakai) and two European cultivars (*Pyrus communis* L.) were analysed during postharvest ripening. One half of pears was stored in controlled atmosphere CA (0.5% O_2, 0.5% CO_2) at various temperatures after harvesting. The second half was stored in normal atmosphere NA (20.9% O_2, 0.05% CO_2). Some fruits were treated with exogenous ethylene for investigation of ethylene influence. Production of CO_2 and ethylene, changes in flesh firmness, soluble solids and total acids were observed. Asian pears showed higher flesh firmness than European pears after storing. Differences in ethylene production and in the intensity of fruit respiration were also observed. Typical effects of postharvest ripening of European pears such as production of buttery flavour were not confirmed in Asian pears.

Keywords: *Pyrus pyrifolia*, *Pyrus communis*, controlled atmosphere, firmness

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S5-P2

Strategy of Chaenomeles Selection Based on the Chemical Composition of Fruits

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Combination of biochemical traits in pome fruit crops has an important role in quality assessment and prediction directions for their more rational use. Chaenomeles is characterized by unique chemical composition of fruits, which are a valuable raw material for juice, puree, aroma extracts, syrups, liquors, carbonated soft drinks, jams, candies, pectin and other products, enriched with biologically active substances. To define a selection strategy based on biochemical characteristics, suitable combination of parental pairs for breeding, as well as valuable genotypes determination we studied genetically distant forms of *Chaenomeles japonica, C. speciosa, C. cathayensis, C.* × *superba* from the collection of Nikita Botanical Gardens on their fruits chemical composition using standard methods. Studied genotypes of all chaenomeles species are characterized by a high content of organic acids, including ascorbic acid, proanthocyanidins, pectin, low sugar-acid index and sugar content varied within wide limits. The greatest accumulation of soluble solids was typical for *C. speciosa* (18.16%). The average amounts of organic acids are similar in three species (3.75 – 4%), except *C. cathayensis* (3.44%). The highest accumulation of ascorbic acid is characteristic for *C. speciosa* and *C. cathayensis* genotypes (244.58 and 258.25 mg/100 g). The greatest amount of common sugars was observed in the fruits of *C. speciosa* (5.2%). *C. speciosa* is differed with the highest sugar-acid index. The highest content of proanthocyanidins, causing astringent taste, was revealed in *C. cathayensis* (1976 mg/100 g) and the lowest in *C.* × *superba* (554.18 mg/100 g). *C. speciosa* is characterized by the highest content of pectin in fruits (1.82%), water-soluble pectin (0.65%) and protopectin (1.21%). Thus, *C. speciosa* genotypes are the most perspective for selection due to the high amount of most chemical components. Genotypes with lower content of proanthocyanidins combined with the average acidity indicators, but with a high content of ascorbic acid have been selected.

Keywords: *Chaenomeles*, fruits, selection, organic acids, ascorbic acid, sugars, proanthocyanidin, pectin

Acknowledgement: This study was funded by a research grant № 14-50-00079 of the Russian Science Foundation.

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S5-P3

Impact of Harvest Time on Chemical Composition and Antioxidant Capacity of Fresh and Dried Plum Fruits

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Fresh plum fruits are traditionally processed into products with longer shelf life, such as jams, compotes and prunes (dried plums). Fruits on a plum tree tend to ripen unevenly, thus enabling repeated harvesting for the same purpose. The purpose of this paper is to establish the impact of harvest time of fruits on their chemical composition and antioxidant capacity. A two-year research (2011 and 2012) was conducted on fruits of cultivar 'Čačanska Rodna', collected by selective picking at three intervals (at 7-day intervals) during the season and dried in the experimental dryer at air temperature of 90°C. Chemical composition was determined in both fresh and dried fruits using standard methods. The antioxidant capacity was established using the ABTS method, while the content of total phenols and flavonoids was determined by the spectrophotometric methods with Folin-Ciocalteu reagent and aluminum-chloride, respectively. Using high-performance liquid chromatography (HPLC) it was established that the major phenolic compund in fresh plums and prunes is neochlorogenic acid, followed by caffeic acid and chlorogenic acid. The obtained results reveal that prunes possess a higher antioxidant capacity than fresh plum fruits, in all the harvesting intervals, which is determined by the phenol and flavonoids contents. Despite the fact that fruits were picked selectively for the drying purposes, later harvesting intervals caused an increase in the dry matter levels and a decrease in total acids, accompanied by a decrease in the content of caffeic acid on the other side. Changes in the content of all the other parameters in the fresh plum fruits and prunes show no regular patterns in correlation with the harvesting interval.

Keywords: plum, prune, Čačanska Rodna, chemical composition, phenolic content, antioxidant capacity

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S5-P4

Modified Atmosphere Packaging and 1-Methylcyclopropene Usage in Sweet Cherry cv. 'Sweetheart' Storage

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Sweet cherries are becoming more and more popular among growers in Serbia. In addition to domestic market they are being exported to Russia and to the EU. Fruit quality is generally good, but post harvest practices do not respect cold chain and packaging that would reduce losses that occur during transport. Also, there are almost no facilities for rapid cooling of fruit after harvest and fruits are generally inadequately stored. Modified atmosphere is not applied in transportation. Late cultivars of sweet cherries are not being stored even though having the potential for longer storage. In this paper, we investigated the storage ability of sweet cherry cultivar 'Sweetheart'. Cherries were stored using a modified atmosphere packaging bags (MAP) for 30 days while 1-methylcyclopropene (1-MCP) was applied either alone or in combination with MAP. Fruits were stored at 1°C. After shelf life period, fruits were sorted into three groups: healthy, bruised and rotten. Further analyses were carried out on healthy fruits and included fruit firmness, soluble solids and total acid content. Also the state of the stem (cherry) was observed along with organoleptic analysis. The results showed that the MAP substantially improved the storage of sweet cherry. The percentage of healthy fruits was higher, fruits looked fresher, there was less water loss, whereas total acids content was higher. Influence of 1-MCP on cherry fruit storage was not significant. Based on the results obtained, it can be concluded that the only successful way to store cherries is the usage of modified atmosphere with the condition that fruits are harvested within the optimum harvest window.

Keywords: sweet cherry, cold storage, MAP, 1-MCP, quality

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S5-P5

Effects of Post-harvest Hydrothermal Treatments on Fruit Storage of Japanese Chestnut (*Castanea crenata*)

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In Brazil, harvest of Japanese chestnuts (*Castanea crenata* Sieb. et Zucc.) occurs during the warm and rainy summer, conditions that increase mold contamination of the burrs. Farmers do not apply any decontamination process, thus fruits deteriorate 5 days after harvest. A post-harvest hydrothermal treatment could reduce fungi deterioration and extend chestnuts shelf life during subsequent refrigerated storage. The main objective of this research was to evaluate post-harvest hydrothermal treatments for mold control and quality of fruits stored at the temperature of 1°C and the relative humidity of 90%. Thermal resistance trials of isolated strains of fungi were performed and the penetration heat history was obtained for establishing the binomials to be applied in the chestnut treatments. In the first experiment, fresh chestnuts were immersed at 60°C for 12 min (T1); 65°C for 9 min (T2); and 70°C for 6 min (T3). Although a significant mold reduction was obtained in all treatments, appearance of the fruits was drastically affected. Thus, a second experiment was carried out at 50°C for 30, 45 and 60 minutes. Sampling was carried out immediately after the treatments and during storage for analyses of fungus infection, weight loss, moisture, water activity, starch and soluble carbohydrates. Results showed a significant control of molds in the shells and kernels mainly for the chestnuts treated at 50°C for 60 minutes. The weight loss was observed which occurred due to the moisture content decrease. After 83 days of storage, a slight increase in total starch and the soluble carbohydrates was observed for the control and treated samples. It was concluded that the post-harvest hydrothermal treatments affect the overall appearance and kernel consistency.However, it could be useful if the chestnuts are further processed to flour as this technology controls molds and also facilitates the kernels removal.

Keywords: chestnuts, post-harvest, conservation methods, hydrothermal treatments, molds

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S5-P6

Changes in Total Anthocyanins and Total Phenolics in Fruit of Three Strawberry Cultivars during Five Harvest Times

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The paper presents the results of the research into the impact made by genotype ('Clery', 'Joly' and 'Dely') and fertiliser on the total anthocyanins (TA) and total phenolics (TP) in the fruit of strawberry in 2014. Two types of fertilisers were applied – mineral NPK fertilisers and microbiological fertiliser (combinations of different bacteria genera: *Azotobacter*, *Azospirillum*, *Bacillus* and *Pseudomonas*). Fruit samples for analysis were collected in five rounds, in the full maturity phase. The obtained results have shown that the content of TA was under a significant impact of the genotype and the interaction effect of the genotype/fertiliser in the first, fourth and fifth harvest time. The fertiliser had a significant influence on TA in the third, fourth and fifth harvest time. In the course of the entire fruit-ripening phase, fruit of cultivar 'Joly' had the highest TA content. In addition to this, significantly higher values of TA were recorded with the use of the microbiological fertiliser, compared to the mineral fertiliser. The results showed that TP was significantly influenced by both factors under consideration (genotype and fertiliser) and their interaction in all the harvesting times, except in the second harvest time, where the genotype showed no significant impact on this property. Over five consecutive harvest times, the content of TP did not show any regularity. Application of microbiological fertiliser has given the best results in terms of TP content during the entire ripening period. Based on the obtained results, it can be concluded that the biggest advantages related to both tested parameters (TA and TP) were recorded in the interaction between the 'Joly' cultivar and microbiological fertiliser. In the overall conclusion, the later times of harvest resulted in a higher TA in all the cultivars. In addition, certain amounts of mineral fertiliser can be replaced with microbiological fertiliser in order to obtain healthy and environmentally-safe products.

Keywords: garden strawberry (*Fragaria* × *ananassa* Duch.), genotype, fertiliser, harvest times, total anthocyanins, total phenolic

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S5-P7

Anthocyanin Content in Cultivated *Fragaria vesca* Berries under High Temperature and Water Deficit Stress

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In recent years, both wild and cultivated strawberry has become very attractive for consumers due to potentially beneficial phytochemicals contained in their fruits. It is well known that these compounds, particularly anthocyanins and other flavonoids form an anti-oxidative potential and protect against chronic diseases such as tumors or heart disorders. The genetic background of the plant is the main determinant of the content of phenolic compounds in plant tissues, whereas external factors like temperature, light, irrigation can cause qualitative or quantitative changes in the composition of these compounds. The aim of our study was to evaluate anthocyanin content changes in berries of different cultivated *F. vesca* cultivars and hybrids under water deficit and high temperature stress during entire cropping season. It was established, that under high temperature conditions quantity of anthocyanins in berries of cultivar 'Rojan' and hybrid 'N15' increased compared to the plants grown in field conditions. It was shown, that anthocyanin accumulation in *F. vesca* berries in greenhouse (at higher temperatures) was influenced by the external air temperature and had two peaks during the cropping season. Increase of cyanidin 3-O-glucoside (C3G) and decrease of pelargonidin 3-O-glucoside (Pel3G) amount in the berries was observed. Significantly lower amount of C3G and higher amount of Pel3G was found in berries of *F. vesca* hybrids 'N12' and 'N15' grown under higher temperature. Anthocyanin amount in berries in *F. vesca* grown under water deficit stress varied depending on variety and cropping time. The results show a negative association between anthocyanin content in berry and average berry weight.

Keywords: wild strawberry, cultivars, greenhouse, fruit characteristics

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S5-P8

Volatile Compounds of Fruits of Raspberry cv 'Meeker' and Blackberry cv 'Čačanska Bestrna' Propagated by Standard Techniques and by *in vitro* Micropropagation

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In order to establish the impact made by the method of planting material production on major characteristics of fruits, a two-year research was conducted (2011 and 2012) into volatile compounds of raspberry 'Meeker' and blackberry 'Čačanska bestrna' fruits collected from plants propagated using different methods. A comparative study was performed of fruits from plants propagated using standard vegetative technique, as well as ones obtained by in vitro micropropagation, harvested at full ripeness. Isolation of the volatile compounds in fruits was performed using the method of simultaneous distillation and extraction (Lickens-Nickerson method), whereas their quantitative and qualitative analysis was conducted using the GC/MS and GC/FID methods. During 2011 year, 81 volatile compounds were identified in the raspberry fruits, as compared to 129 volatile compounds detected in the blackberry fruits. In the following 2012 year, there were 63 volatile compounds identified in the raspberry fruits compared to 58 volatile compounds in the blackberry fruits. Out of the total number of volatile components, key aromatic components were selected, having a decisive impact on the aroma of raspberry and blackberry fruits. In the raspberry fruits, in both experimental years, contents of 48 key aromatic components were compared, as opposed to 53 key aromatic components whose contents were compared in the blackberry fruits in the same period. These components were further classified in alcohols, aldehydes, ketones, acids, esters, terpenes, sesquiterpenes, lacotnes, C13 norisoprenoids (only in raspberry fruits), hydrocarbons (only in raspberry fruits) and phenols (only in blackberry fruits). No significant differences have been established in the presence of certain volatile aromatic components in the raspberry fruits collected within the same year from plants produced using the standard method, compared to plants obtained using the in vitro micropropagation. The same trend was established in blackberry fruits.

Keywords: *Rubus ideaus*, *Rubus fruticosus*, in vitro micropropagation, fruit aroma composition, Lickens-Nickerson method, GC/MS, GC/FID

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S5-P9

Quality Parameters of Black and Red Currants during Ripening

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At black and red currant is extremely difficult to predict the optimal harvest time of fruits. There are no accurate methods for determining when to pick the fruit and this often results in inappropriate quality of marketable product. In the research we have studied changes during ripening process at three cultivars of each currant species. Fruits were analyzed in three sampling dates in the last 2 – 4 weeks before predicted harvest time. Color parameters, pH level of extracted juice and the content of individual sugars and organic acids were monitored. During fruit maturation different changes of primary and secondary metabolites has been observed. The results can be used in combination with non-destructive methods for metabolite evaluation leading to prognosis of harvest. In this manner overall quality could be achieved in order to gratify the demand of users for taste, dietary and healthiness benefits. In addition, results can also help as a basis for selection of currant cultivars with high internal quality parameters, particularly increased levels of phenolic compounds.

Keywords: black currant, red currant, phenolic compounds, sugars, organic acids

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S5-P10

Changes in Fruit Quality of Highbush Blueberries (*V. corymbosum* L.) during the Ripening Season

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This study illustrates variation in fruit quality attributes of two highbush blueberry cultivars ('Duke' and 'Bluecrop') across the harvests. Both cultivars were evaluated for their ripening time, physical fruit characteristics (fruit weight, index of fruit shape, and number of seeds per fruit) and nutritional value (soluble solids content, total acids, total anthocyanin content, total phenolics and total antioxidant capacity). 'Duke' began to ripen 8 days earlier than 'Bluecrop' in both studied years, whereas the beginning of the ripening time was 2 days earlier in 2013. The mean fruit weight is ranged from 1.87 g ('Duke') to 1.94 g ('Bluecrop') in 2013, i.e. from 1.86 g ('Bluecrop') to 1.94 g ('Duke') in 2014. Fruit weight of 'Bluecrop' decreased linearly from the first to fourth harvests and similar trend was observed in number of seeds per fruit, while for 'Duke' trends of berry weight and seed per fruit across harvests were inconsistent. The highest average amounts of soluble solids (SSC) and total acids (TA) in 2013 were detected in cultivar 'Bluecrop' (12.8% and 0.75%, respectively), but in 2014 SSC were similar between cultivars. TA varied greatly between the cultivars, whereby an opposite pattern to SSC can be observed across the harvests only in cultivar 'Duke' in both studied years. The differences in total anthocyanins between cultivars were statistically significant with higher value recorded in 'Duke', which also contained high amounts of total phenolics (TPH). Harvest had a significant effect on the TPH levels in 2013, but no significant differences in TPH were observed between the cultivars and harvest dates in 2014.

Keywords: cultivar, harvest date, physical fruit properties, total anthocyanins, total phenolics, total antioxidant capacity

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S5-P11

Selection of New Blueberry Cultivars with Higher Contents of Biologically Active Compounds

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Blueberries (*Vaccinium corymbosum* L.) and some closely related species are among the most popular commercial berry fruits. Continuous breeding programs were focusing on creating higher commercial value berry plant genotypes with high productivity, large berry size, berry firmness, and disease resistance. Large berry size, waxy coating, light blue color, firmness and long shelf life are the most important berry characteristics of *V. corymbosum* cultivars. However, due to an increasing demand of healthy foods by the consumers, breeding programs of new berry plant cultivars, which would accumulate higher concentrations of healthy compounds, are carried out. Indigenous species of bog blueberry (*Vaccinium uliginosum* L.), highbush blueberry (*Vaccinium corymbosum* L.) genotypes 'Aron', 'Bluecrop', 'Bluegold', 'Bluehaven', 'Bluejay', 'Blueray', 'Hardyblue', 'Nui', 'Patriot', 'Puru', 'Reka', 'Toro' 'Weymouth', and half-highbush blueberry genotypes 'Danutė', 'Freda', 'Northblue', 'Northland', 'Putte', 'No.16' were investigated in this study. The juices of bog blueberry and newly bred blueberry genotypes 'Danutė' and 'Freda' demonstrated significantly stronger antioxidant properties than other analyzed genotypes. An inverse relationship between average berry mass and total phenolic content as well as the concentration of chlorogenic acid was observed. Moderate negative correlation was found between the berry mass and ABTS•+, FRAP and ORAC values as well. The correlations between similar characteristics measured by different methods were quite high. Thus, the genotypes containing larger amounts of phenolics possessed high values of ABTS•+, FRAP, and ORAC; positive correlation coefficients were 0.914, 0.917, and 0.903, respectively. The antioxidative activity measured with ABTS•+, FRAP, and ORAC also had positive correlation with the concentration of quinic and chlorogenic acids ($p \leq 0.01$). The results of this study suggest that germplasm of half-highbush blueberry *V. corymbosum* and *V. uliginosum* could be used in breeding of new cultivars with enhanced antioxidant capacity.

Keywords: *V. corymbosum*, *V. uliginosum*, antioxidant activity phenolic compounds

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S5-P12

Fruit Chemical Composition of Highbush Blueberry Grown on Different Substrates

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The aim of this study was to evaluate the influence of the planting substrates on basic chemical fruit composition of six blueberry cultivars: 'Brigita Blue', 'Bluetta', 'Bluecrop', 'Sunrice', 'Blueray', and 'Safir'. The researches were carried out in period 2010 – 2012, in an experimental plot of Research Institute for Fruit Growing Pitesti, in a soil with pH 6.0. The chemical fruits content was determined. On average in all years of study, and on all three planting substrates the 'Safir' cultivar recorded the highest content of L-ascorbic acid. For the three experimental years and all studied cultivars the average value of dry matter, total acidity and ash, showed differences no statistically assured between the three planting substrates studied. The total sugars fruits content, tanoids substances and the potassium fruits content had recorded the highest values on the b3 (50% acid peat +25% sawdust + 20% native soil + 40 g powder sulphur) planting substrate, the values were significantly higher for 12.23% versus the average values registered on b2 (70% sawdust + 25% native soil) planting substrate and for 12.42% versus the value registered on b1 (50% peat + 25% manure + 25% native soil + 60 g powder sulphur) planting substrate. At the level of b2 planting substrate at five from total ten chemical components analyzed, the 'Brigita Blue' cultivar had recorded significant differences statistically assured versus the other three studied cultivars.

Keywords: blueberry, cultivar, planting substrate, fruits composition

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S5-P13

The Effect of Chitosan Coating on the Shelf Life of *Actinidia melanandra* Fruits

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The species *A. melanandra* Franch. (red kiwifruit) is an attractive dioeciuos climbing plant which produces reddish green large grape-like berries that are sweeter and more intensely flavored than the fuzzy kiwi. Commercial production of *Actinidia melanandra* has been unsuccessful because of short shelf life of its berries. The aim of this study was to investigate the effects of chitosan coating on weight loss and firmness as well as soluble solids, total polyphenols, and ascorbic acid contents of red kiwifruit *A. melanandra*. Chitosan used in this study was obtained from *Daphnia longispina ephippia*. After 26 days of fruit storage at the room temperature (20±2°C), ascorbic acid content of chitosan coated samples was recorded as 105.9±11.9 mg/100 g while ascorbic acid content of uncoated samples was observed as 83.6±16.8 mg/100 g. These results corroborate significant impact of chitosan coating on preservation of ascorbic acid in *A. melanandra* fruits during storage. Chitosan coated berries contained on average 102.9±9.04 mg/100 g of total polyphenols meanwhile uncoated berries were distinguish by significantly lower amount of total phenolics (60.6±4.62 mg/100g) at the end of storage. Consequently, chitosan coated samples kept higher antioxidant activity than uncoated samples during the long-lasting storage process. Changes of soluble solids amounts revealed that chitosan coated samples had slower decomposition than uncoated samples. It was observed that firmness values of not coated red kiwifruit started to decline after the first days of storage meanwhile statistically reliable changes of this parameter were not detected during the period from 7 to 14 day. Subsequently, we concluded that chitosan coating can be used to extend the shelf life of red kiwifruit berries and preserve their value for longer time.

Keywords: red kiwifruit, chitosan, coating, storage

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S5-P14

Biological Value of Persimmon and *Asimina triloba* Varietes, Grown in Crimea

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The comparative evaluation of technical parameters and chemical composition of perspective persimmon and pawpaw varieties has been presented. The researches have been done using standard methods. Fruits and leaves of pawpaw cultivars from the gene fund collection of Nikita Botanical Gardens are characterized by a high content of ascorbic acid, phenolic compounds, calcium, magnesium, potassium, and are a source of biologically active substances. Persimmon and pawpaw fruits of studied varieties are the sources of leucoanthocyanins, polyphenolic substances, vitamin C, β-carotene and iodine. In 100 grams of persimmon raw mass there are in average 21.2 g of ascorbic acid. The minimum quantity of 12.3 g is in variety 'Hyakume' and variety 'Zolotistaya' has the maximum quantity of 59.0 mg. In conditions of the South Coast of the Crimea the persimmon fruits accumulate a small quantity of zinc. Moreover, in varieties 'Hana Fuyu' and 'Nikitskaya Bordovaya' its content is approximately the same and in fruits of variety 'Suvenir Oseny' it is twice higher. Other types of compounds discovered in fruits: chlorogenic acid, nicotinic acid, gallic acid, caffeic acid, protocatechuic acid and resveratrol increased the antioxidant activity of fruits. The flesh of pawpaw fruits is rich in energetically essential components such as carbohydrates (16.8 – 22.4 g), fats (0.6 – 1.4 g), proteins (0.8 – 1.4 g, all based on 100 g of raw material). They are very nutritious as the content of protein, ascorbic acid and vegetable fat is higher than in apples, bananas and oranges. Biological value of pawpaw fruits is provided with eight indispensable amino acids, including valine (up to 6.0 g), lysine (up to 6.3 g), isoleucine (up to 6.8 g), leucine (up to 8.2 g). Fruits of persimmon and pawpaw contain considerable quantity of potassium, which is very important for heart muscle functioning, making them suitable for people with cardiovascular diseases and for strengthening the immune system.

Keywords: persimmon, pawpaw, varieties, chemical composition, gene fund

Acknowledgement: This study was funded by a research grant # 14-5-00079 of the Russian Science Foundation.

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S5-P15

Antioxidant Capacity and Phenolic Contents of Newly Developed Seedless Lemons

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Recently three totally seedless lemons registered as 'Alata', 'Uzun' and 'Gulsen' have been developed by induced mutation breeding method in Turkey. They originated from 'Kutdiken' lemon known with its high yield and quality. These new cultivars have good fruit quality and storage performance. In the study, antioxidant and total phenolic content of juice from new seedless lemons and 'Kutdiken' were determined. Two methods, namely β-carotene bleaching and DPPH assay were used to determine total antioxidant capacity, while Folin–Ciocalteu reagent was used to determine total phenols. Results indicated that there were differences among lemons for antioxidant capacity and phenolic contents. 'Alata' had the highest total antioxidant capacity with β-carotene bleaching (84.46%) and with DPPH (114.73 mg/100 ml). Phenolic contents of lemons studied was very high and 'Kutdiken' was the best for this trait (181.26 µg GAE/mg DW). The study demonstrated that new lemon cultivars had high nutritional potential for human health.

Keywords: *Citrus limon*, mutation breeding, seedless citrus

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S5-P16

Effect of Thermal Treatment and Ethanol on Salmonella spp and Influence on Post-Harvest Quality of 'Tommy Atkins' Mangoes

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Mangoes (*Mangifera indica* L.) are important in the Brazilian fruit trade, but studies have shown that mangoes imported from South America were contaminated by the water used in the hydrothermal treatment since this process is a barrier imposed by some importing countries. This study evaluated the effects of ethanol in the hydrothermal treatment for *Salmonella* spp. control in mangoes and its influence on fruit quality during storage. In vitro microbiological tests were carried out using ethanol (0, 3 and 5% v/v) at 55, 60 and 65°C and, under these conditions, a pool of *Salmonella* was added (*S. Typhimurium*, *S. Enteritidis* and *S. Brazil*). The sample rate during time of exposure was used for the thermal destruction curves. 'Tommy Atkins' mangoes at maturation stage 2 were used in in vivo tests, when the same pool of *Salmonella* was inoculated on the mangoes surface; then the fruits were immersed in the water/ethanol bath in the same foregoing conditions. Microbiological counts were done by serial dilution on plates and results are expressed as CFU/ml. For the quality control tests 140 mangoes were immersed in water (55°C/1 minute) at 0, 3 and 5% v/v ethanol, cooled down (21.1°C) and stored at 25°C/75% RH for 7 days and at 10°C/75% RH for 14 days, then transferred to 25°C/75% RH for 6 days. The physico-chemical determinations carried out were soluble solids, pH, titratable acidity, skin and pulp color as well as appearance tests. Ethanol demonstrated effectiveness in reducing Salmonella, but the fruits treated with ethanol and stored at 10°C showed worse appearance than the control ones. It was found that immersion in 3 and 5% ethanol at 55°C/1 minute may be a viable alternative to control *Salmonella* in mangoes stored at 25°C.

Keywords: *Mangifera indica*, storage, tropical fruits, ethanol, pathogen

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S5-P17

Fruit Quality of Banana Cultivated in Norte Fluminense Region, Brazil

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Despite the large number of banana cultivars, few of them have agronomic potential for commercial exploitation with high productivity and fruit quality. It is known that only high-quality fruit, without pests, diseases and various disorders are able to conquer new markets. Fruits quality of six irrigated banana cultivars were evaluated in an experiment conducted at conditions of Norte Fluminense Region. The design was a randomized complete block with six treatments related to six banana cultivars ('Maçã', 'BRS Tropical', 'BRS Conquista', 'Prata Anã', 'FHIA 18' and 'BRS Platina'), with three replications. To analyze the physical and chemical characteristics of the fruits the following variables were evaluated: fruit firmness (FF - N), epidermal color of fruits, L*, C* and hue color angle, pH value, content of soluble solids, total titratable acidity (TTA). The 'BRS Conquista' presented together with the cultivar 'Maçã' shorter fruit length than 'BRS Platina'. The cultivars evaluated in this study showed a fluctuation in the average pH value from 4.13 to 4.31. The mean values of soluble solids (SS) were in the range from 19.2 to 20.3°Brix and did not show differences among cultivars. The cultivars did not differ in the mean ratio SS/TA of fruits either, ranging from 34 to 46. Regarding the fruit firmness (FF, in N), the 'BRS Platina' (4.72), 'BRS Conquista' (4.74) and 'FHIA 18' (4.80), obtained values below 'BRS Tropical' (7.42) and the 'Maçã' (9.51).

Keywords: *Musa* spp., post-harvest, physical and chemical analyses

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S5-P18

An Insight into Polyphenolic Compounds of Wines Obtained from Three 'Merlot' Candidate Clones

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The clonal selection of grapevine, aiming to improve the existing varieties, is one of the most important factors in viniculture development. Till date, the key results with clones have been achieved in terms of the yield and quality of grapes and wine. 'Merlot', a dark blue-coloured wine grape, is among the varieties that have been grown for hundreds of years all over the world. However, it is still of great importance enjoying a high reputation both among producers and consumers. During such a long period, some individual vines within varieties were exposed to different influences (such as different types of soil, pathogenic organisms, high or low temperatures as well as chemical compounds) causing the heterogeneity within the population which pointed out the need for the clonal selection. This work aimed to evaluate the total contents of polyphenolic compounds (the Riberau-Gayon-Maurié procedure), anthocyanins (by spectrophotometric procedure, using pH differential method) and tanins (the Nègre procedure) respectively of the wines produced from three 'Merlot' candidate clones obtained in the perennial clonal selection. The aforementioned chemical parameters were determined in the relevant wine samples covering the period 2009 – 2012. In comparison both with the standard 'Merlot' wine (originating from mother vine) and the wines obtained from other two candidate clones, the 'Merlot' wine of the candidate clone No. 022 was found to have the highest total content of all three examined components: 1.89 ± 0.05 g/L (polyphenolics), 185.59 ± 5.00 mg/L (anthocyanins) and 1.11 ± 0.03 g/L (tanins). These findings are in good agreement with the observed trend for the viticultural parameters indicating the 'Merlot' candidate clone No. 022 as more promising than mother. The further research work will be directed towards determination of the content of particular phenolics in all wine samples.

Keywords: clonal selection, 'Merlot' wines, total polyphenolics, total anthocyanins, total tanins

Acknowledgement: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Research Grant No. 172053).

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S5-P19

The 'Cabernet Franc' Candidate Clone No. 010 May Offer Wine with Improved Phenolic Acids Content

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This work aimed to determinate the content of selected phenolic acids in the wines made of three 'Cabernet Franc' candidate clones (long lasting clonal selection) including the wine originating from mother vine (used as the relevant standard). The chemical analysis in all wine samples was carried out using UPLC/MS chromatography with TQ analyser. In comparison both with the standard 'Cabernet Franc' wine and the wines obtained from other two candidate clones (Nos. 02 and 012, respectively; covering the period 2009-2012), the 'Cabernet Franc' wine of the candidate clone No. 010 contained the highest content of the analysed phenolic acids: 27.46 ± 0.47 mg/L (gallic acid), 5.93 ± 0.11 mg/L (vanillic acid), 3.64 ± 0.07 mg/L (protocatechuic acid), 1.05 ± 0.02 mg/L (4-hydroxybenzoic acid) and 0.11 ± 0.00 mg/L (ferulic acid). This is especially true for 4-hydroxybenzoic acid and vanillic acid. Cardiovascular diseases are known to be the leading group of 'killer diseases'. Among them, hypertension is the most common heart chronic illness which the world has been facing in the last years. The importance of hypertension lies in the fact that it forms one of the main risk factors for coronary heart disease, atherosclerosis and peripheral vascular disease. The improved content of phenolic acids, the compounds that are tightly linked with cardiovascular physiology, may contribute to the medicinal properties (more precisely, to antihypertensive and cardioprotective activities) of the 'Cabernet Franc' wine originating from the candidate clone No. 010. The evaluation of broad-range chemical parameters of these wine samples is currently in progress in our labs.

Keywords: clonal selection, 'Cabernet Franc' wines, phenolic acids, 4-hydroxybenzoic acid, vanillic acid

Acknowledgement: This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Research Grant No. 172053).

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S5-P20

Variation of Aromatic Compounds in 'Cabernet Sauvignon' Wine under Influence of Climatic Parameters

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These studies should to indicate the impact of climate parameters on accumulation of aromatic compounds in wines. Research was carried out in the vineyard of King Peter I Karadjordjevic - Royal Winery at Oplenac, Topola municipality. Vineyard planted with 'Cabernet Sauvignon' is geographically positioned at GPS coordinates N 44°14'35" and E 20°41'22". Climate parameters (series from 1982 – 2011 years) included following parameters: mean monthly, vegetation and annual temperature and precipitation. Different compounds of aromatic complexes were detected by GC-MS and GC-FID analysis. The relative portions of compounds are determined based on the peak areas in a FID chromatogram. In wine were detected following groups of aromatic compounds: higher alcohols, lactones, organic acids, esters and amides. During the research it was found variation of the relative proportion of aromatic compounds in 'Cabernet Sauvignon' wine influenced by different climate conditions, accordingly to temperature and precipitation distribution.

Keywords: Cabernet Sauvignon, climate parameters, aromatic compounds, GC-MS, wine

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Section 6.

OTHER TOPICS

S6-O1

Economics of Primocane-Fruiting Raspberry Production in Lowland Conditions

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Raspberry descends into plains occupying more and more territory. There, however, plants have to cope with unsuitable climatic conditions necessitating technological improvements and additional investments, e.g. for irrigation. The aim of that publication is to evaluate the economical efficiency of a technology for raspberry production in lowland conditions. The study was carried out eleven years with the 'Lyulin' primocane-fruiting cultivar and spanned the whole life of the plantation. During the main phenonological phases – intensive growth, blossom, and fruiting – water was applied in amounts equaling to 100%, 75% and 50% of crop evapotranspiration, respectively. Fertilizers were applied through the irrigation system, the fertilization rate being equal for all treatments. The costs and returns balance was applied for establishing the economical efficiency of the studied variants at exchange rates: 1.95583 BGN for 1.00 EURO and 1.47 BGN for 1.00 USD. The raspberry fruit production is not paying with price of 1.50 BGN per kilo. Prices of 2.00 BGN kg^{-1} and higher provide very good profitability. With price of 2.00 BGN kg^{-1}, the expenses are paid back during the fourth vegetation, and during the third vegetation with prices of 2.50 BGN kg^{-1} and 3.00 BGN kg^{-1}. When growing the 'Lyulin' primocane-fruiting cultivar in lowland conditions, the irrigation rates may be decreased by 25% in particular phenophase without negative effect on the yield and the economical effectiveness; during the intensive growth the reduction may be even by 50%. Under severe water shortage, irrigation may be realized with the half of the recommended application rates, on behalf of a quite acceptable decrease in the economical results. When the daily yield drops below 50 kg ha^{-1}, the profit decreases to values, which stultify further harvestings; this according to the raspberry-fruit and labor prices in Bulgaria, effective at the moment of the analysis.

Keywords: 'Lyulin' cultivar, regulated deficit irrigation, fertigation, costs and returns balance

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S6-P1

Screening for Copper and Antibiotic Resistance in *Erwinia amylovora* Population from Serbia

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Fire blight, caused by *Erwinia amylovora*, was observed in Serbia in late 1980s, and since then the disease is spreading territorially and in terms of new host plants including apple, pear and quince. Copper-containing pesticides are routinely used against a number of diseases, including fire blight. Antibiotics have been used in USA, but their use in Serbia and most European countries is prohibited. Continuous use of copper-based treatments and unauthorized use of antibiotics may result in occurrence of copper or antibiotic resistant strains. Therefore, it is necessary to monitor population of the pathogen and determine potential changes in sensitivity to these bactericides. We studied the in vitro effect of different concentrations of copper sulfate, streptomycin and kasugamycin on development and growth of 40 *E. amylovora* strains originating from Serbia. Filter sterilized solution of the bactericides was added to the NA medium after sterilization to a final concentration of 100 and 200 ppm, respectively, followed by spot inoculation of each strain on the medium. None of the strains developed on NA amended with 100 or 200 ppm of streptomycin or kasugamycin. However, all strains had normal growth on NA amended with 100 ppm of copper sulfate, indicating certain level of resistance to copper ions. At 200 ppm, 28 strains formed colonies of normal size and appearance, while 12 strains had smaller colonies with reduced growth. Our study shows that, despite the potential exposure to the antibiotics, E. amylovora strains from Serbia did not develop resistance to streptomycin or kasugamycin. On the other hand, most of the strains from this study were not sensitive to 100 ppm of copper sulfate. This might be due to the extensive and frequent use of copper-based compounds to control fire blight in Serbia.

Keywords: fire blight, streptomycin, kasugamycin, copper sulfate, resistance, screening

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S6-P2

Disinfectants Efficacy Testing for Control of Phytopathogenic Bacteria in Pruning

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Phytopathogenic bacteria *Erwinia amylovora* and *Pseudomonas syringae* pv. *syringae* can be the limiting factors in pome and stone fruits production, respectively, causing wide range of disease symptoms. Combination of chemical measures with a good sanitation program performed during pruning could significantly decrease spreading of bacteria in orchards. In this study, the efficacy of some disinfectants (ethanol 70% and 96%; sodium hypochlorite 3% and 5%; hydrogen peroxide 3% and 6%) in different duration time (1, 5, 10 sec) for disinfection of cutting knives was tested against *E. amylovora* (originated from apple) and *P. syringae* pv. *syringae* (originated from peach). A culture media test was used. Scalpel (stainless steel) was first dipped in bacterial suspension (10^6 CFUml^{-1}) simulated contamination of pruning tools, then instantly put in tested concentration of disinfectant, in which was held for a pre-specified time. Sections of 3 x 3 cuts were made on Nutrient agar supplemented with 5% w/v sucrose. Tested disinfectants and pure bacterial suspension were used as a negative and positive control, respectively. Plates were incubated for three days at 26°C. Results were recorded following bacteria growth on the cuts. To quantify the efficacy of disinfectant *d*-value (0-best; 100-worst) was used. Results showed that all tested disinfectants in both tested concentrations showed 100% efficacy (*d*-value=0) after longer dip (5 and 10 sec). After a rapid dip (1 sec), sodium hypochlorite in both concentrations (3% and 5%) and higher concentrations of ethanol (96%) and hydrogen peroxide (6%) were 100% efficient (*d*-value=0). Lower concentration of ethanol (70%) was effective against *P. syringae* pv. *syringae* while colonies of *E. amylovora* appeared on two section cuts (*d*-value=0.05). Efficacy of hydrogen peroxide in lower concentration (3%) was effective against *E. amylovora* but *P. syringae* pv. *syringae* grew on two section cuts (*d*-value=1.36). Obtained results showed that tested disinfectants are useful against phytopathogenic bacteria and their efficacy depends upon concentration and duration time.

Keywords: phytopathogenic bacteria, fire blight, bacterial canker, disinfectant, pruning

Acknowledgement: The work is a part of the Project No. III43010 funded by Ministry of Education, Science and Technological Development of the Republic of Serbia.

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S6-P3

Integrated Approach For Control of Pest and Diseases in Apple Orchards in the Region of Central South Bulgaria

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Codling moth (*Cydia pomonella* L.) as key pest in our country has been controlled by routine applications of a broad spectrum of insecticides, such as organophosphates, to maintain this pest at an economically acceptable level. Disadvantages of such practices include strongly negative effects on beneficial species and eventually development of resistance to the used insecticides. Control by conventional methods, despite the numerous treatments, is often ineffective. During 2012 and 2013 in two commercial apple orchards situated in Plovdiv (12.4 ha with conventional spraying program) and Stara Zagora region (22 ha of integrated orchard) in Central-South Bulgaria incidence of codling moth was monitored. For control of pest and diseases in 2012 and 2013 in the apple orchard in Plovdiv region were applied 19 and 20 pesticide treatments respectively and in Stara Zagora region 12 and 13 treatments, where have been used granulovirus "Madex" against codling moth. "Madex" was used two times against first and second generations. At harvest time the fruit damage in the conventional orchard was more than 5% and in the integrated orchard almost zero percent.

Keywords: apple, pest and diseases, conventional and integrated production, granulovirus Madex

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S6-P4

The Use of Auto-confusion Pheromone Traps for the control of *Cydia pomonella* L.

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Cydia pomonella L. is one of the most important pests of apple fruits and is usually controlled with insecticides. The aim of this study was to investigate the possibility of control of C. pomonella using auto-confusion pheromone traps. The experiments were carried out in 2012 in Mala Remeta and Bački Vinogradi (Serbia, Vojvodina), in apple orchards, using the recommended protocol. Auto-confusion pheromone traps (PhT) were applied at the rate of 25 dispersers/ha before the moths flight begun. After 40 – 56 days, depending on site, dispensers were replaced with the new once. Along with these traps, standard pheromone traps (1 trap/ha) were positioned in orchards, and also the chemical treatment (CT) was performed in the rest of the orchards. Four assessments were made, i.e. 35 days after the set up of traps, two and three months after and before the harvest. The fruits with larval damages were counted (1.000 to 2.000 fruits per treatment) and the results are presented as a percentage (%) of damaged fruits. In Mala Remeta, 35 days after the set up of traps the percentage of damaged fruits in PhT was 0.4% and in CT 0%. Two months after, it was 0.3% in PhT and 0.5% in CT, after three months 0.7% in PhT and 0.1% in CT, but without significant differences. Before harvesting the percentage of damaged fruits was 2.7% in PhT and 0.05% in CT and the difference was statistically significant. In Bački Vinogradi the percentage of damaged fruits after 35 days was 2% in PhT, while in CT it was 0.1%. After two months it was 3.2% in PhT and 0.1% in CT, and after three months it was 2.9% in PhT and 0.5% in CT. Before harvest in PhT was 12.5% damaged fruits and in CT 0.5%. The significant difference between percent of damaged fruits on this locality occurred after two months.

Keywords: apple orchards, *Cydia pomonella*, auto-confusion pheromone traps

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S6-P5

Possibility of *Aphis pomi* De Geer Control in Apple Orchards with Azadirachtin

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Aphids occur regularly in apple orchards and cause severe damages. This research aimed to assess the efficacy of biological - azadirachtine (10 g a.i./l) 0.2% and chemical insecticides - chlorpyrifos + cypermethrin (50+50 g a.i./l) 0.1%, against *Aphis pomi* in apple orchard. The experiments (EPPO methods PP1/135, 1/152 and 1/258) were performed in 2013 and 2014 in Novi Slankamen, Čelarevo and Bela Crkva (Serbia, Vojvodina) on variety 'Golden Delicious'. Treatment was performed twice with azadirachtine in seven days interval and once with chlorpyrifos + cypermethrin. Three assessments were made: before treatment, immediately after the second treatment and 10 days after the second treatment, on 10 previously marked shoots per replication, by counting the number of aphids. Efficacy (E%) was calculated according to Abbott. In 2013, the number of aphids in Novi Slankamen and Čelarevo ranged from 58.7 to 70.0 before the treatment, and after seven days their number (26.5 to 33.5) was significantly lower than in the control (99.5 to 133.7). Insecticides efficacy was 66.3 to 79.6%. Ten days after the second treatment, the number of aphids (9.75 to 10.7) was significantly lower than in the control (135.5 to 148) and insecticides efficacy was 92.2 to 93.9%. In Čelarevo and Bela Crkva in 2014 the average number of aphids before the treatment was 71.7 to 81.2 and after seven days their number (34.5 to 43) was significantly lower compared to the control (127.7 to 145.2) and the insecticides efficacy was 66.3 to 76.2%. The number of aphids (16.2 to 18.2), 10 days after the second treatment was statistically significantly lower compared to the control (160.5 to 160.7) and insecticides efficacy was 88.6 to 90.1%. Efficacies of tested insecticides were on the same level of significance, thus it can be concluded that azadirachtine can ensure adequate protection of *A. pomi* in apple orchards.

Keywords: apple orchards, *Aphis pomi*, azadirachtin, chlorpyrifos + cypermethrin

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S6-P6

Bull's Eye Rot of Apple Fruit Caused by *Neofabraea alba*

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Bull's eye rot caused by *Neofabraea* spp. is an important postharvest disease of apple fruit worldwide. Four species of the genus are known to cause this disease among which *Neofabraea alba* is the main pathogen causing bull`s eye rot in continental Europe. Typical symptoms of the disease were observed in a local market in Belgrade, Serbia in March 2015. Circular lesions, slightly sunken light brown to dark brown with a lighter brown to tan center and a darker outer ring were present on apples cultivar 'Golden Delicious'. Decayed tissue was firm. The aim of this study was to identify the causal agent of bull`s eye rot of apple fruit in Serbia based on morphological and molecular characteristics of the pathogen. Two fungal isolates were obtained using standard laboratory procedure and their pathogenicity was tested by wound inoculation of healthy apple fruit cultivar 'Idared'. Seven days post inoculation lesions up to 2 – 3 cm in diameter, similar to those originaly observed, developed on inoculated fruit while control fruit remained healthy. The isolates were identified based on colony morphology. They formed round, slow growing colonies on potato dextrose agar (PDA) with initially white mycelium which turned pinkish-brown with time. Cylindrical to curved – fusiform macroconidia were formed. Microconidia were not observed. Species level identification was completed by isolating genomic DNA followed by amplification of the β-tubulin locus using gene specific primers (Bt-LEV-Up4/Bt-LEV-Lo1) via conventional PCR. MegaBLAST analysis of the 2X consensus nucleotide sequences (622 nt) revealed 100% similarity with JN856032 and 99% similarity with several *Neofabraea alba* sequences (AF281452, AF281453, AF281456, JN856031, etc.) deposited in GenBank. Based on morphological characteristics and the partial sequence analysis of β-tubulin genes, *Neofabraea alba* (Guthrie) Verkley was identified as the causal agent of bull's eye rot of apple fruit in Serbia.

Keywords: post-harvest decay, identification, fungi

Acknowledgement: This research was supported by the project III46008 financed by the Ministry of Education, Science and Technological Development, Republic of Serbia.

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S6-P7

Dissipation Rate of Iprodion in Cherry Fruits

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Iprodione [3-(3,5-Dichlorophenyl)-N-isopropyl-2,4-dioxoimidazolidine-1-carbox amide], a dicarboximide fungicide, that inhibits germination of spores and growth of fungal mycelium, is a widely used fungicide. In cherry orchards, it is used for control of *Monilinia laxa*, the causal agent of blossom and brown rot of stone fruit. The objectives of this work were the validation of a method for the analysis of iprodione residues in cherry fruits and determination of dissipation rate in real fruit samples during pre-harvest interval (PHI) in Serbia, of 14 days. Samples were prepared using QuEChERS methodology, before quantification by high-performance liquid chromatography with diode array detector (HPLC–DAD). Pesticide residue analysis was performed by Agilent technologies 1100 series HPLC, equipped with a diode array detector. The separation was performed on a C18 column (150 × 4.6 mm, 5 μm). The mobile phase was (ACN/water 55:45, v/v) with a flow rate of 0.9 ml/min and detection wavelength of 250 nm. Validation of the method was performed fulfilling the SANCO/12571/2013 criteria. The QuEChERS method showed good recoveries (71.5-99.5%) at five concentration levels, from LOQ to 4.5 mg/kg. Good results were obtained in terms of repeatability (RSDr=2.5%) and linearity (r2=0.998). The limit of detection (0.02 mg/kg) and limit of quantification (0.06 mg/kg) of the method were far below the maximum residual levels (MRLs) set by the EU and Serbian legislation for this fungicide in cherries (3 mg/kg). Field trials were conducted according to standard OEPP methods for experimental design and data analysis. Iprodion was applied at the manufacturer's recommended concentration. Samples were collected 1 h after the application and then after 2, 4, 6, 8, 10, 12 and 14 days. The initial deposit of 0.40 mg/kg was under MRL. Based on the obtained results dissipation curve was defined. Iprodione dissipated rapidly with half-life (t1/2) of 3.30 days in cherry fruits.

Keywords: cherry, iprodione, dissipation rate, t1/2

Acknowledgement: This research is a part of project TR31038 funded by Serbian Ministry of Education, Sciences and Technological Development.

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S6-P8

Bacterial Diseases of Walnut in Serbia: Current Perspectives for Control

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In recent years, bacterial blight caused by *Xanthomonas arboricola* pv. *juglandis* and shallow bark canker caused by *Brenneria nigrifluens* of walnut (*Juglans regia* L.) have been observed in orchards of Serbian walnut-growing regions. Bacterial blight has been reported over the years with sunken black spots with a chlorotic margin and brown apical necrosis on fruits. Orchards from different areas were inspected throughout the last five-year seasons, from end of May to the harvest. Shallow bark canker has been observed and reported in 2011. The disease is characterized by shallow, irregularly shaped cankers in the bark of the trunk and branches. Diseased branches were collected from 30-year-old orchard in the region of Fruška Gora on chemically untreated trees. Isolation of the pathogens was performed by streaking of macerated margins of necrotic fruit tissue onto yeast extract-dextrose-calcium carbonate agar for *X. a.* pv. *juglandis* and from small pieces from the edge of the cankers onto nutrient agar with 5% sucrose for *B. nigrifluens.* Pathogenicity of both pathogens was confirmed using the method of infiltration of bacterial suspension with syringe into the mesocarp of immature walnut fruits. Identification of pathogens was confirmed by analyses of *gyrB* gene sequences. Management strategies for control of bacterial diseases cannot readily be defined and disease in affected areas is usually not well controlled because of their irregular occurrence and difficulties in prediction. A few chemical products available for growers were present in market, almost exclusively based on copper and they act only as protectants. Preventive treatments with copper derivates, consisting of 3–4 applications from bud break to fruit set are proposed for walnut blight and shallow bark canker control. Strategic application of copper-based products, timed according to pathogen activity, may adequately control unnecessary applications of copper. In some countries, besides copper, different antibiotics and fungicide based on phosethyl aluminium are used. Clearly there is a need for development of new, effective control compounds for control of bacterial diseases in fruit production. Among the new perspectives are products of natural origin, including biopreparations and resistance inducers.

Keywords: walnut, bacterial disease, identification, control
Acknowledgement: The work is a part of the Projects No. TR31018 and No. III43010 funded by Ministry of Education, Science and Technological Development of the Rep. of Serbia.

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S6-P9

Population Structure and Species Composition of Free-Living and Plant-Parasitic Nematodes in Strawberry Plantations under Organic Farming Conditions

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Organic production of strawberry [*Fragaria* × *ananassa* (Duch.) Decne. & Naudin] is increasing world-wide, but knowledge about the influence of cultural practices on the beneficial and harmful fauna is empirical rather than field-based. Some species of plant-parasitic nematodes, which are closely related to the host plants, damage strawberry plants. They can occur in populations with joint free-living soil nematodes. The purpose of this work was to study the soil nematode communities and to determine the ratio between free-living soil and plant-parasitic nematodes in organic strawberry production systems. The investigation of the nematode populations was carried out in the region of Balkan Mountain Range, village Sredogriv (43.549 N, 22.786 E) during the vegetation period on an area of 10 ha, with cultivar 'Zenga Zengana'. The following genera of plant-parasitic nematodes were identified: *Pratylenchus*, *Tylenchorhynchus*, *Hoplolaimus*, *Helicotylenchus*. In free-living genera, the fungivore nematodes *Aphelenchoides*, *Filenchus* and *Aphelenchus* were dominated, followed by the bacteriovore genera *Rhabditis* and *Cephalobus*. The established indicators of the nematode communities (maturity index and plant parasite index) can be used as bioindicators for the health status of the plantation.

Keywords: strawberry, organic farming, plant-parasitic and free-living nematodes

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S6-P10

Economic Evaluation of Sour Cherry Cultivars Grown on Own Roots and Grafted on Mahaleb Rootstock

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The study was carried out at the Institute of Agriculture, Kyustendil (Bulgaria). The aim was to compare the sour cherry cultivars 'Heimanns Rubinweichsel', 'M-15' and 'Nefris' grown on their own roots (trees obtained by in vitro propagation) with grafted ones on seedlings of Mahaleb rootstock 'IK-M9'. The balance value, productivity and economic efficiency of these cultivars were evaluated. The economic analysis showed that the balance value per one hectare of the self-rooted trees was higher than that of the grafted ones. The gross production of 'M-15' trees grafted on 'IK-M9' was 60.8% higher than that of the self-rooted trees. The difference was 98.9% for 'Nefris' and 86.5% for 'Heimanns Rubinweichsel'. The most suitable cultivar/rootstock combinations from an economic point of view were 'M-15' and 'Nefris', grafted on 'IK-M9' rootstock.

Keywords: *Prunus cerasus*, balance value, gross production, rate of profitability

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