

4th International scientific conference

SUSTAINABLE HORTICULTURE FROM PLANT TO PRODUCT: CHALLENGES IN TEMPERATE CLIMATE

Organized and hosted

INSTITUTE OF HORTICULTURE

25–26 August, 2021, Dobele

BOOK OF ABSTRACTS AND SCIENTIFIC PROGRAM OF THE CONFERENCE



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Wednesday, 25 August 2021

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11.15–11.35	o1	**Thyago Rodrigues do Carmo Brito:** Life cycle assessment for olives production: a case study for the Region of Trás-os-Montes, Portugal
11.35–11.55	o2	**Līga Lepse:** Vegetable management strategies for sustainable production
11.55–12.15	o3	**Michael Blanke:** Light deprivation as herbicide?
12.15–12.35	o4	**Florian Gierling:** Mitigation strategies to reduce the carbon footprint of wine from temperate climate – is white wine more sustainable than red wine?
12.35–12.55	o5	**Edgars Rubauskis:** Effectiveness of mechanical action to improve stability of apple production
	Break	
14.00–14.45	2	**Alessandra Trinchera:** Crop diversification: a driver of microbial functional diversity in soil
14.45–15.05	o6	**Sandra Dane:** The first steps in research of soil biological activity in LatHort
15.05–15.25	o7	**Simona Chrapačienė:** Investigation of alternative sources of biopesticides from plants
15.25–15.45	o8	**Neringa Rasiukevičiūtė:** LED-light for strawberry Botrytis cinerea control
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16.30–18.00	**Flash presentations**	
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11.30–11.50	o13	**Ozgecan Yalcin:** Wild edible small fruits in Turkey and their fruit characteristics
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14.35–14.55	o17	**Georgijs Baškirovs:** An eco-friendly method for simultaneous determination of tocopherols, tocotrienols and plastochromanol-8 in oils using supercritical fluid chromatography
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ORAL PRESENTATIONS/ Key speaker 1

presentation

Agroecology innovations for sustainable horticulture in Europe

speaker

Ulrich Schmutz

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‘Agroecology and Organic Farming System’ approaches are gaining more and more influence. The International Society for Horticultural Science (ISHS) has for some years established a commission with this name and mission. In 2020 the EU commission has adopted a 25% certified organic land use target in the EU by 2030 and combined this with a new ‘Biodiversity strategy’. This presentation will describe and critically review the current status of organic farming and agroecology thinking with a specific focus on horticultural science.
It will discuss selected agroecological innovations for both organic and non-organic systems. It will draw on current Europe-wide research projects (Organic-PLUS, AGROMIX and Agroecology for Europe) and discuss innovations to phase-out contentious inputs, system re-design and the integration of system thinking. The innovations aim to phase-out remaining pesticides, like the use of copper, phase-out peat and plastic use in horticulture and integrate agro-ecological service crops, also in intensive horticulture. Alternatives to animal-derived fertilisers for vegan production are also considered.
The presentation concludes with projections to re-design horticultural systems to combine them more with agroforestry, mixed farming and community supported sustainable horticultural systems.

key words

agroecology, organic, vegan organic, agroforestry, contentious inputs, copper, peat, plastic, vegan fertiliser, agroecological service crops, system re-design

ORAL PRESENTATIONS/ o1

presentation

Life cycle assessment for olives production: a case study for the Region of Trás-os-Montes, Portugal

speaker

Thyago Rodrigues do Carmo Brito; Anabela Afonso Fernandes-Silva

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The olive tree (*Olea europaea L.*) is widely cultivated in the Mediterranean countries for olive oil and table olives production, assuming an important economic role. Nowadays, with a climate change is crucial to know the importance of environmental impacts associated to the production system. Thus, the aim of this study is to characterize the environmental impacts of an intensive olive orchard (204 plants/ha) drip irrigated from ground water, located in the Northeast Region of Portugal. The methodology of analysis was done according to ISO 14040 series. We used the openLCA software and Agribalyse V. 3 database and a cradle-to-gate analysis with the adoption of one impact assessment method (Recipe Midpoint (H) V1.13). For this analysis, 1 kg of olives was taking as a reference functional unit.
The results indicated that to produce 1 kg of olives were emitted a total of 0.249 kg CO2-Eq. to the atmosphere on climate change (GWP 100) category. Regarding to the direct impact of production system, a total of 0.177 kg CO2-Eq. (70.97%) were emitted, followed by indirect impacts associated to raw material of irrigation system, with 0.032 kg CO2-Eq. total (12.74%), and a 0.012 kg CO2-Eq. (4.77%) attributed to the electricity need to pump ground water.
In relation of inputs of production, the raw material for urea production was responsible for 0.013 kg CO2-Eq. (5.04%) of total emissions.
Results are in line with similar studies carried out in other countries, namely in Spain, but they are lower in about half of those reported in Italy. To the best of our knowledge, this study is the first carried out in the region of Trás-os-Montes, contributing to acquire a better understand of environmental impacts in order to minimize the main impacts and ensure olive orchard sustainability.

key words

environmental impacts, GWP, LCA, olive production

ORAL PRESENTATIONS/ o2

presentation

Vegetable management strategies for sustainable production

speaker

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Greening measures are increasingly being introduced in agriculture to foster the implementation of environment- and climate-friendly farming practices. These measures include reduced pesticide use, the cultivation of legumes for the fixing of atmospheric nitrogen, as well as increasing the microbiological activity of the soil, in order to contribute to the proportion of biologically sequestered carbon in the soil.
The above-mentioned measures are not novel per se: intercropping, catch crops, and green manure are long-known technological elements used by farmers, which, based on past knowledge and experience, can become important retroinnovations by combining past knowledge with the needs and aims of modern farmers and society. However, until now these environment-friendly green technologies have not been sufficiently widely and effectively implemented, although a number of studies have been carried out in this area that demonstrate the effectiveness of these technological solutions.
The cross-disciplinary approach to identifying and analysing the causes of the above-mentioned situation is necessary to perform in order to introduce these technologies in active farming systems.

key words

intercropping, strip-cropping, biological diversity

ORAL PRESENTATIONS/ o3

presentation

Light deprivation as herbicide?

speaker

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In the light of changing climate, the objective of the present work was to investigate mitigation strategies to reduce herbicide input with the expected glyphosate ban. Naturally reduced weed population/ vegetation has been observed in the summer under fully-grown cv. ´Elstar` apple trees cultivated in temperate climate zones. Hence, the objective of this field trial was to investigate the potential causes. Therefore, the vegetation in the soil of cv. 'Elstar' apple tree strips was compared with that under fully-grown cv. ´Golden Delicious`, ´Gala` and ´Braeburn` apple trees on the same M9 rootstock at the same location at Klein-Altendorf, University of Bonn, Germany (51° N) in 160 vegetation assessments.
To determine the amount of light available to the vegetation in the soil of the tree strip, light interception of the tree canopy was measured. The 300 ceptometer and the 100 sunfleck measurements with the ´point quadrat method` (chessboard) in September after herbicide application in May showed a statistically significant 10 % (ceptometer) and 35% (sunfleck) light reduction in the tree strip under ´Elstar` apple trees relative to ´Golden Delicious` in the adjacent tree row.
The tree strip under fully-grown cv. ´Gala` and ´Braeburn` apple trees was statistical significantly more densely covered with weeds rated as 3.8 - 4.3 in comparison with that of cv. ´Elstar` rated as 1.7 - 1.9 on a scale of 1 (0-20%) to 5 (80-100% surface covered); this finding of fewer weeds in cv. 'Elstar' orchards, possibly due to light deprivation, applied to both chemical (IP) and mechanical (organic) weeding.
Common groundsel (Senecio spp.) and daisy (Bellis perennis) were less abundant in the tree strips under fully-grown ´Elstar` apple trees than under fully-grown ´Golden Delicious` apple trees of the adjacent row. The indirect weed species selection as a result of longtime glyphosate application as described in the literature was confirmed; this herbicide application allowed the subsequent germination of seeds of common chickweed (Stellaria media) and common groundsel (Seneccio spp.). In the present experiment, cuckooflower (Cardamine hirsuta) and meadow grasses (Poa spp.) dominated.
The present results of weed suppression by the cv. ´Elstar` trees after spring herbicide application are in line with those reported for vigorous apple cv. ´Ingrid Marie` on M2 rootstock in the literature in the same region. This weed suppression by fully-grown ´Elstar Michielsen` appears not only cultivar dependent, but may be related to shading by the canopy of vigorous fruit trees such as cv. 'Elstar', irrespective of cultivation (IFP with herbicide or organic production with mechanical weeding) and possibly influenced by further factors.

key words

climate change, temperate growing zone, lyphosate, herbicide, light, alternative to herbicide

ORAL PRESENTATIONS/ o4

presentation

Mitigation strategies to reduce the carbon footprint of wine from temperate climate - is white wine more sustainable than red wine?

speaker

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In the light of changing climate, the objective of the present work was to investigate mitigation strategies to reduce the CO2 emissions viz carbon footprint of wine - from the grapevine in the orchard to the bottled product, and explore the benefits of locally grown and locally consumed wine.
The second objective was to examine whether red or white wine is more environmentally friendly and which one may be preferred by the consumer, who wants to base his purchase on ecological sustainable concerns.
The study was based on PAS 2050-1 (BSI) and included cultivation, processing and marketing strategies for decision making processes between two wineries and elaborate carbon reduction potentials. Both wineries grow the same white (Riesling) and red wine varieties (Pinot Noir/ Spätburgunder) on the same rootstock SO4 on slopes on either side of the Mittelrhein region of Germany.
This study comprised 99% primary activity data derived from farmer interviews and historical records and ranged from planting of the grapevines to disposal of the 0.75 L glass bottle. The largest portion of the product carbon footprint (PCF) of ca. 1.8 (+0.1) kg CO2eq/bottle of wine for both wineries was attributed to the consumer behaviour (ca. 26%), followed by the use of glass bottles and their production (ca. 24%). Grapevine cultivation amounted to ca. 20%; followed by packing, distributing the bottles to the consumer processing. The plant protection chemicals amounted to only ca. 2.8 % and organic fertilizer to ca. 1.4 % of the PCF.
In contrast to the PCF, the Water Footprint (blue water) differed by twofold between winery 1 and 2 for both red and white wine, leaving room for improving management practises.
The results are discussed with higher Product Carbon Footprint values for wine from overseas and identified the following reduction potentials for the local wineries a) reduction of fossil fuels for gas heating of the premises and for farm vehicles, b) the use of lightweight glass bottles as well as c) consumer purchase at the winery when using a private fossil-fuel powered vehicle.

key words

sustainability, carbon footprint, carbon dioxide, water footprint, wine, temperate climate, greenhouse gases, beverages, Riesling, Pinot Noir

ORAL PRESENTATIONS/ o5

presentation

Effectiveness of mechanical action to improve stability of apple production

speaker

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The stability of fruit production always is a challenge. Most of cultivars tend to bear biannually or do not have a nature of self-thinning. Many decades this problem was solved by chemical thinning of flowers and/or fruitlets, however effectiveness of such action depend on conditions at the moment of application of the chemicals. Besides availability of such products are strictly related to regulations and market conditions. Introduction of such products are in opposite to “green course” movement in the agriculture. In some cases, it is possible to reduce the biannual production by various methods of canopy training of apple trees and orchard management. In general, thinning of fruitlets by hand helps to improve fruit quality, however such process is time consuming. In some other fruit growing regions mechanical thinning of flowers is adapted to some cultivars by changing speed of moving and rotation of the mechanisms in order to make partial thinning – destroying of flowers.
The aim of the investigation was to evaluate the effectiveness of total flower destruction mechanically on one side of the tree row and on the other side next year during full production period (8th to 12th year after planting) to obtain production of trees annually and reduce labour costs at harvesting. On dwarf rootstocks M.9 and B.396 seven cultivars of different fruiting type were compared. It was observed that apple trees on the dwarf rootstock B.396 were less impacted by biannual yielding.
Cultivars had strong relation to yielding – ‘Gita’ (Vf), ‘Konfetnoye’ and ‘Kovalenkovskoye’ had less fluctuation year by year, while ‘White Transparent’, ‘Rubin’ (Kazah.), ‘Antei’ and ‘Ligol’ performed opposite. There was a positive influence observed on reduction of periodicity by mechanical flower thinning, however there is a discussion on cumulative yield reduction. The factor interaction had a place as well.

key words

biannual productions, dwarf rootstocks, Malus, cumulative yield

ORAL PRESENTATIONS/ Key speaker 2

presentation

Crop diversification: a driver of microbial functional diversity in soil

speaker

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Sustaining soil fertility by maintaining and improving soil microbial life is an imperative for future. The application of different diversification strategies (rotation, service crop introduction, intercropping with legumes, etc.) in organic horticultural systems, can modify the rhizosphere interactions among neighbouring plants, leading to an improved synchronicity between plant demand and nutrient availability, with a consequent increase of crop production and quality. A fundamental role is played by plant diversity and soil microbiome, and particularly by beneficial symbioses, able to increase N-P uptake by plants. In different diversified organic and conventional cropping systems, we will discuss on the effect of diversification on belowground functional diversity and rhizosphere beneficial interactions, whose benefits can supply great advantages to the farmers in terms of crops yield and quality at short time, while improving soil biological fertility on long term.

key words

belowground diversity, mycorrhizal fungi, cover crop, intercropping

ORAL PRESENTATIONS/ o6

presentation

The first steps in research of soil biological activity in LatHort

speaker

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As sustainable farming model becomes more actual and is promoted by EU policy, it is important to elucidate how it influences soil biological activity. The role of sustainable technologies in the diminishing the environmental load of horticulture needs to be clarified.
From 2011 at Pure Horticultural Research centre and at Latvian State Fruit Growing Institute, now joined in Latvian Institute of Horticulture, studies of soil biological activity (SBA) were started. Such parameters as soil respiration rate, dehydrogenase activity and cellulose activity were measured. The dynamics of these parameters during the vegetation period were studied. As one of the first research attempts in the soil biological activity was carried on in the strawberry plantation with and without black polypropylene mulch under low tunnels. Also influence of vermicompost application on SBA was studied.
The influence of intercropping on SBA in vegetable plantations was started in the frame of EUROLEGUME project. The first research results indicate that under plastic mulch bacteria grow better than fungi. Soil microorganisms were more reactive in treatments with vermicompost, soil microbial activity was lower in treatments with mineral fertilizers in comparison to intercropped systems where legumes were used as companion plants for the biological nitrogen fixation. Intercropped legumes can supply strawberries with nitrogen resources and does not recuse strawberry marketable yield. Appropriate intercropping increases SBA. It was found that also plant genotype has influence on the SBA.
Research on SBA is continued in LatHort in several currently implemented projects.

key words

soil health, sustainable growing technologies, horticulture

ORAL PRESENTATIONS/ o7

presentation

Investigation of alternative sources of biopesticides from plants

speaker

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New sources of alternative compounds for horticultural disease management are under investigation lately as agricultural strategies aim to reduce the use of synthetic pesticides. Biopesticides from plants can help to avoid problems caused by fungicides, like pathogen resistance and environmental pollution. This investigation aimed to determine the antifungal effect of plant extracts and essential oils on the fungal pathogens, causing significant horticultural diseases. Essential oils were produced using Clevenger apparatus, meanwhile, extracts were isolated by subcritical CO2 extraction. In vitro experiments were carried out by mixing tested oils and extracts with potato dextrose agar medium at 200–3000 µl concentrations and inoculating Petri dishes with mycelium plugs. The experiment was placed for incubation at temperature 22–25 oC depending on the pathogen. The antifungal effect was registered 4–7 days after the start of incubation as the reduced growth of the pathogens. Results of the investigation revealed the highest antifungal effect of thyme essential oil on fungal pathogens C. acutatum, B. cinerea, Fusarium spp., and Alternaria spp. as 100% inhibition of the growth of the pathogen was achieved at different concentrations. Meanwhile, the antifungal effect of other investigated plant extracts and essential oils (for example lavender, coriander, sage) varied from low to moderate or was high only on several of the pathogens. Summing up the results, plant extracts and essential oils express antifungal effects on pathogens, causing various diseases on horticultural plants. Their properties should be considered in the development of biopesticides for plant protection.

key words

antifungal, essential oils, fungal pathogens, plant extracts, thyme

ORAL PRESENTATIONS/ o8

presentation

LED-light for strawberry *Botrytis cinerea* control

speaker

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Strawberry growing is expanding in an open field and controlled environment agriculture (CEA) systems. *Botrytis cinerea* is a significant pathogen reducing strawberry yield and decrease of postharvest fruit quality. Supplemental lighting in CEA systems is one of the most important environmental factors for plant growth and development. The light-emitting diodes (LED) are used to optimise the quality and quantity of light on plant growth and development and increase the antioxidant capacity in plants to improve their nutritional value. LED-light has the potential to revolutionise lighting technology for crop protection against pathogens. This study aimed to evaluate the influence of different LED-light wavelengths on *Botrytis cinerea* in strawberry in vivo. The experiments conducted in a greenhouse at the LAMMC Institute of Horticulture in 2020–2021 strawberry cv. Sonata.
Light was high-pressure sodium (HPS Son-T Agro) lamps supplemented with LED: royal blue 455 nm and green 530 nm. The HPS photoperiod was 16-h, and LED supplemented 4-h.
Results indicated that *B. cinerea* growth varies under different LED-light on strawberry. *B. cinerea* management with LED light could be a tool for improving disease control.
This project has received funding from the Research Council of Lithuania (LMTLT), agreement No 2.2-LMT-K-718-03-0035.

key words

CEA, grey mould, growth parameters, pathogen

ORAL PRESENTATIONS/ o9

presentation

Effect of glycine betaine and seaweed-based biostimulant in physiological performance and water status of sweet cherry trees

speaker

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Fruit industry is always looking for innovative approaches to improve overall sustainability of production systems. Plant biostimulants have arisen as new and promising products to increase use-efficiency of agronomical inputs or promote stress crop tolerance. In this work, pre-harvest application of two concentrations of biostimulants (glycine betaine-GB and seaweed based biostimulant-Swd) and their combination, in physiological performance and water status of sweet cherry trees of cultivar Early Bigi, was studied. The use of a high concentration of GB and low concentration of Swd increased photosynthetic (A) and transpiration rates (E). Several parameters of leaf water status were also significantly affected by pre-harvest treatments, namely succulence leaf mass per unit area (LMA), density of foliar tissue, water saturation deficit and cuticular transpiration rate. The results recorded using the combination of low concentration of both biostimulants should be highlighted: values of leaf succulence, LMA and density were significantly higher in this treatment, when comparing to control trees. Although this data reports only one year of study, positive effects of GB and Swd in cv. Early Bigi are clear.
Further studies are undergoing to confirm the present results, to provide a clear strategy to improve physiological status of sweet cherry trees in these specific conditions.

key words

biostimulants, glycine-betaine, seaweed-based biostimulant, Prunus avium L., physiology, water status

ORAL PRESENTATIONS/ o10

presentation

Dynamics of tomato yield and its quality under different types of lighting

speaker

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The research was conducted in the greenhouse of Latvia University of Life Sciences and Technologies, in the winter season of 2019-2020. The aim of the study is to explain the characteristics of biochemical parameters such as lycopene, beta carotene, phenols, organic acids, soluble sugars. Fruit dry matter and yield were also determined. Lycopene, beta carotene, and phenols were determined spectrophotometrically, for the determination of organic acids the titration method was used, and the BRIX method was used for the determination of sugars. LED, Induction and High Pressure Sodium lamps were used to provide plant lighting in the study. Tomato varieties used in the study:'Encore F1', 'Strabena F1', 'Bolzano F1', 'Chocomate F1', 'Forticia F1'.
As a result of research (P = 0.05) it was found that changes in biochemical parameters differ significantly depending on the tomato variety and type of lighting. Variety and lighting method also have a significant effect on yield parameters.

key words

tomatoes, yield quality, light quality

ORAL PRESENTATIONS/ Key speaker 3

presentation

Searching for the ideal apple rootstock

speaker

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Review presents recent status of apple rootstock breeding programs in various countries, their directions and the latest developments. Paper gives a comprehensive overview on apple rootstock effect on tree vegetative and generative development, bearing stability and nutrition, fruit quality with a special attention to fruit bioactive compounds. Rootstock adaptation to biotic and abiotic stresses is discussed too. Review stress attention to growers needs and their expectations for the rootstock induced tree performance.

key words

apple, tree vigour, productivity, adaptation, fruit quality

ORAL PRESENTATIONS/ o11

presentation

Relationships between leaf pigment content and vegetation indices of olive tree leaves

speaker

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Leaf pigments content such as Chlorophyll a and b, Chlorophyll a + b and Carotenoids can provide valuable information regarding to the physiological properties and processes of the leaves, e.g., photosynthesis and nitrogen nutrition condition, being associated with leaf water status. However, biochemical analyses of these compounds are destructive, time consuming and expensive. Thus, several studies in the literature have established correlations between these compounds and water status indicators. Nevertheless, the appropriate use of these indices depends of the plant species and cultivars. Thus, the objective of this study was to assess a list of 27 vegetation indices using a spectroscopy, for the estimation of Chlorophyll a and b, Chlorophyll a + b and Carotenoids of three olive tree cultivars (*Olea europaea L, Cv. Cobrançosa, Cv. Verdeal Transmontana and Cv. Madural*) under different irrigation treatments (well-watered and deficit irrigation).
A good agreement was found, where, the results showed that the best fit between vegetation indices depends not only on the type of pigment but also on the cultivar, in which, Cv. Cobrançosa showed the best correlation between the Carotenoid Reflectance Index (CRI) 2 and carotenoids content (R2 = 0.87).
Although results are preliminary, it seems that vegetation indices could to be a useful tool for leaf pigment content evaluation, ant that for monitor plant water status and its response to climate change.

key words

chlorophyll, carotenoids, spectral indices, precision agriculture

ORAL PRESENTATIONS/ o12

presentation

Strawberry cultivars preserved in the Swedish National Gene Bank

speaker

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Some 35 cultivars of Fragaria are preserved in the Swedish National Gene Bank for vegetatively propagated crops, which was opened in 2016. The gene bank system includes a field collection at Alnarp, southern Sweden and a back-up collection of virus free plants at the Swedish Elite Plant Station. Here we document the methods of selecting these so called mandate cultivars and assembling the collection. Swedish origin was the primary criteria used in the selection process. In this category cultivars from historic Swedish breeding programs are of particular interest. During 80 years, starting in the 1920s and ending the 1990s, 16 cultivars of strawberries including three Fragaria x vescana hybrids were marketed by Swedish breeders. Unfortunately, some of these have not yet been recovered. Swedish bred cultivars are presented with their year of introduction, parentage and short descriptions. Additionally, we describe about ten locally grown cultivars of strawberries and wild strawberries. Another category of mandate cultivars are foreign cultivars with a growing tradition in Sweden dating back to before 1960. Their age, country of origin and importance for Swedish cultivation are discussed.

key words

genetic resources, gene bank, heirloom cultivars, Fragaria x ananassa, Fragaria vesca, Fragaria x vescana

ORAL PRESENTATIONS/ o13

presentation

Wild edible small fruits in Turkey and their fruit characteristics

speaker

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Wild fruits are essential genetic resources for fruit breeding and have either been domesticated or used to introgress disease resistance, and tolerance to abiotic and biotic stress. Numerous studies have reported previously related to health benefits of wild berry fruits and described their antioxidant, anti-inflammatory, antimicrobial and anticancer activity. Turkey has a rich plant biodiversity thanks to its geographic location and encirclement by three seas, leading to a wide variety of climates. A great ecological diversity of the wild berry species in Turkey is a significant bio-gene pool that is vital to human life, and can serve as a source of agricultural development in the future. This study aims to introduce some of the wild edible berry species naturally occurring in Turkey such as *Morus spp., Hippophae rhamnoides, Viburnum opulus, Rubus idaeus, Rubus fruticosus, Sambucus nigra, Vaccinium spp., Arbutus unedo, Ribes spp., Fragaria vesca*, and describe their distribution, uses, and fruit characteristics. Conservation of these wild fruit genetic resources is necessary for use in breeding for novel traits.

key words

genetic resources, plant biodiversity, wild berries, conservation

ORAL PRESENTATIONS/ o14

presentation

Evaluation of introduced red currant cultivars and breeding genotypes based on them in a temperate continental climate

speaker

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Present study was conducted on a loamy haplic Luvisol soil located in the zone of temperate continental climate during May – July from 2013 to 2018 in Central Chernozem area of Russia (Russian Research Institute of Fruit Crop Breeding).
The purpose was to study the complex of economic and biological characteristics of introduced red currant cultivars of foreign and Russian breeding ('Jonkheer van Tets', 'Natali', 'Hollandische Rote', 'Prins Albert', 'Viksne', 'Shchedraya') in the field and laboratory conditions, and the selection forms obtained on their basis, as well as to identify some mechanisms of adaptation to stress factors by the indicators of the water regime in optimal and arid conditions of the temperate continental climate.
In the course of the work interspecific hybridization of cultivars of European origin and species of red currant were carried out. In this experiment, the samples obtained on the basis of the descendant of the large – fruited Ribes vulgare subspecies – ‘Jonkheer van Tets’ were selected. Climatic conditions were found to have significant influence on the disease severity of the red currant genotypes, while the Sphaerotheca mors-uvae infections increased in optimum seasons and Pseudopeziza ribis damages increased in drought seasons. None of the selected genotypes was found to be resistant to any of the diseases/pests but ‘Jonkheer van Tets’, ‘Hollandische Rote’ and 111-19-81 less affected from these diseases. Berry weight, yield, raceme length and number of berries in raceme were found to be higher in optimum seasons and different cultivars/genotypes had superior characteristics for different parameters. Highest berry weight was observed from 261-65-19 genotype (0.65 g), while the highest yield was noted from ‘Hollandische Rote’ (15.6 t/ha).
The direct dependence of the water content of the leaves of the introduced red currant cultivars on the soil moisture and the soil horizon has been revealed. The nature of the correlation relationships made it possible to determine the direction of individual trait selection. The degree of drought resistance of cultivars is determined by the amount of bound water in the leaves, the rate of transpiration and the period of development.
Indicators of the water regime of red currant cultivars can be used to predict the yield. The cultivars of European and Russian breeding ‘Hollandische Rote’, ‘Jonkheer van Tets’ and ‘Shchedraya’ retain their resistance to the stress factors of the growing season of the temperate continental climate. They are characterized by high drought resistance, yield, resistance to major diseases and represent a certain value for the establishment of plantations.
In the framework of breeding programs aimed at finding sources and donors of valuable economic-biological and adaptive-significant traits, it is necessary to use selected forms obtained on the basis of the descendant of a large-fruited subspecies Ribes rubrum – ‘Jonkheer van Tets’.

key words

Ribes, disease resistance, breeding, adaptive traits

ORAL PRESENTATIONS/ o15

presentation

Current achievements of the Latvian apple breeding program

speaker

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The Latvian apple breeding program is targeted at obtaining cultivars adapted to the climate of Baltics and Scandinavia. The growing apple industry in Latvia demands new local cultivars, as few modern introduced apples have been successful. The breeding program aims at resistance pyramiding. Gene Rvi6 scab resistance was overcome in 2020 in some local cultivars. Donors of climate adaptation as well as high fruit quality and long storage are included in crosses. Canker resistance is sought among cultivars, but this demands long-term field evaluation in various locations. Apples for cider making, columnar and crab apples are smaller directions of breeding. Recent cultivars are 'Felicita', 'Paulis' (Rvi6), 'Inta', 'Lora', 'Saulesmeita', ornamental apple 'Karlens' (Co), crabapple 'Auce'.

key words

Malus domestica, climate adaptation, resistance, fruit quality

ORAL PRESENTATIONS/ Key speaker 4

presentation

Sustainability in Horticulture using Multi-Sensor Systems

speaker

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The use of plant protection products and fertilisers in orchards and vineyards is a necessity, but also comes with an environmental impact regarding CO2 footprint, biodiversity or nitrate accumulation in the ground water. This requires an "as much as necessary, as little as possible" approach when applying these substances, offering high potential for optimisation through the adaption of precision farming techniques.
We present a multi-sensor system which can be mounted on a tractor and recognises and assesses the crop-state, and which controls the application of pesticides and fertilisers as efficiently as possible. The spatial recognition of the environment and the assessment of the foliage volume is carried out by LiDAR sensors. Multispectral cameras can be used to assess nutrient- and health state. The system is integrated into an interoperability network allowing the seamless flow of data from the machine to the farm management software.
The system enables the precise application of plant protection during the spraying process, the documentation of the exact amount applied, and the generation of precise georeferenced maps of the plantation covering individual plants. This helps the farmers to reduce the environmental impact, to reduce costs, and enables improved field management processes.

key words

precision farming, targeted application, sensor systems, data processing

ORAL PRESENTATIONS/ o16

presentation

Apple Scab Detection in the Early Stage of Disease using Convolution Neural Network

speaker

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It is important to detect apple scab in the early stage of disease development. The modern reviews of challenges related to deep learning application in agriculture mention the restricted access to open datasets with high-resolution natural images taken in the field conditions. Therefore, artificial intelligence solutions trained on these datasets containing images with low resolution and disease symptoms in the advanced stage are not suitable for the early detection of the disease.
The research project's goal was to collect and annotate a dataset, which can be applied for early detection. This study proposes the collected dataset and convolution neural network, which is trained to detect apple scab in the early stage of development using the sliding-window method. The convolution neural network was trained on using the transfer-learning approach and MobileNetV2 architecture tuned on for embedded devices.
The quality analysis in the laboratory conditions showed the following accuracy results: F1 score 0.94 and Cohen's kappa 0.91; but the occlusion maps - correct classification features.

key words

apple scab, artificial intelligence, early disease detection, deep learning, precise horticulture

ORAL PRESENTATIONS/ o17

presentation

An eco-friendly method for simultaneous determination of tocopherols, tocotrienols and plastochromanol-8 in oils using supercritical fluid chromatography

speaker

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Different reverse-phase stationary phases were applied to supercritical fluid chromatography (SFC) for the simultaneous separation of four tocopherol (T) and four tocotrienol (T3) homologues, as well as plastochromanol-8 (PC-8). PC-8 was isolated from flaxeed oil, γ-T3 un δ-T3 were isolated from Bixa orellana L., α-T3 un β-T3 were isolated from Triticum Spelta bran oil. Development and validation of the analytical method was performed. Tocochromanol content in oils of different origins was determined.

This work has been supported by the Latvian Council of Science project “Dicotyledonous plant families and green tools as a promising alternative approach to increase the accessibility of tocotrienols from unconventional sources” (lzp-2020/1-0422).

key words

tocochromanols, supercritical fluid chromatography, vitamin E, isolation,green analytical chemistry

ORAL PRESENTATIONS/ o18

presentation

Effects of Different Processing Treatments on Almond (*Prunus dulcis*) Fatty Acid Profile

speaker

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The consumption of nuts, including almonds, is associated with several positive health benefits such as antioxidant capacities, anticancer and antiatherogenic actions, as well as the regulation of immune and inflammatory responses. The health benefits of almond are related, among other compounds, to the availability of unsaturated fatty acids which are known to improve human health. Although almonds are mainly eaten in the raw state, sliced, or roasted, almonds can also be processed to obtain products such as marzipan, butter, milk, and oil. Two major methods used in the processing of almonds are roasting and blanching. Roasting and blanching can significantly alter the physical, chemical, and nutritive properties of the almond kernel, thus resulting in desired changes in texture, color, flavor, aroma, and taste. Positive changes are evident in the case of roasted almonds, whose pleasant color and aroma results from the decrease in moisture level observed after roasting. Modifications at a microstructural level due to processing can also lead to unwanted changes such as lipid oxidation. This work was carried out to assess the effects of two processing treatments, namely; roasting and blanching on contents of fatty acids of four neglected Portuguese almond cultivars (Casanova, Molar, Pegarinhos and Refêgo) and two foreign cultivars (Ferragnès and Glorieta). Results showed that in general, fatty acid profiles of raw kernels of all cultivars were generally identical although Refêgo exhibited a high content of α-linolenic acid. Following roasting and blanching, content of polyunsaturated fatty acids increased while saturated fatty acids, monounsaturated fatty acids and several health lipid indices decreased.
The findings of this study shed light on the nutritive and eating qualities of raw and processed kernels from neglected Portuguese almond cultivars, and highlight the potential use of these cultivars in various food industries.

key words

Prunus dulcis, roasting, blanching, fatty acids, health lipid indices

ORAL PRESENTATIONS/ o19

presentation

Highly efficient release of ferulic acid from agro-industrial by-products by cellulose-degrading enzymes (FerulCelluZyms)

speaker

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Historically relevant crops Triticum aestívum L. and Secale cereale L. are widely used in the production of bakery products. From the total volume of grain cultivated, roughly 85% is used for obtaining starchy endosperm (flour), while the remaining part consisting of 10-15% bran and 3% of germ is discarded or utilized rather inefficiently. The limited value attached to bran is associated with their structural complexity, i.e. the presence of cellulose, hemicellulose, and lignin which makes this material suitable mostly as a feed supplement, while in food production their use is challenging. Underestimation of bran as a food ingredient brings about a rise in food waste. Based on FAOSTAT data estimated in 2018, wheat and rye bran increase corresponded to 110 Mt and 1.6 Mt, respectively. To valorize these by-products to food and pharmaceutical applications, additional pre-treatment is required. Considering the evidence of the presence of ferulic acid (FA) in plants, a compound in 99% covalently bound to arabinose residues in arabinoxylans via ester linkages and integrated into the cell-wall matrix, biorefinery process using cellulose and lignin-degrading enzymes (CL-DEs) will afford a selective production of this highly demanded bioactive.
The limited information on the recovery of FA from wheat and especially rye bran through CL-DEs promoted the design of this work to focus on the evaluation of the release of FA from this material applying green and cost-effective technology.

key words

recovery, biorefining, valorization, by-products, ferulic acid, enzymatic hydrolysis, dietary fiber

ORAL PRESENTATIONS/ o20

presentation

Optimization of the ultrasonic extraction of phenolic compounds and antioxidant activity from root parts of Polygonum using response surface methodology

speaker

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The Ultrasonic extraction of phenolic compounds and their antioxidant activities obtained from aerial parts of Polygonum was optimized using response surface methodology (RSM). A Box-Behnken design was conducted to analyze the effects of three independent variables (temperature, extraction time and the ratio of solvent to raw material) on the yield and the DPPH scavenging activity of phenolic compounds. The adequacy of the models was evaluated by coefficient of determination R2. The high R2 value for the yield and the antioxidant potential respectively) demonstrated the response and independent variables predicted by polynomial model were fitted. The optimal conditions for the yield of phenolic compounds were Temperature of 55 °C, extraction time of 5 min and ratio of solvent to raw material of 35 ml/g. Although, for the antioxidant activity were Temperature of 35 °C, extraction time of 5 min and ratio of solvent to raw material of 30 ml/g. Under these conditions, the experimental yield and antioxidant potential were 11.652 ± 0.472 % and 98.0270 ± 1.158 % respectively.

key words

phenolic compounds, polygonum, DPPH, ultrasonic extraction, optimization, response surface methodology (RSM)

FLASH PRESENTATIONS/ f1

presentation

Seaweed-based and glycine betaine biostimulants improved sweet cherry quality

speaker

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Sweet cherry is a highly appreciated fruit, with great economic value, linked not only to production yield but also to quality attributes influencing consumer acceptability. Several strategies are used to enhance cherry quality, with the latest efforts being placed on biostimulants. This work intends to highlight the effect of the application of two concentrations of seaweed-based (Swd) and glycine betaine (GB) biostimulants and their combination, on quality traits (size, soluble solids content-TSS, titratable acidity-TA, maturity index (SST/TA), colour and sensorial characteristics) of fruits from cultivars Early Bigi and Lapins. Fruit size was positively influenced by biostimulants: for cv. Early Bigi, best results were recorded when using the combination of biostimulants, while, for cv. Lapins, fruit size was higher when using the highest concentration of Swd. The combination of biostimulants also improved SST and SST/TA in fruits of cv. Early Bigi. Similarly, the combination of both biostimulants increased SST in cv. Lapins, while Swd treatment improved TA and increased SST/TA. Sensorial profiles of sweet cherries were mildly affected by pre-harvest treatments. For the cv. Early Bigi, both Swd treatments improved the overall appearance of fruits, as well as colour intensity. For cv. Lapins, overall appearance was also improved by biostimulants` application.

key words

Prunus avium L., pre-harvest treatments, seaweed and glycine betaine

FLASH PRESENTATIONS/ f2

presentation

Can forcing partially substitute for chilling?

speaker

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Lack of chilling, a cold temperature period during winter, is a pre-requisite for most temperate zone fruit trees such as apple, pear, plum, peach, cherry and apricot with the onset of recent climate change, horticultural production of these fruit crops has been hampered or affected due to milder, warmer winters and lack of chilling, but possibly more forcing. Temperate climate zones have been particularly affected by this phenomenon.
Year to year variation is still abundant and provides years with and without lack of chilling, with a tendency to more years/winters with a lack of chilling. The research presents 4 year experiments with 160 potted intact cherry trees of three cultivars with a 3fold difference in chilling requirement (500, 1000, 1500 CH) exposed to 8 scenarios.
In the literature, substitution of chilling by forcing and versa vice is often postulated, but no proof and/or exact figures of their magnitude given.
Hence, the objective of the research was to investigate how much lack of chilling can be substituted by more forcing and elaborate practical means of overcoming lack of chill in the orchard.

key words

Climate change, chilling, temperate zone, lack of chilling, substitution by forcing

FLASH PRESENTATIONS/ f3

presentation

Olive phenology and heat requirement for different olive cultivars in a hot dry region of Portugal

speaker

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Olive phenology has been taken an indicator of climate change as it is affected by climatic factors, such as temperature, rainfall, solar radiation, photoperiod and water availability, which vary geographically in latitude and altitude. Temperature has been used to study those processes that lead to flowering in the olive tree. The aim of this work is to contribute to the study of the phenology of four olive cultivars, to use a different model to predict flowering date and to calculate the heat requirement until flowering. Visual observations were done from floral bud's development to the beginning of fruits change colour during three consecutive years in various olive orchards located in the growing region of the Northeast of Portugal. Preliminary results showed that the model De Melo-Abreu (2004) predicted the mean date of full flowering, with variations of 2-5 days in relation of visual observations. In this region the mean date for flowering occurs in the day of the year (DOY) 139 with a mean duration of 10 days, depending on the year. Fruit set occurred around the DOY of 150 and pit hardening around DOY of 206, with a mean duration of 65 days after full bloom.
Nevertheless, these results are preliminary and the study needs to be extended for more years.

key words

cv. Cobrançosa, cv. Madural, cv. Verdeal Transmontana, cv. Negrinha de Freixo

FLASH PRESENTATIONS/ f4

presentation

Cold damages of domestic plum (*P. domestica L.*) buds

speaker

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Cold resistance of fruit tree buds is very important. With climate changes winters stay unstable, temperature fluctuations are often and make a lot of problems. Research of cold damages was done during three years (2019 - 2021). Three Latvian plum cultivars ‘Ance’, ‘Adelyn’, ‘Sonora’ and ’Jubileum' as control was used. Evaluation of buds was done on one-year old branches and on fruit twigs. In winter 2019 and 2021 weather conditions were adequate for Latvia, but winter 2020 was uncharacteristic - without snow and negative temperatures below minus 10 degrees. Previous summers were dry, which affected the length of dormancy period. Evaluation of cold damages of flower- and vegetative buds were done after deep dormancy period: in February, 2019 and in January, 2020 and 2021 after keeping for a limited time in temperatures thresholds -200 °C, -250 °C, -300 °C, -350 °C in alternating climate chambers. Considering warm winter until the second decade of March, in 2020 it was decided to evaluate cold damages after keeping in alternating climate chambers till minus 100 °C (branches collected at the beginning of buds swelling).

key words

flower buds, vegetative buds, cold resistance, cultivars

FLASH PRESENTATIONS/ f5

presentation

Golden currant (*Ribes aureum Pursh.*) cultivar growth, development and yield formation in different growing systems

speaker

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Although the golden currant has been grown in Latvia for several decades, mainly as ornamental plant, there is a little experience in the most suitable cultivation systems for berry production. The research was carried out at the Latvia University of Life Sciences and Technologies in Jelgava. Two cultivars of golden currant – 'Laila' and 'Uzbekistanskaya Krupnoplodnaya' in two cultivation systems – vertical trellis and shrub form were planted in 2017 and the first two seasons with harvest will be described. In addition, plots with and without organic mulch were established in the shrub system. The aim of the research was to study the growth, development and yield of golden currant depending on the cultivation system. All plants bloomed abundantly and practically at the same time in both years, no significant differences were found between cultivation systems and cultivars. The annual growth of shoots in 2020 was significantly influenced by the growing system – in average 0.84 m in the trellis system, and 0.48 m in the shrubs in mulched plots and 0.47 m in unmulched plots. The cultivar 'Laila' also tends to produce longer shoots (average 0.64 m) than the 'Uzbekistanskaya Krupnoplodnaya' (0.55 m). The yield of berries was low because \of poor fruit set and did not significantly differ between cultivars and growing systems, though ‘Laila’ and shrub systems still had higher yields.

key words

Ribes aureum, trellis, shrub, mulch

FLASH PRESENTATIONS/ f6

presentation

Results of propagation for three cultivars of Japanese quince (*Chaenomeles japonica*)

speaker

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The aim of the trial was to gather data on the possible propagation methods of three Japanese quince cultivars and to choose the most suitable method for each. During 2017–2019 rooting trials with cultivars ‘Darius’, ‘Rasa’ and ‘Rondo’ were done in a greenhouse, to investigate the rooting and shoot quality of softwood cuttings, using different treatments, as well as evaluating the data on the beginning of fruit production, vegetative parameters and volume of the first yield with saplings propagated via two different methods.
Softwood cuttings of Japanese quince rooted well (average 82–93 %) in a plastic greenhouse with heated substrate and partly automated temperature and moisture control, in spite to different weather conditions during 3 vegetation periods. The best results for rooting were found for cultivar ‘Rondo’. On average, better results of rooting for all cultivars were obtained when cuttings were soaked in indolylbutiric acid solution and trichodermin was added to the substrate. Each year the soft wood cuttings had one predominant shoot, branching was observed in 0,1% of cases. ‘Rasa’ had the longest average shoot length. ‘Rondo’ had the thickest average shoot width between all trial years.
Significant differences were not established between cultivars when evaluating shoot diameters depending on cutting treatment (softwood cuttings and by micropropagation). When comparing length of bush shoots and diameter of bushes, significant differences were found between years for both propagation methods, significant differences were also found between years within one type of propagation. On average, the best results for shoot length were obtained using micropropagation. After evaluating the first yield of fruit, no significant differences were found between cultivars during the first 2 trial years. However, plants acquired by micropropagation had a significantly higher yield per bush.

key words

softwood cuttings, micropropagation, rooting, shoot quality

FLASH PRESENTATIONS/ f7

presentation

Goji berry (*Lycium spp*) Cultivation in the Turkey

speaker

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The goji berry (*Lycium spp*) belongs to the Solanaceae family. The genus Lycium comprises 87 recognized species and is distributed in arid and semi-arid regions in temperate to subtropical zones in the world. In botanical terms, there are three types of Lycium species known as wolfberry and commercially grown in the whole world, and these are; Lycium barbarum Linne (2n=24), Lycium chinense Miller (n=12), Lycium ruthenicum Murr (n=12). Wolfberry is a herb growing naturally in both the mild and tropical areas of East, Southeast Asia and Southern Africa. Also known as wolfberry (Lycium spp.), the motherland of wolfberry is China and it can even be grown in the Himalayas, the highest points of Tibet and Mongolia. Recently, in Turkey goji berry became one of the popular fruit due to having health benefit compounds especially phenolic compounds (phenolic acids and flavonoids), carotenoids, tocopherol, ascorbic acid and antioxidant properties.
The purpose of this study is to make a historic assessment of botanic properties and cultivation of wolfberry plant and providing information on the types and cultivars grown commonly in Turkey, distribution areas of production, consumption and use as a technologic product, marketing status, benefits for human health, multiplication and production techniques.

key words

goji berry, production, propagation, consumption

FLASH PRESENTATIONS/ f8

presentation

Tree vigor, yield and its quality of the apple cultivar ‘Dace’ on different clonal rootstocks in a young orchard

speaker

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A long-term field trial with an apple scab resistant cultivar ‘Dace’ that is considered to have good prospects for growing in Estonia, was established in South-Estonia at Polli Horticultural Centre (58°07’N, 25°32’E) in 2016. The trees had been grafted on 16 rootstocks: M26 (England), E20 and E28 (Estonia), B9 and B396 /Russia), P22 and P59 (Poland), MTT4 (Finland), Pure 1 (Latvia) and eight new rootstocks from Polli. The trial orchard is on a clay loam soil with medium fertility. In a four-year-old orchard, the trees grew taller than on M26 (control rootstock) on new rootstocks 9-1, 2-3, 8-7 and remained shorter on P22, 2-6, P59, B9 and Pure 1. The diameter of the crown varied to a greater extent. Compared to the control rootstock M26, the crown of the trees on 8-7 was wider and the crown of the trees on B9 and 3-2 smaller. Floral buds formed on test trees already in the nursery. Blossoms opened and fruits formed in the year of establishing the orchard. In the first three years there were a great number of blossoms on trees on rootstocks 8-7, B396, P59, 2-1 and M26 (71-104 inflorescences) and fruits formed on trees on rootstocks P59, B396, P22, and M26 (0.9…3.8%).The total yield in the young orchard was greater on trees on rootstocks 2-1 (18.3 kg), 8-7 (15.5 kg), 4-1 (15.1 kg), M26 (15.0 kg), B396 and E28 (14.5 kg).The fruit of ‘Dace’ is large, the average fruit mass exceeding 190 g on most rootstock combinations.

key words

apple, clonal rootstock, growth, yield

FLASH PRESENTATIONS/ f9

presentation

Growth and development of Hippeastrum seedlings in response of different light spectra of LED lamps

speaker

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Growth of Hippeastrum seedlings can be affected by many agricultural factors. However, light seems to be one of more significant. The aim of the experiment was to evaluate the effect of light spectra on early hippeastrum seedling development. Seeds were obtained after crossing of Hippeastrum hybridum Red Lion and H. x chmielii (bred at Warsaw University of Life Sciences – Poland). After germination in jars with water seedlings, graded into three group of size (small, medium and large) were transferred to containers with peat substrate and grown in controlled climate chambers with artificial light from LED lamps. Three different LED lamps were applied with light spectra, Red (R), Blue (B), Green (G) and Far Red (FR) bands as: LED I, 90;2;4;4, LED II, 78;14;4;4 and LED III, 50;42;4;4. The photosynthetically active radiation (PAR) at the plant level was 120–±10 µmol m-2s-1, and photoperiod 16/8 h day/night. Plants were evaluated after 4 months of cultivation with regular fertilization at irrigation, according to the growth phase. The obtained results showed that light spectrum influenced leaf number. Plants grown with LED I, LED II and LED III developed 5,5; 6,1 and 6,2 leaves, respectively. As expected, the highest leaf number had plants developed from large seedlings. In case of plant height R light (90% in LED I) significantly stimulated this parameter. The most compact plants were obtained under LED III lamps, with 42% of B. Interesting results were obtained when comparing the effect of light spectra on bulb diameter measured after 4 month of cultivation. The biggest bulbs had plant cultivated with LED II (25,3 mm) then LED III (23,7 mm) and the smallest were bulb of plants grown with LED I. The increased level of blue light positively influenced also the leaf greenness.
In conclusion it should be said that when the LED lamps, used for hippeastrum seedling contains a lot of red light plants growth is rapid but unbalanced, developing long leaves but not very well colored and smaller bulbs.

key words

amarylis, light spectra, geophites

FLASH PRESENTATIONS/ f10

presentation

Drought effects on the physiological and biochemical parameters of Actinidia (C-4) plants

speaker

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Drought is one of the limiting factors affecting the environment worldwide. The stressful effects of arid conditions cause changes in the morphological traits and physiological processes of plants. This study, photosynthetic pigment contents, photosynthetic system 2 (PS2) activity, antioxidant activity, and total phenolic compound (TPC) amounts were determined in the leaf extracts of two species of actinidia, specifically, Actinidia arguta cultivar ‘Taezhny Dar’ and Actinidia kolomikta cultivar ‘Narodnaya’. All parameters were measured before and after drought stress. The seedlings were initially grown in the laboratory, then planted in separate pots and kept in the greenhouse under a canopy to protect them from the rain. Chlorophyll (Chl) a and b, carotenoids, antioxidant activity, and phenolic compound contents were determined spectrophotometrically. PS2 activity was determined by using pulse amplitude modulation fluorometry. Car content was 6.5 times higher in the leaves of A. arguta and 2.5 times higher in the leaves of A. kolomikta than in the leaves of the control plants.

key words

drought, leaves, photosynthesis, antioxidant activity, phenolic compounds, *Actinidia arguta L., Actinidia kolomikta L.*

FLASH PRESENTATIONS/ f11

presentation

Genetic variation in population of onion thrips (*Thrips tabaci (Thysanoptera: Thripidae)*) in Lithuania and their link with sustainable grown vegetable

speaker

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Onion thrips (*Thrips tabaci Lindeman*) is one of the most important polyphagous horticulture crop pests in Lithuania. The aim of the research was to investigate new approach with the geographic distributions and host plant associations between different mtDNA cytochrome c oxidase I (COI) haplotypes of *T. tabaci*. Specimens of T. tabaci were collected from different horticultural crops in the main horticulture regions across Lithuania, where sustainable plant growing practice was used. Four different haplotypes of *T. tabaci* were detected during investigation, and the greatest haplotype diversity was registered in the northern districts of Lithuania. The mean genetic distance between different haplotypes was 1.6%, and diversity was up to 2.9%, comparing with sequences from other European countries (the Netherlands, UK and France) deposited in GenBank. Sequences obtained during this investigation differed by ≥10% comparing with sequences from other countries. *Thrips tabaci* COI gene differences partly reflect the geographic distribution, but results did not reveal the relationship between COI gene polymorphism of T. tabaci and different host plants.

key words

COI diversity, haplotypes, horticultural crops

FLASH PRESENTATIONS/ f12

presentation

Antifungal activities of volatile compounds released from *Brassica juncea* seeds against grey mould agent *Botrytis cinerea*

speaker

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Brassica juncea seeds contain glucosinolates. Their hydrolysis products – volatile isothiocyanates are the most toxic and are known to have broad biocidal activity.
The objective of this study was to investigate the biofumigation effect of volatile compounds released from ground seeds of mustard on *B. cinerea* growth and its sclerotia formation on microbiological media. Then, the development of grey mould on the leaves of bean and cucumber, and on the raspberries was studied.
To examine the fumigation effect, mustard seed powder and examined objects were placed in one Petri plate (18 cm diameter), tightly sealed with parafilm. Following objects were studied: *B. cinerea* mycelium or sclerotia inoculated on PDA medium; bean or cucumber leaves and raspberries fruits previously contaminated with *B. cinerea*. The mustard seeds were watered. Different doses of mustard and different biofumigation durations were studied.
The most antifungal effect was observed with a 1g dose of mustard and a fumigation time of 3 hours. The mycelial growth of *B. cinerea* on PDA was completely inhibited. Whereas the development of grey mould on vegetable leaves and fruits was completely inhibited when continuous biofumigation was performed (mustard was not removed).
The obtained results open a potential application of mustard seed biofumigation in the control of *B. cinerea* in vegetables and fruits production.

key words

biofumigation, biological control, vegetable, fruit

FLASH PRESENTATIONS/ f13

presentation

New food plants for *Igutettix oculatus (Hemiptera)* and *Otiorhynchus smreczynskii (Coleoptera)*

speaker

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Two insect species – Igutettix oculatus (*Hemiptera: Cicadellidae*) and Otiorhynchus smreczynskii (*Coleoptera: Curculionidae*) share the same food sources as some of their food plants overlap. *Hemipteran I. oculatus* is an oligophagous species and feeds only on plants belonging to the genera Fraxinus, Ligustrum and Syringa from the family *Oleaceae*, tribe *Oleeae* (*subtribes Fraxininae and Ligustrinae*). In this study, four Fraxinus and four Ligustrum species have been confirmed as the new food plants for I. oculatus. The main food plants for adult weevils of O. smreczynskii probably originally belonged to the genera Ligustrum and Syringa. In this study, several new main (*Euonymus europaeus, Prunus cerasifera* and *Rhamnus cathartica*) and many new alternative food plants have been recorded for the first time. The species *Ribes alpinum* and *Symphoricarpos albus* that were previously already known have also been recognised as the main food plants in this study. Most of the new registered food plants for O. smreczynskii belong to the plant families *Oleaceae* (more than 10 taxa, including cultivars) and Rosaceae (more than 15, including three herbaceous species, *Fragaria vesca, F. ×ananassa and Geum urbanum*). Other main or alternative food plants belong to the families *Adoxaceae* (2 species), *Celastraceae* (3), *Grossulariaceae* (3) and *Rhamnaceae* (1).

key words

Exotic species, feeding behaviour, food diversity, food plant switch, lilac leafhopper, lilac weevil

FLASH PRESENTATIONS/ f14

presentation

Evaluation of Apple Chlorotic Leaf Spot Virus impact on fruit yield and vegetative growth

speaker

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The pathogens negative influence on plant development is well known. However, the negative impact depends on various factors: cultivar and rootstock resistance; nutrition and environment; the virulence and concentration of pathogens in the plant tissue. The evaluation of ACLSV influence on apple tree growth and production was performed at Institute of Horticulture (LatHort) from 2012 - 2020. Virus-free and ACLSV-infected trees from “old fashion” cultivar ‘Antonovka’ and new scab resistant cultivar ‘Gita’ were evaluated on dwarf rootstock B.396. The presence of four common apple viruses (ApMV, ACLSV, ASGV and ASPV) was assayed in planting year and repeated at end of investigation period. The vigour of planting material, growth, yield, and yield efficiency were compared between virus-free and ACLSV infected trees. The larger volume of canopy was observed for ACLSV infected trees, the higher cumulative yield per canopy volume had for virus free trees. The negative impact of ACLSV on cumulative fruit yield in the seventh and eighth year after planting were observed for cv. ‘Antonovka’ only. ACLSV infection did not show any negative impact on vegetative growth or yield for cv. ‘Gita’.
The obtained results showed that the choice of cultivar is the main factor that can influence potential losses caused by virus infection.

key words

Malus, canopy volume, cumulative yield, trunk increase, dwarf rootstock

FLASH PRESENTATIONS/ f15

presentation

Expression of genes related to the response of *Brassica* plants to *Plasmodiophora brassicae* infection and selection of the potential molecular markers for clubroot resistance

speaker

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The aim of study is to understand the molecular mechanism of resistance to clubroot in *Brassica* plants. Eight genotypes differing in the level and type of clubroot resistance were used. Analysis for the identification of genes related to the response to pathogen infection was performed using cDNA-AFLP and validation of selected markers - by real time PCR. The Pearson correlation coefficient between the gene expression and the disease index of each genotypes was determined. 150 ESTs, transcripts with different expression during infection were identified. The analyzes showed that 59.4% of genes were overexpressed and 40.6% were silenced in infected plants. 45 candidate genes were selected for validation and finally, 28 ESTs were selected for further work: 26 ESTs negatively and 2 ESTs positively correlated with plant resistance. These ESTs encode proteins involved in: resistance (N, PDCD1; cdc7 kinase; SBT3.3 protease; germacren D synthase; PcbC dioxygenase); signal transduction (KCTD8 membrane receptor; PP1R26 phosphatase); cellular transport (transporter 4 and NRT1/PTR); cytoskeleton structure reorganization (formin 3); regulation of gene expression (PMT24 and ATX5 methyltransferases; bHLH118 and ERF109 transcription factors) and cell cycle (cyclin Y).
The study was funded by the Polish Ministry of Agriculture and Rural Development, Biological Progress, Task No. 99 (2015-2020).

key words

Brassica species, clubroot resistance, *Plasmodiophora brassicae*, molecular mechanism of resistance, transcriptome analysis, biotic stress

FLASH PRESENTATIONS/ f16

presentation

Effects of different processing treatments on almond (*Prunus dulcis*) chemical and sensorial characteristics

speaker

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Almond is one of the most commonly consumed nuts worldwide, with health benefits associated with availability of bioactive compounds and fatty acids. Almond is often eaten raw or after some processing steps. However, the latter can positively or negatively influence chemical and sensorial attributes of almonds. This work was carried out to assess the effects of two processing treatments, namely; roasting and blanching on the content of bioactive compounds, antioxidant activity and sensorial characteristics of four neglected Portuguese almond cultivars (Casanova, Molar, Pegarinhos and Refêgo) and two foreign cultivars (Ferragnès and Glorieta). Results showed that in general, levels of bioactive compounds and antioxidant activities increased with roasting and decreased with blanching. Roasting positively affected perception of skin color and sweetness of Ferragnès and Glorieta as well as skin roughness of Molar and Pegarinhos. Blanching on the other hand led to positive changes in textural properties of Refêgo and Pegarinhos.
This study reveals the nutritive benefits of consuming neglected almond cultivars in Portugal, and the novel data reported here could be of interest to growers, processing companies and consumers.

key words

Prunus dulcis, processing, sensorial analysis, bioactive compounds, antioxidant activity

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-1

presentation

NDVI and SI-NDVI measurement comparison for continuous plant “well-being” monitoring

speaker

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The high-cost spectral and hyperspectral imaging tools are seen as the most precise way for obtaining detailed information about plants NDVI parameter with non-destructive measurement techniques. IoT-based prototype is created, integrating SI-NDVI calculation method and low-cost camera and image processing unit. Our study aims to compare two different data collection methods to assess the “well-being” of greenhouse-grown plants under different artificial light spectrum conditions, additionally monitoring air temperature and humidity. The study was arranged in the polycarbonate greenhouse of the Faculty of Agriculture of the Latvia University of Life Sciences and Technologies. Additional lighting was provided by LED COB Helle Top LED 280 luminary, induction lamp and high-pressure sodium vapor lamp Helle Magna with PAR at the cucumbers, tomatoes plant tips 180±30 µmol m-2 s-1. Leaf reflection spectra were determined for plants with a portable spectroradiometer RS-3500 (Ltd. Spectral evolution) and an SI-NDVI prototype sensor.
Studies have shown that both methods can be used to assess plant welfare. The NDVI indices obtained by both methods are comparable. It can be concluded, that it is possible to use the SI-NDVI sensor for continuous and remote measurements of approximate NDVI values, and by applying a corrective light distribution coefficient - obtaining precision error between 6-19%.

key words

greenhouse, cucumbers, tomatoes, remote measurement

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-2

presentation

Mixing hydrogel capsules into peat substrate improves germination and enhances growth and physiological performance of tomato seedlings

speaker

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The effects of hydrogel capsules mixed with peat substrate on germination, morphological and physiological parameters of plugged seedlings were tested in tomato seedlings, under two different irrigation regimes. The water content of growth medium was affected by the presence of hydrogel capsules which absorbs and releases water. Due to hydrogel presence, the germination speed was increased, whereas mean germination time was significantly reduced. Slight improvements were recorded regarding final germination, but no effect was found regarding synchronization index and seedling vigor index. Due to addition of hydrogel capsules a significant increase was recorded in dry matter of shoots and plants. No effect was found regarding dry matter of roots, but the presence of hydrogel granules has significantly reduced the length of tap root. Interestingly, stomata conductance was significantly reduced and the chlorophyll index was significantly than in control plants. No statistically significant interaction was found between hydrogel variants and irrigation frequency, i.e., the effect of different levels of hydrogel variants were not depending on what level of irrigation frequency was present. Therefore, we conclude it is worth mixing hydrogel capsules into the substrate of plug seedlings to improve the morphological and physiological parameters of the seedlings and reduce water and fertilizer leaching into the environment.

key words

final germination, germination speed, mean germination time, dry matter, stomata conductance, chlorophyll index

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-3

presentation

Biofortification of hydroponically grown broccoli microgreens with Se at different ratios of blue and red LED light

speaker

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This study aimed to determine the responses of broccoli microgreens to 0, 1, 2, 3, 4, 5 ppm Se in hydroponic solution with sodium selenate at different ratio of blue (B) and red (R) light in light-emitting diodes lighting. Broccoli microgreens were grown under B:R light ratios - 10%B:90%R, 75%B:25%R (treatment code M10R90 and M75R25, respectively) using 220 mmol m-2 s-1 the photon flux density (PFD). Results showed that Se content and translocation factor (TF) increased and bioconcentration factor (BCF) decreased with increasing Se in solution. Broccoli microgreens appeared as accumulating Se plants under M75R25, i.e., TF values were higher than one at 2 - 5 ppm Se exposure. However, at 3-5 ppm Se doses, the TF was lower than at 2 ppm. M75R25 lighting and 2-3 ppm Se doses positively affected the content of mineral elements in broccoli. M75R25 reduced broccoli elongation. Lighting and Se doses did not affect leaf area, fresh and dry weight and chlorophyll content. Higher levels of flavonols were found at M75R25, but the Se doses had no significant effect.
Results suggest that 2-3 ppm Se doses and lighting with a higher proportion of B light could be suitable for cultivating Se-biofortified broccoli microgreens without any adverse effects on growth. Funding: This project has received funding from the Research Council of Lithuania (LMTLT), agreement No. S-MIP-19-2.

key words

selenium, biofortification, blue and red light ratio, broccoli microgreens

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-4

presentation

Quality evaluation of cowpea immature pods and grains

speaker

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The introduction of new pulse-based products can be an important step to increase the sustainability of agro-food systems. Cowpea (Vigna unguiculata L. Walp) is a protein-rich grain legume and the aerial section of the plant is entirely edible. Study main objective was to evaluate the protein and polyphenolic contents (total phenols, flavonoids and ortho-diphenols) and antioxidant capacity (ABTS and DPPH) in alternative cowpea food sources (immature pods and grains) comparatively to dry grains. Ten cowpea genotypes were analysed during two harvest seasons. In general, most of the genotypes produced cowpea products with high values for all the parameters being observed a high variation between them. Immature grains revealed the highest levels of protein content (average 294 g kg-1), followed by dry grains (average 270 g kg-1) and immature pods (average 253 g kg-1). For the polyphenolic contents and antioxidant capacity, the immature pods presented the highest values, while the dry grains the lowest.

Our results proved that cowpea immature pods and grains are a rich source of protein and phenolics presenting also a high antioxidant capacity compared to cowpea dry grains. Their introduction in the market have a high potential allowing a healthy and variable diet and, due the necessity to have a shorter growing season, a better use of the crop under climate changes scenario.

Acknowledgements: CITAB project funding from National Funds by FCT - Portuguese Foundation for Science and Technology, under the projects UIDB/04033/2020.

key words

Vigna unguiculata L. Walp., pulse-based products, protein, polyphenolic contents, antioxidant capacity

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-5

presentation

Variability of flower bud and fruit quality in local sour cherries of Latvia

speaker

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Sour cherries have been grown in Latvia for at least several centuries, and valuable landraces were developed. Essential differences were observed between the landraces and their clones in flower bud and fruit traits. The aim of the research was to characterize the variability of flower bud and fruit quality in Latvian local sour cherries and select the most promising genotypes. The data of fruit set in self-pollination, cold-resistance of flower buds, and fruit properties were collected for 29 genotypes. Fruit mass, stone mass, and soluble solid content had the highest contribution to variability explaining 79.90% of it. The factors could be joined in three components where 1st component combined the proportion of fruit flesh, stem retention force and soluble solid content (SSC), the 2nd component – fruit set and proportion of cold-resistant buds and 3rd component – fruit mass and stone mass. According to cluster analysis, the genotypes with high SSC, relatively big stone and small fruit flesh proportion were combined in 1st cluster, the genotypes with large fruit flesh proportion, cold-resistant buds and high fruit set after self-pollination – in 2nd cluster but the genotypes with high stem retention force, cold-intolerant buds and low fruit set – in 3rd cluster. ‘Latvijas Zemais’ clone 62 stood out with stable fruit set after self-pollination, cold-resistant flower buds and high proportion of fruit flesh.

key words

Landrace, cold-resistance, fruit set, fruit mass, soluble solid content

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1–6

presentation

Effect of size of onion (*Allium cepa L.*) sets to the bolting and bulb productivity

speaker

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The experiment was performed at the experimental field of Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry during 2018–2019. The aim of investigation was to evaluate the parameters of onion productivity and bolting induction related to the sets size. The planting material of cultivars ‘Babtų didieji’ and ‘Stutgarten Riesen’ was graded into three different groups according to the size. The diameter of sets reached 0.7–1.5 mm in the 1st group, 1.6–2.5 mm – 2nd group and 2.6–3.5 mm – 3rd group. The results revealed that the productivity varied depending on the size of the sets. The highest productivity was obtained in the 3rd size group of the sets (diameter 2.6 – 3.5).
In this experiment the total yield of ‘Babtų didieji’ and ‘Stutgarten Riesen’ reached 33.7 t ha–1 and 30.4 t ha–1 respectively. But the output of marketable bulbs was significantly higher in both experiments where the smaller sets were used.
Bolting is undesirable factor for formation of marketable yield of onions. The frequency of bolting was found to increase up to 60% of both cultivars in the experiment with the 3rd size group of sets. No bolting was observed in the experiment with the smallest sets.
The size 0.7–1.5 mm of sets appears to be optimum for onions marketable yield production.

key words

bolting, cultivar, onion sets, productivity, marketable yield

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1–7

presentation

New strawberry cultivars for growing in high tunnels

speaker

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Strawberry growing in high tunnels is widely used in many countries and the area of strawberries under cover is increasing. Usually early ripening cultivars are planted to obtain earlier yield in the season. Several new strawberry cultivars and one hybrid (of Dutch breeding) with medium and late ripening time were evaluated for growing in high tunnels in soil. The trial was established in August 4, 2016 in FVG type tunnel (60 × 4 ×3.35 m). The following cultivars and hybrids and frigo plant categories were used in the investigation: ‘Sonata’ (A) and ‘Sonsation’ (A+), medium ripening time; ‘Faith’ (A+) and hybrid 09-90s-05 (A), late ripening time; ‘Malwina’ (A+) and ‘Magnus’ (A), very late ripening time. Plants were grown on rised beds covered with black plastic mulch in double rows with drip irrigation applied. Soil type: sandy clay loam. Plant survival after winter, productivity potential, yield, fruit size, the ratio of qualitative to damaged berries in the crop, fruit sensory characteristics, shelflife and biochemical content after freezing were evaluated.
According to three-year evaluation results ‘Sonsation’ had better fruit quality and resistance to crown diseases than ‘Sonata’ and is appropriate for yield forcing in high tunnels. ‘Faith’ and 09-90s-05 are not appropriate for growing in high tunnels in heavy soils. ‘Faith’ had low productivity potential and fruits of medium taste. 09-90s-05 had good yield, but medium fruit quality and low taste evaluation, and it was susceptible to gray mold. Very late ripening cultivars ‘Malwina’ and ‘Magnus’ had low productivity in all evaluation years, probably because of too heavy soil.

key words

Sonsation, Faith, Magnus, Fragaria ananassa Duch

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-8

presentation

Effect of biologically active preparations TotalHumus and Bacterbase on the ex vitro early growth of micropropagated strawberry, blueberry and hip rose plants

speaker

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One of the key steps in the plant micropropagation is rooting and acclimatization of the microcuttings. The aim of the study was to investigate the suitability of preparations, TotalHumus and Bacterbase, to stimulate the growth of young plants derived from in vitro propagation. TotalHumus is made from brown coal. Bacterbase is a bacterial preparation, containing Bacillus velezensis and Bacillus amyloliqefaciens with antifungal properties that stimulates the growth. Unrooted microshoots of strawberry 'Grandarosa', highbush blueberry 'Chandler' and rooted in vitro microcuttings of hip rose 'Konstancin' were planted in a peat substrate. Three weeks after planting ex vitro, the plants were treated with the biopreparations. Four times, at two-week intervals, the plants were drenched and sprayed with mineral fertilizer 0.1% Hydrovit, 0.04% TotalHumus and 0.03% Bacterbase. In hip rose and strawberry, the best growth parameters of shoots and roots were observed after the use of TotalHumus and/or Bactebase. The plants had the highest fresh weight, longer shoots and more than in the control (Hydrovit). Root system development parameters were improved after using Totalhumus in strawberries and Bacterbase in rose. The use of the tested biopreparations alone or in combination reduced the infection of rose leaves with powdery mildew. Biopreparations had no effect on highbush blueberry.

key words

biologically active preparations, ex vitro, acclimatisation, Fragaria x ananassa, *Vaccinium corymbosum, R. rugosa x R. beggeriana*

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-9

presentation

Nutrient requirements for Japanese quince (*Chaenomeles japonica*)

speaker

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Nutrients runoff with leaves usually return to the nutrient cycle. N is runoff with leaves (av. 2.9–5.4 kg/ha) and fruit (5.2–7.2 kg with 1-ton yield). K is runoff with fruit (5.6–6.9 kg with 1-ton yield) and leaves (1–2.8 kg/ha). Ca is mostly runoff with leaves (1.5–7.4 kg/ha). P and Mg runoff with leaves and fruit is low. Nutrients accumulate in shoots and roots during the entire growth period, losses of nutrients only happen in the case of bush removal. Nutrient runoff was calculated for 4–6-year-old seedling plantations and 7–9-year-old cultivar plantations. The highest mineral runoff for shoots and roots was N (35.2–69.4 kg/ha) and Ca (17–49.6 kg/ha). Necessity of fertilization was calculated after calculating nutrient runoff in a year, assuming that yield was 11 t/ha.

key words

remove nutrients, cultivars, seedlings, soil

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1–10

presentation

Evaluation of *Ribes rubrum* cultivars in Estonia

speaker

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The evaluation of cultivars of red and white currant (*Ribes rubrum L.*) was carried out in 2019–2020 in South-Estonia at Polli Horticultural Research Centre of the Estonian University of Life Sciences. The aim of this study was to estimate traits of red and white currant cultivars of both Estonian and introduced origin. The evaluation plot was established in the autumn of 2016. For two consecutive years, 2019–2020, 11 promising cultivars were evaluated for beginning of flowering and fruit ripening, winter hardiness, resistance to diseases and pests (expressed in scores 1–9), number of fruits per cluster, yield (kg per bush), weight of fruit, drop off of flowers and premature berries and content of the soluble solids (°Brix), titratable acids, ascorbic acid, total phenols and total anthocyanins.
The highest yield was determined in cultivars ‘Bayana’ and ‘Viksnes’, while cvs. ‘Rovada’, ‘Jonkheer van Tets’, ‘Kurvitsa 4’ and ‘Valko’ had the largest berries. The highest soluble solids content was found in the berries of red currant ’Krameri punane’ (13.8 °Brix) and from white currants in ’Bayana’ (12.4 °Brix).

key words

red and white currant genotypes, fruit quality, fruit weight, yield

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1-11

presentation

Results of the evaluation of the promising selections of floricane raspberry in Institute of Horticulture

speaker

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Raspberries are one of the most important berry crops in Latvia. According to the statistical data, in 2020 raspberries were grown in 226 ha in Latvia. The average raspberry yield is still low. The low level of agrotechnics and lack of suitable cultivars are the main causes for low yield. Raspberry breeding at the Institute of Horticulture, Dobele, Latvia (LatHort), GPS location: N: 56°36'39" E: 23°17'50" has been carried out since 1980. The main objectives of raspberry breeding are ecological plasticity of plants, high-yield and berry quality, resistance to diseases and pests. During the period 2018-2021, the evaluation of promising hybrids and cultivars of floricane raspberry has been carried out at LatHort in Dobele in order to assess their suitability for integrated growing. Winter hardiness is one of the most crucial criteria for raspberry cultivars. Artificial refrigeration of raspberry canes in a climate chamber was carried out to assess the frost resistance of prospective hybrids and cultivars. The frost resistance was tested at temperatures -25 °C and -30 °C. Of the evaluated cultivars and hybrids, the highest frost resistance was shown by the cultivar 'Lubetovskaya'. In general, the promising selections S1-12-13, S1-12-17, and S11-25a-4, showed relatively better results for the frost resistance at minus 30 °C. In the period of evaluation, the highest average yield was for the hybrid S11-25a-6.9 t ha-1.

key words

floricane raspberry,frost hardiness, frost resistance, yield, fruit weight, biochemical content

POSTER PRESENTATIONS/ Sustainable growing for climate change mitigation/ p1–12

presentation

Serendipita indica and *Trichoderma* strains as growth stimulators of horticultural plants

speaker

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Serendipita indica and *Trichoderma* spp. are known beneficial microorganisms. S. indica is an endophytic fungus that colonizes roots of many plant species. Whereas *Trichoderma* spp. are widely used as biostimulants and biological control agents in crops. The aim of the study was to determine the degree of root colonization by S. indica, and whether S. indica and strains of T. virens (TRS106) and T. atroviride (TRS20, TRS14) can stimulate the growth of tomato and pepper seedlings, depending of used plants cultivar. The ability of S. indica to colonize seedlings of 6 tomato and 10 pepper cultivars, and the influence of S. indica and Trichoderma strains on the growth of the seedlings were studied in Phytotoxkit plates. The peat substrate was inoculated with *Trichoderma* spores (105 spores/1 g of substrate) and S. indica (1 g of mycelium/100 ml of substrate). The seeds were germinated in the substrate, and then the length, weight of the seedlings and root colonization were measured after 21 days. The percent of root colonization by S. indica was greater in case of pepper (38–56%) than tomato (15–33%). The addition of S. indica to the substrate stimulated also growth of pepper seedlings. The effect of *Trichoderma* strains on plant growth was varied. The addition of TRS20 and TRS106 showed a tendency to inhibit the growth of young plants. On the other hand, TRS14 increased the weight of the seedlings.

key words

beneficial microorganisms, root colonization, growth stimulation, plant cultivars

POSTER PRESENTATIONS/ Plant protection/ p2-1

presentation

Sea buckthorn diseases caused by pathogenic fungi: a reviewv

speaker

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Sea buckthorn (*Hippophae rhamnoides L.*) is a native species in various regions of Asia and Europe. It is cultivated as multipurpose horticultural species in northern temperate regions of Europe, Asia and North America with large economic potential used for food, pharmacology, cosmetics and environmental conservation. Diseases in natural populations and managed landscapes have increased, endangering sea buckthorn growth and cultivation worldwide.
This review article focuses on sea buckthorn canker, wilt and decline diseases caused by pathogenic fungi, their distribution, hosts of involved pathogenic fungi and symptoms.
Published information on sea buckthorn fungal diseases is available only about few diseases, such as wilt (*Verticillium* dahlia), the dried-shrink disease caused by various fungi and abiotic factors, and stem canker (*Cytospora spp., Stigmina sp.*). Some fungi reported on sea buckthorn are poorly studied, or the sea buckthorn is a newly discovered host, as in the case of Eutypa spp. The most often reported symptoms of these diseases are cankers and cracks on trunks and main branches, dead buds and leaves, necrosis of various tissues on branches, and root necrosis, resulting in the death of the shrubs.
In general, the fungal diseases on sea buckthorn are not sufficiently addressed, and more research is needed.

key words

Hippophae rhamnoides L., canker, decline, wilt

POSTER PRESENTATIONS/ Plant protection/ p2-2

presentation

Xanthomonas arboricola pv. corylina as a bacterial blight disease causal agent of hazelnuts in Latvia

speaker

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European hazelnut (*Corylus avellana*) represents an economically important crop in several countries of Europe, western Asia, northern and southern America and Oceania. In Latvia, hazelnut has been traditionally grown by amateur growers in home gardens and small orchards, however, interest in the commercial cultivation of hazelnuts has been significantly increased recently. Infectious diseases are of the important limiting factors of hazelnut production. *Xanthomonas arboricola pv. corylina* the causal agent of hazelnut bacterial blight it especially dangerous for younger plants, with a mortality rate of up to 10%. In the years 2014 and 2019 leaf spots and cankers were observed on different hazelnut cultivars grown in one orchard in central Latvia. On the leaves and involucres of shells were observed lesions which corresponded to Xanthomonas symptoms on hazelnut, described in EPPO standards. Tests in our study: morphology on Nutrient Agar and KB agar, KOH test for determination of Gram negative or positive isolates, aesculin hydrolysis test, pathogenicity test on tobacco leaves and growth at 35°C in yeast media confirmed availability of Xanthomonas as pathogen on hazelnuts. In Latvia, research about the hazelnut bacterial blight is relevant only in recent years and therefore, there is not much data yet, but researches of Xanthomonas disease biology are in progress.

key words

hazelnut diseases, pathogenicity tests, cankers

POSTER PRESENTATIONS/ Plant protection/ p2-3

presentation

Peculiarities of the *Gymnosporangium sabinae* developmental cycle

speaker

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European pear rust agent *Gymnosporangium sabinae* (Dicks.) G. Winter is a dioecious rust pathogen with an incomplete developmental cycle, which forms four spore types - telial and basidia spores on junipers, spermatia, and aecia spores on pears. However, the duration and progress of each developmental stage are affected by agro-ecological factors. Therefore, it is necessary to determine these peculiarities to predict the possible spread of disease and its severity under specific circumstances. Such studies in Latvia were started in 2008.
The aim of the research was to clarify the impact of agro-ecological factors on *G. sabinae* biology.
Results of this study showed that pear infection depends on *G. sabinae* basidia spore formation and release, which is influenced by the meteorological situation. Favourable conditions are rainfall over 10 mm and average air temperature not lower than 10 °C. The stages of pathogen development on shoots are the same as on leaves but slower. European pear rust agent G. sabinae does not overwinter in pear shoots.

key words

pathogens, pears, agro-ecological factors

POSTER PRESENTATIONS/ Plant protection/ p2-4

presentation

Population of weeds in the plantation of red raspberries (*Rubus idaeus L.*)

speaker

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The data from monitoring of weed population are relevant for successful integrated weed management. The purpose of this experiment was to compare the diversity of weed species in red raspberries plantation rows. The red raspberries plantation was established in August, 2019. Plantation is located in the south part of Latvia, Zemgale region (N56°33'29.5302'', E23°46'26.04''). In the experiment the following red raspberry cultivars: 'Daiga', 'Shahrazada', 'Norna' and 'Polana', were grown in the plantation. The width of raspberries plantation rows was 3 m and distance between seedlings 0.6 m, the size of the plot was 0.51 ha-1. The weed infestation in the red raspberries plantation was determined by using the counting method. The counting of weeds and identification of weed species were done in two times during in vegetation at 16th and 22th week of 2021. It was found that in total 34 weed species, including 18 annual and 16 perennial weeds, were present in the red raspberry plantation. Poa annua (40 - 310 plants per 1) and Elytrigia repens (50 - 1020 plants m-2) was found as dominant weeds. During experiment it was concluded that there can be observed differences of weed population and density between red raspberry cultivars. The cultivar 'Norna' had the highest weed density at both weed counts at 16th (33.5 - 37.8 plants m-2) and 22th week (61.1 - 69.7 plants m-2).

key words

weed incidence, red raspberries

POSTER PRESENTATIONS/ Plant protection/ p2-5

presentation

Apple scab control and resistance risk of *Venturia inaequalis* to curative fungicides in apple orchards

speaker

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In apple orchards, the use of pesticides is high compared to other crops. In integrated pest management (IPM) apple orchards in Latvia or Lithuania, 6-12 sprays are commonly applied against apple scab each season. Number of sprays depend on cultivar susceptibility, weather conditions and the amount of inoculum. Discussions with growers show that they are not always satisfied with the effectiveness of fungicides. There may be various reasons for this, including fungicide resistance. Due to low fungicide efficacy it is suspected that some orchards *V. inaequalis* has developed fungicide resistance. In 2020 samples of apple leaves with scab symptoms were collected and the sensitivity to difenoconazole, cyprodinil and trifloxystrobin were tested in Bio-Protect laboratory, Germany. Tests of the sensitivity was done on potted apple trees (in vivo) for difenoconazole and cyprodinil, and using germination assay for trifloxystrobin. Results in vivo showed that sensitivity of the samples to difenoconazole and cyprodinil were clearly reduced compared to the base line sensitivity. Therefore, reduced efficacy of curative fungicides against V. inaequalis is expected in these orchards. Trifloxystrobin showed an efficacy of only 9% against conidia of the sample indicating that 92% of the conidia were resistant to this active ingredient. Therefore, reduced to almost no efficacy of strobilurin fungicides is expected in the tested orchard against V. inaequalis. The obtained data are valuable for the tested populations and for the orchards, in which the samples were taken. Scab populations from other orchards with different history of fungicide treatments should be tested further.

key words

fruit disease, sprays, decision support system, RIMpro

POSTER PRESENTATIONS/ Plant protection/ p2-6

presentation

Evaluation of apple scab and occurrence of *Venturia inaequalis* races on differential Malus genotypes in Latvia

speaker

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Apple scab (*Venturia inaequalis (Cooke) Wint.*) is one of the most severe apple diseases in apple-growing regions worldwide. Annual sexual reproduction during the dormant season ensures the formation of V. inaequalis populations with high variability and better adaptability to resistant cultivars. The research aimed to assess the virulence of *V. inaequalis* population in the experimental orchard where introduction, evaluation and breeding of apple cultivars are carried out, and the apple germplasm collection of Latvia is located. Fifteen differential Malus genotypes, obtained within the VINQUEST initiative, were planted in 2016 in the germplasm collection sector of the orchard in five blocks, each containing one tree of each genotype. In 2017–2021, apple scab symptoms on the leaves and fruits of each tree were scored according to the methodology used in the VINQUEST network. Although the evaluation scores were low, sporulation lesions of apple scab were detected on leaves of six genotypes, indicating the presence of various races in *V. inaequalis* population in the evaluation site.

key words

diversity, fungi, plant disease, plant pathogen, resistance, virulence

POSTER PRESENTATIONS/ Plant protection/ p2-7

presentation

On *Cecidophyopsis* gall-mite damage assessment methodologies

speaker

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The literature indicates that *Cecidophyopsis* gall-mites are very important and dangerous pests in blackcurrant cultivation. The importance of these mites is increasing as they spread the Blackcurrant reversion virus. Analysing the literature, it has been noticed that the evaluation of these mites on blackcurrant cultivars and new hybrids takes place in different ways. Most publications mention rating scales, according to which the degree of infestation is determined by specific scores. These scales are as follows: 1 to 3, 1 to 4, 0 to 4, 0 to 5, 1 to 5, and 1 to 9 points. However, it is very rare indicated in the literature whether the buds were counted in the whole crown of the plant, or only on randomly selected branches, or whether the evaluation was performed visually, excluding the actual counting of damaged and healthy buds. In order to test the methodologies, 55 blackcurrant shrubs were evaluated in the spring of 2020, counting all the buds on the shoots selected on the four sides of the shrub.
The results obtained are compared with the evaluation scales presented in the literature. In some previous studies, the rating scales did not distinguish a single score for completely healthy plants, or have identified weakly infested genotypes as "resistant plants". Therefore, the terminological issues of "resistant plant" and "fully resistant plant" are also discussed.

key words

blackcurrants, genotype evaluation, methodology comparison

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-1

presentation

The results of developing new cultivars and clonal rootstocks of *Prunus* × *rossica Erem.* at the Krymsk Experiment Breeding Station

speaker

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The paper considers the possibilities of expanding the assortment of plum cultivars in the world production by hybridizing large-fruited myrobalan plum (*Prunus cerasifera Ehrh.*) cultivars with those of Japanese plum (*Prunus salicina Lindl.*) and other diploid stone fruit species. As a result of many years of breeding work in Russia, cultivars of a new hybridogenous species *Prunus* × *rossica Erem.* (Russian plum) have been created, it is ensuring a permanent supply of fresh fruit from late June to September and complementing the range of common plum cultivars.
A description is given for the best new adaptive, high-yielding cultivars with good taste and high canning qualities, namely ‘Kubanskaya Kometa’, ‘Globus’, ‘Gek’, ‘Iyulskaya Roza’, ‘Dynnaya’, ‘Kolonnovidnaya’, and ‘Podarok Sad-Gigantu’. The expediency of their cultivation using intensive technologies and own-rooted plants, as well as clonal rootstocks bred at the Krymsk Station has been substantiated. It is recommended to carry out intensive cultivation of Russian plum using such medium vigorous rootstocks as Kuban 86, Evrika 99, Zarevo, Fortuna and dwarf rootstocks VVA 1, Best, Upryamets, and VSV 1.

key words

technology, fruit quality, productivity, winter hardiness

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-2

presentation

Evaluation of blackcurrant (*Ribes nigrum*) germplasm structure by microsatellite-based fingerprinting for the diversification of the breeding material

speaker

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Blackcurrants are an important berry crop whose further development depends mainly on the diversity of available plant material and its successful inclusion in the breeding. The study aimed to evaluate selected SSR markers' applicability for the analysis of germplasm consisting of genotypes developed through complicated multistage crosses among different Ribes species and estimate the genetic structure and level of genetic diversity of the blackcurrant collection. The set of 110 blackcurrant accessions from the Latvian genetic resources collection was genotyped using 18 previously described SSR markers. The marker set provided all genotypes with unique fingerprints and proved the need for reference genotypes in international studies for data validation. The accessions clustered according to pedigree and did not group by country of origin or breeding programme. The tested SSR markers uncovered relationships between blackcurrant accessions of complicated interspecific composition and revealed an extensive mutual exchange of germplasm among breeding programmes, thus pointing to the need for new donors of valuable characteristics. The results also highlighted the necessity to identify each species' proportion in the hybrid material to assess the impact of species-linked gene expression.
Data acquisition was supported by the Latvia State Research Program in Agrobiotechnology "Innovative technologies for the production of high-quality, reliable and healthy products from genetic, physiological and biochemical diverse plants and raw material of animals", data analysis and manuscript preparation – in the frame of the ERDF project No. 1.1.1.1/18/A/026 "Studies on Ribes plants, Cecidophyopsis mites and Blackcurrant Reversion virus for sustainable resistance breeding and cultivation of Ribes".

key words

Ribes, microsatellites, SSR, germplasm, genetic diversity

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-3

presentation

Genetic diversity and relatedness of Latvian *Pyrus* germplasm revealed by a set of SSR markers

speaker

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Pears (*Pyrus communis L.*) are not native plant species in Latvia but have a long history of introduction and growing, using various sources of plant material over time. Therefore, the existing collection of genetic resources combines accessions of different origins. Therefore, to plan the further development of the crop and ensure its successful preservation, the study aimed to characterise Latvian *Pyrus* germplasm collection using SSR molecular markers and estimate the level of genetic diversity within germplasm. Six SSR markers were applied on 206 pear accessions of different origin, like cultivars and hybrids bred in Latvia, landraces collected during expeditions throughout the country, and introduced foreign cultivars. The used marker set provided 197 accessions with unique genotypes, a comparison of different origin groups, and an assessment of genetic diversity. Allele numbers ranged from 15 to 28 for the markers used, whereas observed heterozygosity ranged from 0.519 to 0.956. Grouping by accession was not observed. However, the genetic background of Latvian samples was entirely in alignment with international germplasm.
The research was supported by the Latvian Council of Science project No. 223, "Studies on inheritance and diversity of apple and pear resistance to scab and characterisation of races and population diversity of causal organisms - Venturia inaequalis and Venturia pyrina".
The Latvian Council of Science funded the data analysis and preparation of the manuscript, project "Application of deep learning and datamining for the study of plant-pathogen interaction: the case of apple and pear scab", project No. lzp-2019/1-0094.

key words

Pyrus, microsatellites, SSR, germplasm, genetic diversity

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-4

presentation

Characterization of Latvia gooseberry genetic resources

speaker

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Gooseberries nowadays are not among the most widely grown commercial berry crops, while they are very popular at home gardens and have a long growing history in Latvia. The growing was succeeded by some enthusiastic breeders during the previous century who developed many cultivars. Unfortunately, some part of this breeding material is now already disappeared. Several expeditions were organized to collect still available genotypes. Obtained material was propagated and planted at the collections of Institute of Horticulture. During 2019-2021 there were performed the evaluation and describing of gooseberry genotypes including expedition material and cultivars of Latvia origin to select the most valuable for maintenance in the National Genetic Resources Collection. In total, 22 genotypes were evaluated. Plant morphological, phenological, yield and fruit quality traits as well as resistance to pests and diseases and biochemical value were investigated. Evaluated accessions showed great variability within evaluated traits. The most valuable and diverse genotypes from expedition material were selected. The selected most valuable Latvia origin cultivars ‘Avenīte’, ‘Kuršu Dzintars’, ‘Maija’, ‘Mazērkšķotā‘ and ‘Rita’ were initiated, multiplicated and maintained in-vitro for establishment of core collection.
The studies were performed in the frame of the ERDF project No. 1.1.1.1/18/A/026 “Studies on Ribes plants, Cecidophyopsis mites and Blackcurrant Reversion virus for sustainable resistance breeding and cultivation of Ribes”.

key words

Ribes uva-crispa, genetic resources, phenotypic properties, phenology, resistance

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-5

presentation

Evaluation of flowering apple tetraploids

speaker

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One of the methods used in plant breeding is the process of polyploidization. Apple triploids and tetraploids usually are characterized by larger organs, higher fruit quality and increased resistance to biotic and abiotic stresses. Apple autotetraploids may serve as a promising source of resistance and could be used for crossing with diploids to obtain triploid genotypes. The aim of the research was to evaluate apple autotetraploids of four cultivars 'Free Redstar', 'Sander', 'Redchief' and 'Pinova' in relation to their diploid counterparts at the generative phase. The observations were carried out on 4-5-year-old trees, own-rooted and M.9-grafted plants, grown in the experimental orchard. The number of flowering trees, flower size, flowering date, pollen grain size and pollen germination capacity were assessed. Tetraploids grafted on the M.9 rootstock bloomed in 51%, and own-root plants in 4%. The tetraploids started flowering two to five days later than the diploids. In tetraploids, pollen grains were larger, but their germination capacity was lower as compared to the diploids. In 'Free Redstar', tetraploids had 20% larger flower diameter compared to diploid plants. The first interploid crosses were performed in order to check a crossing ability.

key words

Malus × *domestica*, polyploidization, autotetraploids, flowering

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-6

presentation

Frost resistance potential of hybrid apple seedlings of VNIISPK breeding during winter thaw

speaker

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The goal of our work was to access the ability to keep the frost resistance of hybrid apple seedlings and their parent forms during the thaw period by an artificial freezing methods. Apple resistance was studied in the laboratory by modelling the damage factors of the frost resistance component III with the use of climatic chamber “Espec” PSL-2KPN.
As a result of the experiment, all of the studied hybrid apple seedlings from all used crossing combinations showed the sufficient level of frost resistance under modelling of the three-day artificial thaw (+2°C) with the following temperature lowering to -25°C. The damages of bark, cambium and wood in all of the studied hybrid seedlings were reversible and did not exceed 2.0 rating. The temperature rises up to +2°C during three days in February did not cause the activation of growth processes in buds and bark and did not affect hybrid apple seedlings ruinously. At the same time, it is important to note that according to the results of the artificial freezing, hybrid apple seedlings of the 6026 family (‘Imrus’ × ‘Krasa Sverdlovska’) and hybrids of the 6030 family (‘Svezhest’ × ‘Pepin Orlovsky’) showed the largest potential of frost resistance during the thaw in winter.

key words

apple, breeding, hybrid seedlings, artificial freezing, frost resistance component III

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-7

presentation

Expression of genes PaExp1, PaExp2 and PaXTH, potentially involved in sweet cherry cracking, under foliar application of magnesium and potassium

speaker

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Sweet cherry is a seasonal fruit with high commercial value, being considered one of the most popular spring-summer fruits in temperate regions of Europe, due to its quality attributes such as taste, colour, sweetness, sourness or firmness and even due to benefits in human health. However, cherry cracking emerges as a disorder that highly affects the commercial value of the fruit. In this follow up, an orchard located in Resende region (Portugal) was selected to carry out an assay trying to reduce cherry cracking by crop nutrition namely by application of magnesium and potassium nutrients, at high and low doses and a control that combines high doses of both nutrients, at foliar level on a Cv. Burlat of *Prunus avium L.*

From all treatments, fruits were collected at different maturation stages, which were used to extract total RNA from fruit exocarp and then cDNA was synthetized. The gene expression was analysed by a semiquantitative and also by a quantitative analysis by real time PCR, in order to understand how the applied compounds, influence sweet cherry cracking at molecular level.

The expression patterns of genes PaExp1, PaExp2 and PaXTH, potentially involved in cherry cracking, appear to have differences among treatments and maturation phases by a semiquantitative analysis, which was complemented by a quantitative analysis to attest the preliminary results. In both analyses, a housekeeping gene - PaAct - was used as control.

key words

cherry cracking, cv. Burlat, gene expression, magnesium, potassium, *Prunus avium L.*

POSTER PRESENTATIONS/ Genetic resources, breeding and genetics/ p3-8

presentation

Integrated assessment of oregano accessions from the ex situ collection of genetic resources

speaker

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In Europe oregano (*Origanum vulgare L.*) is defined as one of priority medicinal and aromatic plants because of wide potential for use as well as of threat and distribution assessments of the species. Cultivation of oregano genetic resources solves the problems of natural biotopes` depleting and gives the opportunity to receive high yield in the reason of non-optimal meteorological conditions. Besides, ex situ conservation is defined as the most applicable method for conservation of species of medicinal and aromatic plants in the Nordic Europe. It is a lack of information about characterization and evaluation of oregano genetic resources in Latvia and Europe. For this research, during long-term observation, 44 oregano accessions from the ex situ collection of medicinal and aromatic plants, attached to the Latvia University of Life Sciences and Technologies, were characterized by Draft Descriptor List and evaluated in the agro-climatic conditions of Latvia. Integrated assessment of oregano accessions was made for recommendation of the most valuable for growing in agrocenosis.

key words

oregano, genetic resources, evaluation

POSTER PRESENTATIONS/ Food processing and chemistry/ p4-1

presentation

Evaluation of phenolic profile of bear's garlic (*Allium ursinum L.*)

speaker

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Allium ursinum L. European wild garlic (wood garlic, ramsons or bear's garlic) is a perennial plant species widespread through Europe and Asia, rare in the Mediterranean region. Bear`s garlic is included into the Latvian Red Data Book. It is defined as plant with high commercial value with high amount of biologically active compounds. Because of conservation status of wild populations, raw material should be received by cultivation. For the experiment, leaves of 6 accessions of bear`s garlic from the ex situ collection of medicinal and aromatic plants, attached to the Latvia University of Life Sciences and Technologies, were used. The aim of the investigation was to identifying the individual phenolic compounds of bear's garlic leaves. The composition of phenolic profile was detected using high-performance liquid chromatograph (HPLC) Shimadzu Nexera LC-40 with diode-array detector (DAD).
Overall, 18 phenolic compounds (gallic acid, 3.5-diOHbenzoic acid, catechin, chlorogenic acid, 4-hydroxybenzoic acid, epicatechin, homovanillic acid, caffeic acid, syringic acid, vanillin, p-coumaric acid, rutin, sinapic acid, ferulic acid, 2-OHcinnamic acid, quercetin, luteolin, kaempferol) were analysed in the samples.
In the research were found that predominant phenolic compound was gallic acid. The wide range of gallic acid from 75.8 mg 100 g-1 to 322.5 mg 100 g-1 in bear's garlics were determinate.

key words

bear's garlics, *Allium ursinum L.*, phenolic compounds, HPLC

POSTER PRESENTATIONS/ Food processing and chemistry/ p4-2

presentation

Processing of sea buckthorn by-products. The case of short supply chain of SMEs in Lithuania

speaker

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The industrial food sector is working to reduce food waste, as well as shortening supply chains. Sea buckthorn (*Hippophae rhamnoides L.*) fruits are actively processed in Lithuania. With the increasing relevance of short supply chains in the food industry, it is important to assess the participation opportunities of small and medium enterprises. Therefore, we aimed to evaluate the case of cooperation of two SMEs operating in the food sector. Small supply chain of sea buckthorn processing was analysed to assess the potential for further recycling of sea buckthorn by-products. Industrial waste of different cultivars sea buckthorn after juice and jam production (pulp and seed) was further processed by subcritical CO2 extraction to obtain the oil. The composition of fatty acids was analysed by gas chromatography-mass spectrometry. Also, qualitative parameters for realization in the food industry were determined. The content of carotenoids and tocopherol in oils and de-oiled cake was determined by high-performance liquid chromatography. De-oiled cake was additionally tested for the nutritional value and vitamin E. Oils rich in polyunsaturated acids (52.57-53.76%) were produced from sea buckthorn by-products. The major fatty acids determined were palmitic (13.55-15.71%), palmitoleic (8.99-10.62%), olein (14.81-15.04%), linoleic (29.97-31.13%), alpha-linolenic (19.89-24.01%). De-oiled sea-buckthorn cake was rich in protein and fiber (22.6% and 49.4% respectively).
The study revealed a high potential of SMEs to participate in the small supply chain and creating high-value products - oil and de-oiled, nutritious cake from sea buckthorn industrial waste.

key words

by-product valorization, fatty acids, Hippophae rhamnoides, sea buckthorn oil

POSTER PRESENTATIONS/ Food processing and chemistry/ p4-3

presentation

Options for the use of plant biomass for the reduction of food by-products and promotion of green thinking in the catering sector in the Swedish nature reserve areas

speaker

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The vegetable and fruit processing industry produce by-products such as bark, pomace, cores, crickets and seeds. The by-products are further used as animal feed, for the extraction of biogas or are not used at all. By-products from vegetable and fruit production contain biologically valuable substances such as fibres, vitamins, carotenes, organic acids, micro and macronutrients that play an important role in human health. The study was carried out in the area of the Stockholm Archipelago Nature Reserve, Uto Island's largest restaurant network, Uto Vards Hus, in order to identify the types of by-products, the amount of recycling, the motivation of employees to be involved in sorting, and the possibility of using by-products for further distribution of biologically active substances. By-products likely to be used for further removal of biological active substances are: citrus fruit bark and pomace after juice extraction (can be used for the production of pectin (~10-20%)), pumpkin bark (pectin (content of 2-8% depending on the type of extraction)), carrot bark (for the extraction of carotenoids). The results of the survey show that on average 3 tonnes of citrus fruit for juice per year is used in the enterprise, of which 50-70% are by-products, so that 1800 kg of crushing residue and bark could be used for the extraction of pectin, which would constitute 270 kg of pectin per year, as well as the bark from carrots which make up ~ 4000 kg/year, according to the extraction method (76 mg 100 g-1) 3 kg of carotenoid can be further used as food additives. The survey shows that 70% of the employees involved in the company are willing to be involved in sorting by-products, 10% do not see the point, 30% would do so if they were paid extra. 85% of those involved in the survey had no prior knowledge of the possibility of using by-products for the extraction of biologically active substances and functional raw materials.
This work has been supported by the European Regional Development Fund within the Activity 1.1.1.2 “Post-doctoral Research Aid” of the Specific Aid Objective 1.1.1 “To increase the research and innovative capacity of scientific institutions of Latvia and the ability to attract external financing, investing in human resources and infrastructure” of the Operational Programme “Growth and Employment” (No.1.1.1.2/VIAA/4/20/656).

key words

by-products, carotenes, extraction, functional products, pectin

POSTER PRESENTATIONS/ Food processing and chemistry/ p4-4

presentation

Investigation of fruit-vegetable smoothies enriched with fresh and powdered wheatgrass

speaker

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Today, consumers are focusing on ready-to-eat foods and beverages. Smoothies are mixed drinks that can contain fruit pulp, fruit juice, vegetables, yogurt, milk or honey in various proportions. In many parts of the world, cereal germ and sprouted grains are used as organic, high-quality food. Wheat grass makes a significant contribution to health, making it recognizable as a dietary supplement. In the study, smoothies made of strawberries, bananas, spinach with fresh and powdered wheatgrass were prepared. The aim of the study was determining the bioactive components (vitamin C, total phenolic, chlorophyll content and antioxidant activity) of all ingredients and products, as well as sensory properties of ready smoothies. The results show that in the smoothie with wheatgrass was the highest content of vitamin C (respectively, fresh 21.8 and powdered 19.0 mg 100 g–1) and total phenolic content (respectively, fresh 55.0 and powdered 53.5 mg 100 g–1). Between used raw ingredients, the highest chlorophyll content in spinach (82.5 mg 100 g–1) was determined, while in smoothies the sample with powdered wheatgrass contain 6.9 mg 100 g–1of chlorophyll. The highest antioxidant activity (by DPPH) was shown by a smoothie with powdered wheatgrass (2.2 mol TE 100 g–1).
The results of the sensory evaluation show that in terms of taste, a control sample with a score of 8.0 was preferred. Smoothies with wheatgrass were rated slightly lower (respectively, fresh 7.8 and powdered 5.9).

key words

smoothie, wheatgrass, sensory evaluation, antioxidant activity

POSTER PRESENTATIONS/ Food processing and chemistry/ p4-5

presentation

Obtaining of bio-degradable polymers from renewable resources for production of protective coatings and packaging materials for fruits

speaker

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Over the last decades, the world's population has grown significantly, so the issue of innovative food product development and enhancing the quality of already existing ones is becoming increasingly relevant. There is a strong correlation between life expectancy and functional food consumption. Today, a healthy lifestyle and a balanced diet are a modern trend for which consumer demand is steadily increasing. Food products must meet not only the quality standards, but they should be with high-added-value, e.g., containing no artificial supplements and shall possess positive health benefits.
The objective of the current study to develop new materials for treating fruits, in particular soft berries (raspberries and strawberries), with the use of microbially synthesized and fully biodegradable polymer materials in a way of coatings (edible films), which would allow to maintain the quality of berries and extend their shelf life without applying chemicals those significantly endanger both human health and environment.

key words

edible coatings, biodegradable films, shelf-life, fruit quality

POSTER PRESENTATIONS/ Food processing and chemistry/ p4–6

presentation

The effect of ozonated water on changes in the quality of blanched Edamame during cold storage

speaker

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Vegetable soybean (*Glycine max (L.)* Merr.) is a seasonal vegetable and have limited shelf life. The present study was carried out to determine the use of ozonated water as a sanitizer to extend the shelf life of blanched edamame and to study the effect of ozonation on the quality indicators of packaged soybeans. Raw unwashed beans as control was used, for testing treatments beans washed, blanched in water bath at 93±2 °C for 2 minutes; part was cooled in ice cold distilled water and part was cooled in ozonated ice cold distilled water. Chilled edamame was packed in a polypropylene bag, hermetically sealed and stored at the temperature of +4.0 °C for 21 day. The use of ozonated water for cooling the blanched edamame effectively inhibits the development of harmful microorganisms without significant colour changes of pods and beans. The data obtained from the analytical hierarchy process revealed that the ozonated water used to cool blanched edamame compared to pure water did not significantly affect the change in phenolic content in 11 days of storage.

key words

antimicrobial agent, chemical compounds, microbiology, vegetable soybean

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