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IHC2018-Merged Program of Symposium 21-22-27

S21 Quality and Safety of Horticultural Products

S22 FAVHEALTH2018: Human Health Effects of Fruits and Vegetables (7th International Symposium)

S27 Fruit and Vegetables for Processing

ORAL PRESENTATIONS

KEYNOTE 1

DETERMINING QUALITY IN FRUITS AND VEGETABLES

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The fruits and vegetables sector is constantly bombarded by quality dictates attributed to modern consumerism that always include and firmly believes that quality matters. For agricultural crops particularly, fresh fruits and vegetables the same holds true. Dr. LaFond, draws on real life experience to concur with the wisdom of Dr. W. Edward Deming (1982) that "Quality cannot be inspected into a product or service; it must be built into it" . Applying this quote to fresh fruits and vegetables and considering their physiology it implies that "quality requirements of fresh fruits and vegetables cannot be added after harvest but must be built in and maintained at every stage from production planning to retail". Dr. LaFond, addresses the subject of quality: how it is determined and by whom, the beneficiaries and difference between quality and safety.

Keywords: fruits and vegetables, built-in and maintained, quality, safety, beneficiaries



SESSION I: VARIETY CHARACTERISTICS, QUALITY AND NUTRITIONAL VALUE RELATED TO CULTURAL TREATMENTS

OS 1-1:

EFFECTS OF DIFFERENT ROOTSTOCKS ON FRUIT QUALITY OF GOLD NUGGET LOQUAT VARIETY

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In this study, fruit quality of 16- year old tree Gold Nugget loquat variety, which are grafted on Quince, Hawthorn and Loquat rootstock seedlings were investigated in Serik-Kayaburnu, Antalya. Fruit weight, fruit firmness, fruit skin color, fruit/seed rate, soluble solid content, titratable acidity, maturity, ethylene production, respiration rate and sensory analysis were evaluated to determine the effect of rootstocks on fruit quality. Trials were conducted according to completely randomized design (CRD) with three replications. According to the results; quince had the ability to increase fruit weight for Gold Nugget loquat variety, the seed ratio in this variety was higher in Hawthorn-grown fruit than those of other rootstocks. Total soluble solid content in the fruit of Gold Nugget-Hawthorn combination was lower than other rootstocks. Fruits grown on Hawthorn rootstock had more yellowish green color than the others, while fruits grown on loquat rootstock had vivid and orange-yellow shades. Quince rootstock increased the total phenol content significantly. Fruit grown on quince and loquat rootstocks were found to have better appearance and flavor than those of Hawthorne rootstock. As a result, Gold Nugget variety grown on quince and loquat rootstocks might be more appropriate for loquat cultivation, the fruit of these combinations can easily be used as a fresh consumption and processed product such as jam and jelly.

Keywords: *Eriobotrya japonica*, loquat, fruit attributes, rootstock



OS 1-2:

FRUIT SENSORY EVALUATION-BASED SELECTION OF APPLE FULL-SIB OFFSPRINGS AND SUBSEQUENT STORAGE PERFORMANCE OF SUPERIOR GENOTYPES

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This study was conducted at Fruit Research Institute located in the West Mediterranean Region of Turkey. Seventy seedlings of full-sib offsprings, which were derived from ‘Amasya’ x ‘Delbarestivale’ and ‘Amasya’ x ‘Williams’ Pride’ crosses, were grafted onto M.9 rootstock. ‘Amasya’/M.9 trees served as controls. Each genotype was represented by two replicates in the orchard, planted at 4 x 1 m. Firstly, fruit sensory quality based on appearance and eating quality (sweetness, acidity, aroma, crispness, juiciness, and firmness) was evaluated by expert panelists. Factor analysis showed that the genotypes, ‘63’, ‘91’, ‘109’, ‘120’ and ‘177’, from ‘Amasya’ x ‘Delbarestivale’ cross, and ‘368’ from ‘Amasya’ x ‘Williams’ Pride’ cross were superior to their parents in terms of both appearance and eating quality. Secondly, the six superior genotypes were examined for fruit quality changes during storage. Data show that the genotype ‘177’ showed a significant decrease in aroma compounds. Textural properties (i.e. firmness, juiciness and crispness) of the three genotypes, ‘63’, ‘91’ and ‘368’, were unacceptable. The two genotypes, ‘109’ and ‘120’, among the six genotypes were superior in terms of firmness, soluble solids content and sensory evaluation during storage. Of these, the two genotypes, ‘109’ and ‘120’, could be recommended for further evaluation.

Keywords: Amasya’ apple, breeding, crossing, eating quality, fruit evaluation, progeny, selection



OS 1-3:

MECHANICAL THINNING OF APPLES REDUCES FRUIT DROP

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The effect of the intensity of mechanical thinning with the device Darwin 250 on fruit drop and final fruit set was investigated in the years 2011 and 2014 on apple trees with varying flower set considering the cultivars 'Elstar', 'Gala' and 'Pinova'. Thinning was carried out at balloon stage (BBCH 59) at constant vehicle speed of 8 km h⁻¹ with rotational frequencies of 200 rpm, 240 rpm, 280 rpm, and 280 rpm. By calculating kinetical energy at the end of the rope, thinning treatments equal 0.68 J, 1.01 J, 1.42 J and 1.89 J. Removal of flowers increased with enhanced rotational frequency. Additionally removal of flowers was affected by flower set and increased at higher abundance of flowers. Thinning showed no effect on fruit drop in 'Elstar' and 'Pinova' in 2011. In 2014, thinning treatment of 1.42 J and higher reduced fruit drop on 'Elstar' and 'Gala' due to a reduced number of sinks competing for available carbohydrates. Consistently, fruit drop was enhanced on trees with high flower set in comparison to trees with low flower set in every trial. Final fruit set underrun yield capacity of the trees when trees had flower set of 1-200, and on trees with higher flower set when thinned above 1.01 J. Therefore thinning above 1.01 J caused over thinning in all trials.

Keywords: precision horticulture, crop load, *Malus x domestica*, flower thinning, 'Elstar', 'Gala', 'Pinova'



OS 1-4:

HYDROGEN SULFIDE AMELIORATES CADMIUM CHLORIDE INJURY IN SEEDLINGS OF MALUS HUPEHENSIS BY REDUCING INFLUX AND ACCUMULATION OF CADMIUM IN ROOTS

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The seedling of *Malus hupehensis* were treated with cadmium chloride treatment and hydrogen sulfide donor- NaHS (sodium hydrogen chloride) in the hydroponics system. The cadmium ion flow in the roots was measured in the living state, and the cadmium content, the respiration rate and the malondialdehyde (MDA) content in the roots were investigated and analyzed. The results showed that NaHS could reduce the cadmium ions influx and rate of cadmium absorption by roots, decrease the cadmium content in roots and maintain the respiration rate of root in *Malus hupehensis* under treatment of the cadmium chloride. The increase of content of MDA in roots and leaves caused by cadmium chloride was reduced by NaHS. This indicates that the hydrogen sulfide can alleviate cadmium damage to seedlings by reducing influx and accumulation of cadmium in roots.

Keywords: hydrogen sulfide, cadmium stress, cadmium ion flow, *Malus hupehensis*, root



KEYNOTE 2

THE IMPORTANCE OF THE POSTHARVEST DISCIPLINE TO THE FOOD PROCESSING INDUSTRIES.

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Processing of horticultural products requires sourcing and supplying processing facilities with appropriate quality product. In most cases, high value processed horticultural products require surprisingly high quality inputs – with the exception of cosmetic defects such as external blemishes or misshapen fruit. There are a wide range of pre-harvest factors that impact on quality, the most significant of these is the time of harvest, and there are a range of tools that can assist with harvest decisions. To achieve continuity of supply, storage may be required. Again a myriad of factors come into play but most importantly temperature management (cooling and target temperature) and other factors that can deliver longer-term storage if required such as 1-MCP treatments and/or controlled atmosphere storage. If the product is sourced as a by-product, then storage is out of the processors control. Nevertheless, understanding the factors contributing to the quality of the product up to this point is important to reducing variability and improving quality. At grading there is an opportunity to use rapid in-line non-destructive tools to sort fruit by external quality and shape (image analysis), internal quality (Near Infrared (NIR)), taste (sweetness - NIR) and firmness (acoustic system or NIR). For food processing researchers there are also tools available which are traditionally used in postharvest that should improve understanding of the raw product such as respiration rate (CO₂ production), ethylene production, electrolyte leakage and impedance measures. Thus, a greater understanding of pre- and post-harvest factors and tools will ultimately place processors in the best position to reliably deliver a quality processed product at the highest profit.

Keywords: Pre-harvest, storage, quality, non-destructive technologies, respiration rate



SESSION II: PREHARVEST TREATMENTS, QUALITY CHANGES AND POSTHARVEST LIFE

OS 2-1:

EFFECTS OF THE SUPPLY CHAIN ROUTES AND PRE-STORAGE TREATMENTS ON THE POSTHARVEST QUALITY OF 'NEMO-NETTA' TOMATOES

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Tomato climacteric nature limits its shelf life. In this study, the effects of three supply routes (Pontdrift, Letaba, Esmefour), and four pre-storage treatments (anolyte water, Gum Arabic (GA), Anolyte water + GA, hot water treatment (HWT)+ GA, control/ untreated) ambient (25 °C) were evaluated in tomato 'Nemo-netta' quality. A randomized complete block design was selected as the experimental design with three supply routes as blocks and a random allocation of five pre-storage treatments within each block. Three replications of 15 fruit per replicate were used in each treatment. Tomato quality was assessed on day 0, 8, 16 and 24 of storage. Quality assessment involved mass loss %, firmness, total antioxidant capacity (TAC) and general marketability. The results generally revealed a significant difference in the quality of tomatoes from different supply chain routes, with fruit from Letaba (EM) being most superior followed by Pontdrift (PD), then Esmefour (EF). Tomatoes from Letaba Municipality were of optimum quality upon the arrival, and became the best in terms of maintaining quality throughout the storage period. The combination treatment of HWT and GA coating was most effective in reducing water loss by (2.17 ± 1.85 %) compared to untreated control. It also reduced firmness loss by (3 ± 2.35 N) in fruit from EF and PD, and by (6 ± 2.35 N) in fruit from Letaba during day 24 of storage, compared to untreated control. Anolyte water was the most effective treatment in maintaining the appearance and retained more total antioxidant capacity (TAC). This revealed a physiological impact of applying anolyte water treatment, however, the mechanism of action has not yet been studied, thus still need to be done. The findings from this study revealed that individual treatments may have significant effect in maintaining the tomato quality. However, integration of number of treatments would be more superior. Therefore a holistic approach is most efficient in extending shelf life of tomatoes.

Keywords: tomato, quality, postharvest treatment, transportation



OS 2-2:

GROWTH AND DEVELOPMENT OF ASAI (*EUTERPE PRECATORIA*) IN GUAVIARE-COLOMBIA CHEMICAL CHANGES DURING RIPENING STAGES

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Asai (*Euterpe precatoria*) is a neotropical palm from the Amazonian region. It is a wild palm distributed in Venezuela, Brazil and Colombia. This palm grows in different environments, floodplains and mainland that influence fruit performance during ripening and maturation. This study was carried out in order to determine variations in respiratory activity, ethylene production, flavonoids, total anthocyanins, polyphenols and color in asai fruits during ripening in both environments in a forest in Guaviare, Colombia. These results showed that the fruits had five color stages: green, half ripen, ripen, fully ripen and mature, and exhibited a respiratory climacteric peak at the beginning of ripening, while the ethylene production was undetectable in fruits from the floodplain or firm land. Previous experiences with asai from Guaviare forests reinforce the present results; asai is a non-climacteric fruit that remains immature when it is harvested close to the green and half ripen stages. Phytoterapeutic compounds increased during the fruit ripening, anthocyanins, total phenolic compounds and polyphenols, which coincided with the color change from green to purple. The fruits had more total anthocyanins, total polyphenols and flavonoids during ripening; the fruits from the mainland always exhibited low phytoterapeutic compounds concentrations when compared to the floodplain fruits. This behavior could be associated with the extreme conditions in the floodplains, which reduces oxygen in roots and increases hydric availability and nutrients. As a result, the fruits from extreme conditions, such as the floodplains, were rich in phytoterapeutic compounds and could be considered for nutraceutic processing.

Keywords: Polyphenols, total phenolic compounds, color, respiratory activity



OS 2-3:

EFFECTS OF HOT WATER TREATMENT AND MODIFIED ATMOSPHERE PACKAGING ON THE STORAGE AND SHELF LIFE OF POMEGRANATE FRUITS CV. 'HICAZNAR'

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The objective of this study is to determine effects of hot water treatment and modified atmosphere packaging (MAP) on storage and shelf life of 'Hicaznar' pomegranate fruits. Pomegranate fruits were subjected to the following treatments: (1) fruits were dipped in hot water (at 50°C for 3 min) and stored in plastic boxes (HW); (2) fruits dipped in hot water were packaged with MAP bags (HW+MAP); (3) fruits without hot water dip were packaged in MAP bags (MAP); (4) fruits were dipped in water at 24°C for 3 min and stored in plastic boxes (W) and (5) Untreated fruits stored in plastic boxes were served as control (C). Fruits were then kept at 6°C for 6 months and for 7 days at 20 °C. MAP and HW+MAP treatments delayed changes in husk color and aril color during cold storage and shelf life period, resulting more bright and reddish husk and adequately intense aril red color. In other treatments, loss of husk color redness and brightness occurred after 6 months of cold storage and shelf life period. Although C, W and HW fruits showed more intense aril red color after cold storage, discoloration of aril color was observed after shelf life period, indicated by higher h° values from initial values. MAP and HW+MAP treatments reduced weight loss, incidence of husk scald and fungal decay and better maintained overall visual quality, compared to other treatments. HW treatment alone controlled fungal decay in both storage and shelf life period, but was not as successful as MAP and HW+MAP treatments in preventing scald incidence and weight loss and maintaining visual appearance. After shelf life period following 6 months of storage, severity and incidence of husk scald were similarly high in HW, C and W treatments and these fruits become unmarketable.

Keywords: Pomegranate, hot water MAP, quality, storage, shelf life



OS 2-4:

IMPROVEMENT OF GRAPE PHENOLIC CONTENT AND ANTIOXIDANT ACTIVITY BY PRE-HARVEST APPLICATION OF METHYL JASMONATE

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In this study the effect of methyl jasmonate (MJ) pre-harvest treatment, as a safe chemical elicitor, in different concentrations (0 (control), 1, 5, and 10 mM) on total phenolic (TPC), total flavonoid (TFC), total tannin content (TTC), and antioxidant activity (DPPH, ABTS, and FRAP) of Thompson seedless grape skin (*Vitis vinifera* L.) through storage at 15 °C and 85% RH were evaluated. The interaction effects of MJ treatment and storage time were significant for all parameters, except for TTC and FRAP assay. TPC of samples increased through storage until day 4 and 5, and then decreased. However, MJ-treated samples showed higher TPC compared to that of control. MJ at the high concentration (10 mM) resulted in higher TFC until day 3 of storage and then decreased so that at the end of storage there was not significant difference among treatments and control. MJ, however, had no effect on TTC of skin samples during storage. DPPH assay showed a prominent increase in the last 2 days of storage. ABTS assay exhibited a high antioxidant activity in treated samples at the end of storage, as well. Scavenging activity of FRAP radical solution was noticeably high in 10 mM MJ-treated samples through storage, but at the end of storage no significant differences were detected. These results suggested that MJ could be used as a practical, environmental friendly and safe treatment to improve health-promoting compounds on Thompson seedless grape

Keywords: elicitor, methyl jasmonate, grape, phenolic compounds, antioxidant



KEYNOTE 3

MYCOTOXINS AND HORTICULTURAL PRODUCTS: RISKS AND MANAGEMENT ALONG CHAINS

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The management of good agricultural practices in the pre-harvest is a key issue for minimizing the risk of mycotoxin accumulation in the crops before the harvest, including the horticultural products (e.g. fresh and dried fruit and vegetables, nuts, pulses and medicinal aromatic plants). Such practices can involve crop rotation, tillage, proper fertilization and fungicide or biological control distribution, variety selection, planting and harvest timely and the control of the insects which often act as vectors of toxigenic fungi spores. On the other hand, the reduction of mycotoxins along the agro-food chains is also highly depending from a correct post-harvest management that must aim firstly at the separation of the infected crop products from the healthy material. In addition, the use of a range of rapide and effective detection tools is also a crucial point for evaluating the level of mycotoxin contamination of a given crop or food/feed. Moreover, it is extremely important to prevent post-harvest contamination during the storage by keeping low temperature and humidity conditions, in order to limit the development of toxigenic fungal strains. An update review will be given on the integrated pre-and post harvest management practices, aimed to minimize the risk of mycotoxin contamination of the main horticultural crops of agro-food importance and main effective solutions proposed and reached by EU project MycoKey

Keywords: toxigenic fungi, good agricultural practices, sorting, storage



SESSION III: POSTHARVEST TREATMENTS (LIGHT, UV AND PACKAGING)

OS 3-1:

BLUE AND UV-A LIGHT WAVELENGTH POSITIVE AFFECTED ACCUMULATION PROFILES OF HEALTHY COMPOUNDS IN PAK-CHOI

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To explore the effects of different blue and UV-A light wavelength on accumulation profiles of healthy compounds in vegetable, the contents of healthy compounds was measured in pak-choi (*Brassica campestris* ssp. *chinensis* var. *communis*, cv. red- and green-leaf) response to supplementary intensity ($100 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) of blue light (430 and 460 nm) and UV-A (380 and 400 nm) at 10 days before harvest. The results indicated that the content of phytochemicals and morphology were significant affected by blue and UV-A light wavelength, especially in content of nitrate and antioxidant compounds. The anthocyanin content and DPPH significantly increased with light wavelength decreasing. The growth and healthy function compounds and secondary metabolism in pak-choi were remarkably improved by supplemental blue and UV-A light, and there was wavelength- and cultivar-depended effects.

Keywords: light wavelength, healthy function compounds, antioxidant compounds, pak-choi



OS 3-2:

POST-HARVEST MODULATION OF TOMATO FRUIT COMPOSITION AND SENSORY PERCEPTION USING LED LIGHTING

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Typical tomato handling involves that fruits are harvested unripe, stored at 12-15 °C in the dark and ripened with ethylene until they reach consumers. The growing interest for health- and flavor-related compounds such as secondary metabolites triggered the development of post-harvest practices such as light exposure that may increase their biosynthesis during storage. The impacts of different light spectra on the biosynthesis of secondary metabolites have been little studied in tomato. To improve our understanding of the relationship between light supplementation, secondary metabolites and tomato quality, an experiment involving two cultivars (*Solanum lycopersicum* 'Flavorino' and 'Starbuck') and six light treatments (blue LED, red LED, far red LED, white LED, UV and darkness) repeated on three blocks was conducted during Winter and Spring using mature-green commercially-grown tomatoes. Treated fruits were exposed for 11 days prior to analyses that included: analysis of quality attributes, HPLC-analysis of carotenoids, LC-MS/MS analysis of phenolic compounds, and GC-FID analysis of volatile compounds. Descriptive sensory analyses were conducted using panelists trained for typical tomato aroma and taste descriptors. Our results showed that the largest differences in fruit composition were observed between the seasons (Winter and Spring), for both cultivars. Light treatments had different impacts on the levels of carotenoids, phenolic compounds and vitamin C. In both Starbuck and Flavorino, treatments involving UV, far red and darkness increased the level of volatile compounds derived from aliphatic amino acids such as methylbutanals and methylbutanols. In Starbuck, treatments involving blue, red and white light increased the level of fatty acid derived volatile compounds such as C₅ and C₆ alcohols. UV-treated Flavorino tomato from the Spring assay scored higher on the perception of tomato taste. Those results suggest that post-harvest light treatment using different spectral characteristics efficiently modulate the composition of commercial tomato, and consequently have a significant effect on consumer preference.

Keywords: health compounds, flavor, secondary metabolites, aroma volatiles, UV, far red, light emitted diode, artificial lighting, consumer preference



OS 3-3:

THE NEW BOX SYSTEM JANNY MT EFFECTS FRUIT QUALITY AND SOME BIOCHEMICAL PROPERTIES OF POMEGRANATE AFTER HARVEST

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The aim of the study was to examine the effects of Janny MT box on fruit quality and some biochemical properties of pomegranate after harvest. In addition, this technology was compared to normal atmosphere (NA), modified atmosphere packaging (MAP) and controlled atmosphere (CA) storages. The fruit of Hicaznar variety was used as plant material. Fruit harvested at optimum stage were stored at 6°C and 90±5 % relative humidity for 6 months in NA, MAP and CA conditions. Weight loss (%), fruit skin color, soluble solids content (SSC), titratable acidity (TA) and some biochemical parameters were determined initially and at 30 day intervals. According to results related to some quality parameters, Janny MT box showed similar characteristics with MAP and CA conditions. Janny MT box gave better results than other storage conditions in term of some quality parameters such as weight loss, acidity and red color. As a result, Janny MT box system can be successfully used in pomegranate (cv. Hicaznar) storage.

Keywords: Janny MT box, *Punica granatum* L., quality, modified atmosphere, controlled atmosphere



OS 3-4:

POST-HARVEST EFFECTS OF RED LIGHT ON GREEN-STAGE 1 TOMATO FRUIT

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The aim of this research was to investigate the potential of continuous red light and short periods of UV-radiation to shorten post-harvest ripening time and increase the concentrations of antioxidative compounds in tomato fruit. Green stage-1 tomatoes were radiated with 30 minutes of UV and/or continuous red light provided by LED modules for up to 20 days. Radiation with continuous red light and red light with 30 minutes for 10 days sped up the ripening process and increased the concentration of important carotenoids such as lycopene and β -carotene, whereas UV-treated and non-treated tomato fruit needed 5 more days to ripen to a stage where fruit can be sold. In addition, radiation with red light increased concentrations of other important antioxidative compounds, such as flavonoids and phenolics. This increment of health benefitting substances could be an attractive advantage when tomato fruit are sold to the customer.

Keywords: Lycopene, β -carotene, antioxidant activity, LED, *Solanum lycopersicum* L.



KEYNOTE 4

IT'S A GUT FEELING-FRUIT AND VEGETABLES DO HAVE PREBIOTIC-LIKE EFFECTS

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It is now widely accepted that fruit and vegetables (FAV) are providing many health benefits. Indeed, preclinical and human clinical studies have shown that regular consumption of FAV prevent or reduce the incidence of many disorders and illnesses like cardiovascular diseases, obesity, metabolic syndrome, diabetes, cancer, and neurodegenerative diseases. FAV are rich sources of minerals, vitamins, fibres and phytonutrients and they are especially rich in polyphenols. These molecules display strong antioxidant activity *in vitro*, but less so *in vivo*. There is thus much debate on the exact mode of action of these bioactive molecules on health. Polyphenols have a very low bioavailability and are subject to extensive phase I and II metabolisms once in circulation. However, more than 95% of these molecules reach the colon intact where they can modulate the gut microbiota and prevent dysbiosis. We have recently shown that berry polyphenols can strongly alter the gut microbiota and favour the development of a beneficial gut microbial community. In particular, they can stimulate the growth of a mucus inhabiting bacteria called *Akkermansia muciphila*, coined the “anti-obesity” bacteria. This bacterium has been associated with reduction of gut leakiness and attenuation of low-grade inflammation. We will thus present in this conference results to support new modes of action of FAV on the gut microbiota and in turn, show how microbiota homeostasis may prevent many chronic diseases.

Keywords: prebiotic, polyphenols, health, microbiota, akkermansia



SESSION IV: FRUIT, VEGETABLES AND NUTS AND HEALTH

OS 4-1:

FRUIT AND VEGETABLES: A SCIENCE BASED INITIATIVE FOR HEALTHY DIET

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The growing world population and the increasing middle class drive demand for healthy, nutritional food. Historically the increase of wealth has changed the dietary patterns with a shift to resource and energy intensive diets. By 2050 the world needs to feed nearly three billion more people. Progress is made to improve food security. At the same time malnourishment is increasing associated with excessive weight and obesity. Even diets that provide sufficient calories may be lacking important nutrients (hidden hunger). The imbalances in the diet pose a burden on global society with increased numbers of food related diseases such as diabetes, cardiovascular diseases and Crohn's disease. Governmental institutions and private industry (World Economic Forum) have taken initiatives to initiate behaviour change at consumer level and to stimulate the adoption of a healthy diet. In these policies the increased consumption of fruits and vegetables will play a pivotal role and consequently modify business models for the food system. Bayer initiated a scientific literature study to identify key food ingredients in a broad range of fruit and vegetable crops. Research data on dietary significance and health effect of vitamins, minerals, carotenoids, flavonoids and phenolic acids were collected along with the stability and the bio availability of the ingredient at processing and consumption. The findings of the study will be shared with growers, value chain partners and stakeholders in support of policy and business initiatives to support consumers adopting local, regional or cultural defined diets contributing to health and wellness.

Advancing nutrition through healthy fruit and vegetables is one of Bayer's key commitments underlined by long term investments into innovation to support the sustainable production of fruit and vegetable crops.

Keywords: Healthy nutrition, fruit and vegetables, UN Millennium Goals



OS 4-2:

ELLAGITANNINS AND HUMAN HEALTH

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Ellagitannins are a class of polyphenolic compounds found in many plant families. They are particularly rich in species in a number of Rosid families (Fagales, Rosales and Myrtales); but are also abundant in the Ericales, which are in the Asterid grouping and diverged from the Rosids around 110 million years ago. Ellagitannins are metabolised by gut flora to yield urolithins and ellagic acid. Urolithins can be absorbed into the blood and are commonly excreted as glucuronides via the urine. Urolithin metabolites accumulate in the prostate gland and tissues of the small intestine and colon in mice. Pomegranates, guavas and feijoas are all ellagitannin-producing fruit in the Myrtales and pomegranate juice was strongly promoted in the early 2000s for its potential to 'prevent or treat' heart disease and prostate cancer. The US Federal Trade Commission issued an administrative complaint over alleged misleading advertising of pomegranate juice and extracts in 2010. The lack of clinical trials of the specific products being promoted was the principal problem. On appeal, in 2016, the clarification was received that at least two randomised, double-blind, and placebo-controlled clinical trials would be required of the company for any future claims for their products to be able to prevent or treat prostate cancer or heart disease. This was an important ruling but must not be interpreted as meaning that fruit and vegetable products should not be promoted for human health. In this paper I review the evidence that dietary ellagitannins can be safely consumed by people who have already had a prostatectomy as part of a medically-supervised strategy to reduce their risk of recurrence of prostate cancer

Keywords: cancer, heart disease, feijoa, pomegranate, guava, urolithin



OS 4-3:

MACADAMIA NUTS 'GOOD FATS, BAD FATS AND BIOFORTIFICATION

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Macadamia nut kernels are high in oil, of which the majority is mono-unsaturated and considered to be good for cardiovascular disease (CVD). At the same time, macadamia oil has a significant proportion of saturated fat, which is considered to have the opposite effect on CVD. Although this level is relatively low compared to the mono-unsaturated fats present, its concentration is marginally high enough that US health claims regarding the benefits of nut consumption to CVD need to be specifically qualified for macadamia nuts. In order to remove this restriction, a reduction of saturated fat concentration would be required in macadamia nuts. A potential way to achieve this is to identify macadamia breeding accessions with increased capability of desaturating saturated to mono-unsaturated fats. The current paper summarises an exploration of fatty acid profiles in existing commercial cultivars of macadamias, wild macadamia accessions and related Macadamia species, and factors that may influence the fatty acid profile

Keywords: macadamia oil desaturation mono-unsaturated fat



OS 4-4:

FIBER AND TOTAL CAROTENOIDS CONTENT IN PRODUCED IN THE FEDERAL DISTRICT, BRAZIL

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Collards leaves are a nutritionally rich food because they contain vitamins, minerals, fiber, carotenoids. Fibers and carotenoids are functional components and are important for preventive health practices, more efficient and inexpensive than corrective health. The fibers have properties such as intestinal regulators, colon cancer preventive factor, and intestinal absorption retarder with cholesterol and blood glucose lowering. Carotenoids are important sources of vitamin A precursors and antioxidants. Vitamin A is important for growth, development, maintenance of epithelial tissues, reproduction, immune system and vision. The objective of this work was to quantify total carotenoids and fibers in 29 collards genotypes produced and consumed in the Federal District, Brazil. The total fiber contents were quantified. Total carotenoids were extracted with ice-cold acetone, transferred to petroleum ether and the absorbance of the ethereal extract read at 450 nm. Aliquots of the extracts were analyzed by high performance liquid chromatography. The average value found was 14.53% dry matter. The mean value found was 181.1µg of phenolic compounds/g of collards, ranging from 75.6µg of phenolic compounds /g of collards to 366.4µg of phenolic compounds/g of collards. The average value found was 2.73 g fiber/100 g collards, ranging from 1.95 g fiber/100 g collards to 3,41 g fiber / 100 g collards. To be considered a food source of fiber in Brazil the food must have at least 3g of fiber per 100g of the food, so the content 2.73g is very close to this reference. This content covers 10.92% of the daily intake requirement of children aged 4 to 8 years, 9.1% of women over 50 years of age and 13% of the daily requirement of men over 50 years. It is concluded that collards is a high-fiber food, an important functional component of the diet, and its consumption is a good choice for preventive health care

Keywords: collards, nutritive value, fiber, carotenoids



OS 4-5:

NITRATE, NITRITE AND CHLOROPHYLL CONTENTS IN PARSLEY AND THEIR RELATIONS EACH OTHER

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Parsley (*Petroselinum hortense* Mill.) is very important among leafy vegetables. Antakya and Iskenderun are very important districts in Turkey for leafy vegetable production and consumption. Nitrate and nitrite accumulations in green leafy vegetables are very important for health. In this study, the relationships between nitrate, nitrite, total chlorophyll, chlorophyll a and b in parsley were investigated. Every month, for two years, four samples for each district were collected from local markets in both districts. Nitrate and nitrite analyses were conducted by using a DAD detector in the HPLC device. Chlorophyll measurements were determined spectrophotometrically. In Antakya district, nitrate concentrations were between 634 in April, and 1969 mg·kg⁻¹ in July. In Iskenderun district, nitrate concentrations were between 241 in April and 3077 mg·kg⁻¹ in December. The nitrite concentrations ranged from 2,01 in April to 191,97 mg·kg⁻¹ in January in Antakya. In Iskenderun nitrite concentrations ranged from 0,36 in September to 68,77 mg·kg⁻¹ in February. We conclude that there were no health concerns for parsley in either place according to the acceptable daily intake (ADI) for nitrate and nitrite determined by the WHO (World Health organization). The relationship between nitrate and nitrite was not found significant in either place but there were significant positive correlation between nitrate and total chlorophyll. Significant positive correlations were also found between nitrite and total chlorophyll. In both districts we have calculated the daily intake amount of parsley for a person (60 kg) that can be safely eaten according to the toxic nitrite limits determined by the WHO.

Keywords: Nitrate, Nitrite, Accumulation, Chlorophyll, Parsley



SESSION V: METABOLOMICS, SECONDARY METABOLITES AND NUTRITIONAL VALUE

KEYNOTE 5

USING METABOLOMICS TO BETTER UNDERSTAND SECONDARY PLANT METABOLITES AND THEIR HEALTH BENEFITS

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Consumption of diets rich in fruits and vegetables has been associated with a decreased risk of development of a number of chronic diseases, including cardiovascular disease and various cancers. Both tomatoes and berries have been particularly studied in the context to understand how consumption confers the benefits noted in epidemiological studies. Identification of bioactive compounds from plants can inform breeding and agricultural management strategies to produce crops with enhanced health benefits. By utilizing untargeted metabolomic approaches, both plant and biological material can be more comprehensively evaluated to glean information on potentially bioactive compounds. Tomato consumption in mice was responsible for a ~40% decrease in keratinocyte carcinoma, but seemed uncorrelated to plasma or skin carotenoids. Untargeted metabolomics profiling revealed tomato glycoalkaloids as putative bioactive compounds from tomatoes that may be responsible for decreased tumor development. Fresh black raspberries are well studied in oral cancer prevention despite processed berry products being more commonly consumed. Correlating untargeted chemical profiles of black raspberries during storage demonstrated little change in bioactivity via cell proliferation assays despite large changes in chemical profiles. These studies demonstrate the value of studying the totality of small molecules within a food as single phytochemicals often do not explain the bioactivity associated with plant food consumption. Untargeted metabolomics can reveal new or understudied plant compounds that can be further tested to evaluate their bioactivity.

Keywords: metabolomics, chemical fingerprinting, bioactivity, tomatoes, berries



OS 5-1:

MICRONUTRIENT BIOFORTIFICATION OF SWEET CORN FOR HUMAN HEALTH

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Zinc (Zn) deficiency is widespread in agricultural soils, resulting in *ca.* 30% of the world's population being considered Zn-deficient. Severe Zn deficiency causes stunted growth, poor immunity and retarded mental development, and is ranked the 5th leading factor causing diseases in the developing world, affecting more than half of the children, pregnant women and the elderly. It has also been associated with age-related macular degeneration, the leading source of blindness in developed countries. Although attempts have been made to biofortify maize, biofortification has not reached its full potential as the embryo and tough outer layer, where Zn is deposited, is often removed during processing into flour. A promising alternative is sweet-corn, since the entire kernel is consumed, including the Zn rich embryo and outer layers. Being a widely consumed vegetable, it is a candidate for Zn biofortification, promising to deliver potential benefits in both developed and developing countries. This study focuses on Zn biofortification of sweet-corn, a previously unreported research area. Genetic variation for high Zn uptake and storage is being quantified within existing germplasm, to identify lines able to accumulate Zn in kernels, or with potential to be used as future parents for targeted crosses. Concurrently, research is also exploring agronomic and fertiliser application strategies that may further elevate Zn concentration. Early results indicate that sweet-corn Zn concentrations could potentially be doubled and possibly tripled, enabling sweet-corn to contribute a significant proportion of the recommended daily intake of this important micronutrient.

Keywords: Zinc; micronutrient; deficiency; biofortification; sweet-corn; genetic; agronomic



OS 5-2:

REDUCING NUTRITIONAL VARIABILITY IN SALAD CROPS COLLARDS AND OPPORTUNITIES FOR HORTICULTURE

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Diets rich in fruits and vegetables (F&V) have been associated with a reduced risk of many non-communicable diseases (e.g. cardiovascular disease and some cancers). Data from human dietary intervention trials attributes some of these protective effects to phytochemicals in F&V (e.g. flavonoids, carotenoids and glucosinolates). However, the effects seen in these human studies correspond to the specific phytochemical dose administered in the intervention. Phytochemical concentrations are known to differ between varieties of F&V. More importantly, these concentrations have been shown to fluctuate widely within the same variety of crops due to environmental conditions (e.g. light intensity, water availability, soil conditions etc). This variation means that nutrition professionals are currently unable to provide additional population-level public health messages about F&V consumption other than to consume a minimum daily intake of a wide range of F&V. In order for consumers to make informed choices when purchasing F&V for specific health effects, the concentration of the beneficial phytochemicals in commercial crops needs to be consistent. This presents a significant challenge to the horticultural industry. However, it can also be viewed as an opportunity, as improving the nutritional quality of produce will add value and potentially open new segments of the market. Advances in controlled-environment agriculture technology may potentially enable growers to meet this demand. This technology utilises artificial control of light, environmental control (humidity, temperature and gases) and fertigation. Evidence has shown that LED lighting and hydroponic systems can be used to manipulate phytochemical concentrations in a research setting. However, using this technology for commercial production is in its infancy. This paper will report on an ongoing study by the author in collaboration with a commercial salad leaf producer to investigate whether crops with a consistent nutrient profile can be produced on a commercial scale using their existing advanced technology-controlled growing systems.

Keywords: controlled-environment agriculture, phytochemicals, nutrition



OS 5-3:

SCREENING BRAZILIAN COLLARDS CULTIVARS FOR GLUCOSINOLATE CONTENT

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Collard is one of the most consumed leafy vegetables in Brazil, being very important in the diet of the Brazilian population as a source of vitamins and antioxidants. Among the most important antioxidants are glucosinolates (GSs), whose compounds contain sulfur molecules in their molecules that act to prevent cancer. Sinigrin (2propenylglucosinolate) is a secondary metabolite of the plant glucosinolate group, and occurs naturally in Brassica plants with significant quantities. In this work, the objective was to evaluate the concentration of sinigrin in 29 collard cultivars produced and consumed in the federal district, Brazil. A reversed phase-high performance liquid chromatography (HPLC) method was used to quantify sinigrin. Freeze-dried samples (25 mg) were boiled in 1 ml of water for 10 min. After recovery of the liquid, the residues were washed with water (1 ml), and the combined aqueous extract was applied to a DEAE-Sephadex A-25 column (pyridine acetateform). Then the samples were separated on a Waters Spherisorb C18 column using acetonitrile and water at a flow rate of 1.0 ml/min. The procedure employed isocratic elution with 1.5% acetonitrile for the first 5 min, a linear gradient to 20% acetonitrile over the next 15 min, followed by isocratic elution with 20% acetonitrile for the final 10 min. Absorbance was detected at 226 and 280 nm. Sinigrin content varied significantly among Brazilian collard cultivars. The cultivar HI61 had the highest total glucosinolate content, which was $219.46 \mu\text{mol} \cdot 100 \text{ g}^{-1} \text{ DW}$, followed by 'DB74' ($178.58 \mu\text{mol} \cdot 100 \text{ g}^{-1} \text{ DW}$) and 'EN42' ($169.63 \mu\text{mol} \cdot 100 \text{ g}^{-1} \text{ DW}$). The lowest total GSs content was $1.00 \mu\text{mol} \cdot 100 \text{ g}^{-1} \text{ DW}$ with cultivar MC47. These findings showed that Brazilian collard varieties showed great variation in their glucosinolate content, whose compounds are beneficial to human health. Thus, cultivars with high glucosinolate content could be used in Brazilian breeding programs to improve commercial cultivars.

Keywords: sinigrin; kale; phytochemical; antioxidant; Brassica oleracea



OS 5-4:

PREPARATION AND PROCESSING OF SEED SPICES FOR VALUE ADDITION

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Seed spices are low volume high value export oriented crops and India is a major producer and exporter of seed spices and their products. India despite being the largest producer of seed spices could not exploit their value addition potential as majority of export is in the form of whole spices. There is a great potential for increasing export of Indian spices in the form of value added products. To realize this potential there is need to enhance the quality as per international standard through post harvest technology and value addition at different level of post production system. The preliminary processing is required to provide better income to the farmer, less losses in transport to urban areas for processing, creation of gainful employment at rural level besides to enhance the processable character of farm produce and to achieve the good quality. Cleaned produce fetch high price in the market always. After threshing and cleaning the produce should be dried below 10% moisture level to avoid the pathogenic infections, insect infestations etc in the storage. Spices can be graded by size, density, colour, shape and flavour. Spices can be graded in to 3-4 grades as per the quality. The packaging has played pivotal role in increasing the price to the produce. Barrier films, vacuumed packs, MAP/ CAP are effective and reliable methods of packing for these commodities to retain quality and shelf life. The extracted compound of spices serves as the alternate to whole and ground spices. They are used in various food products like sauces, confectioneries, beverage, pharmaceutical and perfume industries. Extracted oleoresins have the full aroma, flavour and pungency of fresh or dried spices. The oleoresins and/ or essential oils are encapsulated to keep the full flavour impact of spices over an extended shelf life. The seed spices based beverages such as RTS and squashes have been developed and commercialized. Besides, these several other products such as mouth fresheners/ chews, biscuits, toffees, dill parag, cookies and many more products can be prepared for value addition.

Keywords: Seed spices, value chain, post-harvest handling, processing, value added products, quality



SESSION VI: MINIMALLY PROCESSING AND ANTI-MICROBIAL COATING IN FRUIT AND VEGETABLES

OS 6-1:

STORAGE OF MINIMALLY PROCESSED PEARS FROM ANDEAN TROPIC USING CELLOPHANE OR POLYVINYLIDENE FILMS

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In Colombia, the pear (*Pyrus communis*) is abundant in the Andean productive system, but its commercialization is low compared to imported pears from subtropical zones. This study was carried out in order to minimally process ripen pears as a possible healthy snack. Pear disks were placed in baskets with polyvinylidene or cellophane film. The disks were pre-treated with ascorbic acid 2% + CaCl₂ at a 1% w/v solution, separately. The packaged pears were stored at 4°C for 3 and/or 6 days with a shelf-life period of 3 days at 8°C. Respiration rate, pH, soluble solids, titratable acidity, flesh firmness and color were measured in each condition and treatment. One way analysis of variance using film as factor was conducted after each storage condition (end of storage with or without a shelf-life period). The respiration rate decreased in both treatments, while cellophane delayed the climacteric peak, as compared to the polyvinylidene. Overall the pH increased and the TTA decreased, which is usual in climacteric fruits, but the total acidity was higher under cellophane film because of less consumption of acid compounds. Similarly, the total soluble solids increased more under polyvinylidene film than in cellophane film. The texture was maintained in both packages and no significant differences were observed during storage, while slight darkness appeared after 6 d in the pears stored under polyvinylidene film particularly after the end of the shelf-life period. In conclusion, cellophane film could be used for minimally processed pears stored up to 6 d at 4°C plus 3 days of shelf-life at 8°C.

Keywords: temperate, pomology, healthy, snack



OS 6-2:

THE EFFECTS OF DIFFERENT APPLICATIONS ON QUALITY OF MINIMAL PROCESSED DEVECİ PEAR DURING SHELF LIFE

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In this research, the effects of some edible coatings on minimal processed 'Deveci' pear cultivar fruits during shelf life were carried out. Pears were first stored for 1, 3 and 5 months respectively. Minimal processing and coating were materialized after each storage period. For this purpose, Natureseal including potassium sorbate, potassium ascorbate, citric acid and calcium chloride with 2% and 4% doses were applied as dipping after each cold storage period than the fruits were kept at 4-5°C refrigerator conditions for 7 and 14 days respectively. Some quality parameters such as firmness, total polyphenols, soluble solids content, malic acid content, pH, browning incidence and taste were assessed after each storage period before applications and after each shelf life period. According to the results; 7 days is more available for minimal processed 'deveci' pear fruits and Natureseal edible coating application with 4% dose was found very effective on keeping the quality parameters besides reducing the browning.

Keywords: Deveci pear, minimal processed, quality, edible coating, shelf life



OS 6-3:

EFFECT OF PROCESSING STEPS ON QUALITY ATTRIBUTES OF MINIMALLY PROCESSED ROCKET LEAVES

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Minimal processing and storage of leafy vegetables is limited by several quality challenges despite numerous research interventions. Rocket leaves samples were collected during processing by sampling the product flowing after each main processing steps (from raw material, washing throughout packaging). The effect of operation modes was evaluated on different quality attributes: total phenols (TP), Total antioxidant activity (TAA), Ascorbic acid (AA), Dehydroascorbic acid (DHAA), Total vitamin C (Vit. C), Mesophilic count (MC), Psychrophilic count (PC), Yeast and molds (Y&M) and aroma volatiles of products after each processing step, including storage at 5 °C, were evaluated. The washing and sanitization steps increased phenolic and antioxidant activity inducing a reduction of microbial counts (MC, PC, Y&M). Generally this increase was not affecting the overall nutrient content of the final product since a further oxidation was then induced by the drying steps. The raw material had the highest concentration of 4-Methylpentyl isothiocyanate which decreased during the processing steps and after storage of 5 days at 5°C. Samples after 5 days of storage in passive atmosphere resulted in increased concentration of off-odour volatiles as Benzaldehyde, Methyl thiocyanate and Dimethyl sulphide. The results of this study showed that processing operations induced some immediate responses in the product even if final quality did not substantially changed.

Keywords: Washing, drying tunnel, packaging, nutritional quality, microbial



OS 6-4:

POTENTIAL APPLICATION OF NATURAL PHENOLIC ANTIMICROBIALS AND EDIBLE FILM TECHNOLOGY AGAINST BACTERIAL PLANT PATHOGENS

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In this study, antimicrobial edible film technology used frequently for inhibition of human pathogens in processed food was employed as a post-harvest bio-based preservation method to prevent bacterial spoilage of fresh fruits and vegetables. Antimicrobial edible zein films were developed by incorporation of pure phenolic acids (PAs) such as gallic acid (GA), cinnamic acid (CA), vanillic acid (VA); essential oils (EOs) such as carvacrol (CAR), thymol (THY), eugenol (EUG) and citral (CIT) and phenolic extracts (PEs) from plant materials. In order to test synergetic effect of PAs, different amounts of PA were added into film solution to obtain films containing mixture of GA and CA, GA and VA, and CA and VA at different concentrations. The antimicrobial performances of edible films were tested on selected plant pathogenic bacteria including *Pseudomonas syringae*, *Erwinia amylovora*, *Xanthomonas vesicatoria* and *Erwinia carotovora*. The overall results of antimicrobial tests showed that films containing PAs between 1 and 4 mg/cm² inhibited all pathogens while EOs at concentrations between 2 and 4 mg/cm² and clove extract between 4 and 8 mg/cm² were found effective against pathogens except *P. syringae*. Moreover, the incorporation of combination of different PA showed greater inhibitory activity on plant pathogens than incorporation of a single PA into films. The edible zein coatings have already been applied for coating of fresh fruits and vegetables at the post-harvest stage to suppress their respiration rate and prolong their refrigerated storage. This work clearly showed the benefit of incorporating a single or mixture of antimicrobial phenolic compounds, EOs and PEs in edible zein films against bacterial plant pathogens. The developed films might be employed against plant pathogens by coating fresh fruits and vegetables, seeds, seedlings, tree stems, soil as well as agricultural tools and constructions without using toxic chemicals.

Keywords: phenolic acid, essential oil, phenolic extract, plant pathogen, antimicrobial film, zein



OS 6-5:

QUALITY RETENTION OF FRESH CUT FRUITS OF AVOCADO ENHANCED WITH THE ESSENTIAL OILS FROM AERIAL PARTS OF *LIPPIA JAVANICA*, INCORPORATED IN GUM ARABIC EDIBLE COATING

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The effects of 1% and 3% concentrations of essential oil from the aerial parts of *Lippia javanica* extracted through Solvent Free Microwave Extraction method (SFME) and integrated into an edible coat from Gum Arabic, on the shelf life enhancement of fresh cut of Avocado fruits were investigated for 28 days at $4\pm1^{\circ}\text{C}$. The essential oil was assayed using GC-MS system. The antioxidant components (total phenolics, ascorbic acid and carotenoid contents), pH, browning potential, total soluble solids, microbial loads, fruits microstructures analysis with the aid of scanning electron microscope, colour determination, antioxidant capacity through DPPH method and visual acceptability were used to determine the potential of coated essential oil from *L. javanica* as agent of preservation of fresh cut of Avocado fruits. Results showed that the coated essential oils at 1% and 3% concentrations significantly ($P < 0.05$) enhanced the shelf life of the fresh cut fruits of Avocado compared to uncoated fresh cut fruits of Avocado. The study showed that the 3% coated oil concentration showed higher enhancement than 1% concentration. Based on our findings, the preservation potential of essential oil incorporated in Gum Arabic showed that it could enhance the shelf life of fresh cut of Avocado fruits.

Keywords: avocado fruits, Essential oils, Gum Arabic, *Lippia javanica*, Shelf Life, SFME



OS 6-6:

FRUITS AND VEGETABLES SHELF LIFE EXTENSION AFTER IN SEASON TREATMENTS WITH LUNA

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FAO investigations indicate that up to 50 % of the initial production of fruits and vegetables can be lost in the field but also after harvest, during storage, packaging, transportation and on the shelf before reaching the end consumer. Many diseases such as Botrytis, Monilia, Sclerotinia, Alternaria, Anthracnose, and Gloesporium can be established already at flowering and on young fruits, however they often remain latent even until postharvest. The in-season control of these latent diseases, even at early stages in the field has a significant influence on the shelf life of the harvested fruit. A compilation of 20 trials Bayer performed on 13 different F&V crops has shown that from an initial production of 100 fruits and vegetables only 33 % of the production will reach the end consumer if not treated against these diseases vs 51 % with standard treatments and 71 % with a program including one or two Luna™ products. The fact that Luna™ can preventively control most of the latent diseases early in the season - only 9 % of the initial production was lost in the field - and delay their further development post-harvest - losses after harvest were limited to 20 % - explains this impressive difference regarding “production efficiency” (quantity of marketable fruits at consumer level vs quantity of fruits produced). The results demonstrate that optimized in-season control of latent diseases including novel fungicides such as Luna™ and high performing Biologicals such as Serenade™ lead to a large reduction of losses in pre-harvest but also post-harvest with the corresponding savings for soil occupation, packaging and transportation of fruits which will not reach the end consumer.

Keywords: shelf-life, Luna™, Serenade™, latent diseases, marketable yield



SESSION VII: DRYING AND EDIBLE OILS

OS 7-1:

COLD-PRESSED AVOCADO OIL PROCESSING FROM SMALL-HOLDER FARMERS IN KENYA

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The New Zealand Institute for Plant & Food Research Limited has partnered with private company Olivado New Zealand and the New Zealand Ministry of Foreign Affairs and Trade in a 5-year project to improve returns for small-holder avocado farmers in Kenya through improved production technologies that increase fruit quality and postharvest processing. The project approach is to assist Olivado field staff working with the farmers to adopt improvements in critical tree growth factors, including pruning, irrigating, soil fertility and tree nutrient inputs for the predominant 'Hass' and 'Fuerte' grown varieties. This presentation will focus on the postharvest and processing aspects of the avocado production system, where the challenge is to harvest, transport, ripen, and process fruit to maximise quantity and quality oil yields. Previously used artificial fruit ripening with ethylene is not possible when accessing preferred European Union markets with an organic certification. The stage of fruit softening that delivers the highest oil yield (which is economically important) does not result in the best quality cold pressed oil, since softer fruit will have more fruit rots, which reduces oil quality. The presentation will discuss the development of a novel ripening system that addresses these challenges to delivering quality cold-pressed organic oil in Kenya and will introduce a dry matter monitoring system that helps determine the optimum harvest periods to maximise oil yield; and discuss critical pre- and post-harvest factors that influence oil quality and yield.

Keywords: extra virgin oil, organic, 'Hass', persea americana



OS 7-2:

Effects of pre-drying dipping in some essential oil emulsions on quality and nutrients of dehydrated tomatoes

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In tomatoes to prevent color darkening, rise in the microbial load and loss of some nutrients, sulphurdioxide (SO₂) has been used as an antioxidant and antimicrobial agent during drying process for years. However in the last years, with increasing consumer preference for more natural foods, there is a worldwide trend to reduce SO₂ levels. The aim of this study was to investigate the effects of some aromatic plant essential oils that can be used as an alternative to sulphurdioxide for maintaining color and nutrients during drying of tomatoes. For drying process, all matured tomatoes were cut into 4 slices longitudinally after pretreatment (2% ethyl oleat+4% potassium carbonate, 1 min.) and then slices were dipped into 0.2% and 0.5% lemongrass (*Cymbapogon citratus*) oil, 0.2% and 0.5% origano (*Origanum majorona* L.) oil, 0.2% and 0.5% sweet basil (*Ocimum basilicum*) oil emulsions and 0.2% and 0.5% of combination of all three oil emulsions for 5 minutes and control group without any treatment. Drying trials were performed at 50°C and 60°C drying air temperatures and 1.5 m/s air velocity at cabinet dryer. Some quality measurements and nutrient analysis were performed at both fresh and dried tomato samples. As a result, tomatoes dried at 50°C had higher a* values (red color) than 60°C. The highest a* values were measured in slices dipped into lemongrass oil (both in 0.2 and 0.5%). Generally, all essential oils were found to be better than control group for maintaining nutrient characteristics. In contrast to total fenolic content and antioxidant capacity, tomatoes dried at 50°C had higher lycopene than 60°C. The highest total phenolic contents and antioxidant capacities were found to be in dried tomatoes dipped into sweet basil (0.2%) and origano essential oil emulsions (%0.5).

Keywords: Dipping, essential oil, eco-friendly, dehydration



OS 7-3:

THE EFFECTS OF HARVEST TIME AND DRYING METHODS ON AFLATOXIN PRODUCTION OF SOME ALMOND TYPES GROWN IN TURKEY

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In this Project, determination of the sensitivity of some almond types grown in Turkey to aflatoxin production at different harvest time and different drying types was aimed. For this purpose, Ferraduel from stone almond class, Ferragnes from hard almond types, Texas, Halitbey and Bozkurt from tooth almond types and Nonpareil from hand almond types was harvested at two different times (early and normal harvest time) and analysed for aflatoxin before drying. Also each sample was dried to 5% moisture with and without dehulling and analysed for aflatoxin to determine the effects of hulling before drying on aflatoxin production. The results show that aflatoxin production was not determined in the samples of early harvest before and after drying. At the samples of normal harvested almonds, the aflatoxin was determined in two samples in first year and three samples for second year of the project. As a result, 5 samples were contaminated with aflatoxin among the 66 samples analysed in two years. However; aflatoxin levels of these 5 samples were under the allowed limits. It can be concluded that, when almonds cultivated at the areas where the weather is hot and the relative humidity of air is low during almond maturation and harvest time period, almond has low risk in terms of aflatoxin production providing the almonds are well dried.

Keywords: almond, aflatoxin, harvest time, dehulling



OS 7-4:

INVESTIGATING THE EFFECT OF THIN LAYER DRYING METHODS ON QUALITY OF MANGO SLICES

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Fresh Tommy Atkin mango (*Mangifera indica* L.) with flesh colour parameters L^* (47.70±5.6), a^* (24.72±6.9) and b^* (34.87±8.76), an average TSS of 13.85±2.07°Brix and firmness of 4.4±3.2N were used for the drying experiments. This study investigated the effect of three drying methods namely; open-air solar drying (OAD), a modified ventilation solar dryer (MVD) and an oven dryer (OVD) on quality parameters of 3mm, 6mm and 9 mm mango slices with lemon juice pre-treatment. The study observations found a relatively higher colour changes (ΔE) for mango slices dried in open-air solar drying (OAD) than in a modified ventilation solar dryer (MVD) and an oven dryer (OVD) respectively. Treatment did not affect the colour parameters L^* and a^* , only drying method and the mango slices affected the colour. It was found that thicker mango slices (9mm) in OAD became darker (L^*) indicating browning compared to thinner slices (3mm and 6mm) in MVD and OAD. Furthermore, pre-treatment did not affect the rehydration ratio however, thicker slices dried in OAD showed to have a higher rehydration ratio, indicating cell damage. This was evident with the microstructure which showed cracks and pores in OAD dried mango. Sensory evaluations showed that panellists preferred treated mango samples. The overall acceptability of treated mango in MVD (7.09±1.26) was not significantly higher ($P>0.05$) than that of mango dried in OVD (6.94±1.64) and OAD (6.51±2.07) respectively. In addition, Microbial counts showed that the dried mango was safe for human consumption because pathogens were not detected. However, fungi and anaerobic bacteria counts found were higher than international stipulated limits of 1×10^3 .

Keywords: Solar, drying, thickness, pre-treatment, colour, microbial count, sensory evaluation, microstructure



OS 7-5:

Influence of partially substituting sodium chloride with potassium chloride as a pre-drying treatment on quality of sun-dried tomatoes during storage

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In this research, the effects of different salt and potassium chloride applications on sun dried tomato physicochemical and sensory quality during 10-month storage were investigated. For the experiment approximately 1200kg of fresh tomatoes were obtained and divided randomly into 8 lots of approximately 150 kg to which the following pre-drying treatments were applied: two different salt concentrations namely, 5 % and % 10 total salt. In each of these pretreatments NaCl was partially replaced by KCl at three ratios: 85:15, 70:30, 55:45 and control (100:0) was also included. Drying took seven days under direct sun light. After drying the samples belonging to each treatment were packed into LD polyethylene bags (250 g±5 g) and stored at 4°C for 10 months. Samples, at the beginning of the storage and taken from cold room at 2 month interval during storage were analysed. Quality of sun-dried tomatoes was evaluated by determining colour (CIE L*, Hue* and Chroma*), moisture, lycopene content and sensory evaluation. The research showed that quality loss occurs during storage, however the replacement of NaCl using KCl don't have negative effect on quality of dried tomatoes. In conclusion, it is possible to use KCl up to 45 %, without affecting the quality and consumer acceptance.

Keywords: *Lycopersicon esculentum* Mill. table salt, potassium chloride, lycopene, storage



OS 7-6:

MORINGA OLEIFERA PODS: PHYSICO-CHEMICAL CHARACTERIZATION OF FRESH PODS AND POD FLOUR PRODUCE AT DIFFERENT DRYING TEMPERATURES

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Moringa oleifera is a tropical plant grown for its nutritious leafy greens, flower buds, and mineral-rich green fruit pods. It is a drought tolerant plant and adapts easily to arid climates and to nutrient poor soils. Due to its high nutritive values all parts of are used for either nutritional or commercial purposes. The objective of this work is to produce and characterize flour from dried pods under different conditions at 40, 50, 60 ° C (in the oven) and at ambient temperature of ± 30 ° C. Physicochemical analyses were carried out on fresh pods and flours. The fresh pods presented a moisture content of $81.26\% \pm 0.54$ and a water activity of 0.76 ± 0.01 . The vitamin C content per 100 g was $12.38 \text{ mg} \pm 3.31$. The flours were produced from *Moringa oleifera* pods which were dried at different temperatures and the physicochemical properties were determined and compared. The parameters determined were: moisture content, fiber, protein, fat, vitamin c and water activity dried flour. The results showed that the optimum drying temperature was found to be 40 ° C and the physico-chemical characteristics of the flour were: $12.97 \text{ mg} \pm 1.78$ of Vitamin C, per 100 g, $25.73\% \pm 0.22$ of fiber and $20.83\% \pm 0.36$ of protein. The flour of the different parts of the pod (whole pod, mesocarp, seed with endocarp, and seeds without endocarp) was also produced at 40 ° C and its physicochemical properties were compared. In general the moisture content of all type of flours was lower than 4% and the water activity was lower than 0.4. The results showed that the whole *Moringa oleifera* pod flour can be a better nutrient source compared to seed flours due to its high fiber and vitamin C.

Keywords: Moringa pods, moringa oleifera seeds, flour



SESSION VIII: HUMAN HEALTH IMPACT

OS 8-1:

THE EFFECTS OF HYLOCEREUS (DRAGON FRUIT) AND OPUNTIA (CACTUS PEAR) ON ENDOTHELIAL AND VASCULAR FUNCTION: A SYSTEMATIC REVIEW OF ANIMAL AND HUMAN STUDIES

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Hylocereus (dragon fruit, pitaya) and *Opuntia* (cactus pear) are cacti species that have been widely used as a reliable source of food as well as traditional folk remedies in Southeast Asia and South America. They have become of scientific interest recently due to their high levels of bioactive phytochemical compounds (such as betalains). Earlier systematic reviews have explored the impact of supplementation of these cactus species on obesity, type-2 diabetes mellitus and cardiovascular risk factors: body weight and composition, serum triglycerides, cholesterol, blood glucose and blood pressure. However, its effect on vascular health and endothelial function has yet to be reviewed. In order to address this gap in the literature, a systematic review has been conducted to evaluate the physiological effects of *Hylocereus* and *Opuntia* cacti on endothelial and vascular function from *in vivo* animal models and human studies. An electronic search was performed in the following databases: PubMed (MEDLINE), EMBASE (via Ovid), CINAHL, Scopus, Web of Science®, and The Cochrane Library (CENTRAL). All databases were searched from their earliest inception up to November 2017 without language restriction. Outcomes of interest were blood pressure, arterial stiffness, vascular reactivity and biochemical markers of endothelial dysfunction. Two investigators independently performed the study selection and data extraction. From 292 references, only 13 studies (7 animal and 6 human) fulfilled the eligibility criteria. In general, the animal studies suggested a potential increase in vasodilation and serum nitric oxide and a reduction in vascular stiffness, blood pressure and cell adhesion molecule expression. Similarly, the small number of human studies also showed a reduction in blood pressure. Although these findings appear to indicate overall improvement in vascular health, there is a severe lack of robust, randomised human intervention studies to identify underlying mechanisms, optimal dose and long-term effects of cacti consumption

Keywords: cardiovascular, pitaya, nopal, prickly, endothelial, blood pressure



OS 8-2:

A PHYTOALEXIN RICH FRACTION FROM POTATO WITH BIOACTIVE PROPERTIES AGAINST THP-1 MONOCYTIC LEUKEMIA CELLS

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Secondary metabolites play significant function in plants. Among the secondary metabolites are the phytoalexins, which are involved in plant defense against pathogenic microorganisms. In the recent years, there have been an abundant literature generated on the beneficial effect the stilbene phytoalexin from grape, Resveratrol, might have on human health. In the solanaceae, such as potato, the known phytoalexins belong to the sesquiterpenes family. In the present study, the sesquiterpene phytoalexins were induced in several breeding lines and commercial cultivars of potato tubers using a physical treatment. The evaluated lines could be categorized by their qualitative and quantitative sesquiterpene phytoalexins. The potential bioactivity of the phytoalexin rich extract prepared from a commercial potato cultivar was evaluated against 3 model cancer cell lines: A549 pulmonary carcinoma, DLD colorectal adenocarcinoma and THP-1 monocytic leukemia. The Alamar blue and the Annexin V assays were used respectively to measure the induction of cytotoxicity and of apoptotic cell death by the extract. The impact of the extract on cell cycle was also tested by flow cytometry. The phytoalexin Resveratrol was used a reference compound to compare the bioactivity of the extract from potato. The data indicate that the phytoalexin rich extract from potato possesses apoptotic activity against selected cancer cell lines.

Keywords: apoptosis; cancer cell lines; cytotoxicity; potato; resveratrol; sesquiterpene



OS 8-3:

EFFECT OF 28-HOMOBRASSINOLIDE ON HUMAN HEALTH PROMOTING COMPOUNDS OF CAULIFLOWER SEEDLINGS

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Brassinosteroids (BR) are plant hormones with growth-promoting activities. Recent research suggest that BRs are involved in many physiological processes including stress tolerance in plants. Studies report that exogenous application of BRs to plants under stress conditions may help to cope with the adverse effects of stress. Glucosinolates are plant secondary metabolites known as defence compounds in brassicas that are associated with health promoting activities. Studies are focused on enhancing glucosinolate content, particularly the aliphatics, using different approaches for increased health benefits. Recent studies suggest that brassinosteroids may participate in regulation of glucosinolate biosynthesis in *Arabidopsis* through BZR1 and BES1, two transcription factors in BR signal transduction. However, evidence revealing the influence of brassinosteroids on glucosinolate content is limited. In the present study, the effect of foliar application of 28-homobrassinolide, a biologically active form of BRs, to young cauliflower seedlings on the aliphatic and indole glucosinolate content was investigated. The objective was to explore the influence of this particular plant hormone on glucosinolate content at earlier developmental stages of the plant known to possess higher levels of glucosinolates. The seedlings were grown in an inert medium with Hoagland nutrient solution at climate controlled growth room and were sprayed with 28-homobrassinolide at concentrations of 0.5 mg l⁻¹ and 1 mg l⁻¹ at 4-5 leaf stage. The findings revealed the differential response of individual aliphatics and indoles to BR concentrations when applied exogenously

Keywords: brassinosteroids, brassicas, glucosinolates



OS 8-4:

IMPACT OF ANTIOXIDANT SPICES ON VITAMIN B₉ AND B-CAROTENE IN STEAMED SWEET POTATO LEAVES

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Leafy vegetables provide essential nutrients for human beings. However, these nutrients are lost during cooking. Spices, which have good antioxidant activity, were cooked with sweet potato leaves to appreciate their impact on nutrients losses prevention. Sweet potato leaves were steamed during 20 minutes with 4 spices: turmeric, nutmeg, Guinea pepper and cloves. Vitamin B₉, β -carotene and total phenolic content were determined on spices and sweet potatoes cooked without and with spices. Free radical-scavenging, inhibition power of lipid peroxidation and reducing power were also determined. The results showed that turmeric contained the most elevated total phenolic content (1633.33 mg Gallic Acid Equivalent (GAE)/g dry matter (DM)) and Guinea pepper the least one (69.58 mg GAE/g DM). However, after steaming process, total phenolic content in sweet potatoes without spices (174.75 mg GAE/g DM) decreased with turmeric (41.66 mg GAE/g DM) and increase until 625.83 mg GAE/g DM with cloves. There was a loss of vitamin B₉ in sweet potato leaves steamed with cloves. Indeed, the value in sweet potato without spices (0.23 mg /100g) decreased up to 0.02 mg /100g. But, with the other spices, there was a retention in the leaves. B-carotene used to increase in sweet potato leaves steamed with turmeric, cloves and nutmeg. However, it decreased with Guinea pepper. Free radical-scavenging inhibition percentage at 50% was about 0.50, 0.268, 4.17 and 21.50 in sweet potatoes steamed with cloves, Guinea pepper, nutmeg and turmeric respectively. The capacity of spices and steamed sweet potato leaves to inhibit lipid peroxidation was higher than that of Gallic acid (reference). But, their reducing power capacity was lower than that of the reference (vitamin C). Vitamin B₉ and β -carotene are useful for human well-being and antioxidant spices contribute to reduce their losses during sweet potatoes leaves steaming.

Keywords: Leafy vegetables, cooking, nutrients losses, prevention, retention.



OS 8-5:

PESTICIDE REGULATION IN EUROPE AND SYSTEM FOR SETTING MAXIMUM RESIDUE LEVELS FOR FOOD PRODUCTS OVERVIEW

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The aim of the presentation is to provide a review of the European Union's (EU) regulatory framework for plant protection product and to explain the EU process for the evaluation of applications to set import tolerances (IT) to support international trade. In the EU, placing on the market of plant protection products must comply with the requirements of EU Regulation (EC) No 1107/2009. Hazard based approval criteria, for the approval of active substances in the EU, have been introduced in the EU's legislation for the authorisation of plant protection products. Challenges for member states to apply this regulation will be discussed, as well as consequences on innovation in the European market. A separate EU regulation, Regulation (EC) No 396/2005, establishes maximum residue levels (MRLs) for pesticides permitted in food products of plant or animal origin and intended for human consumption. Hazard based criteria are not included in the legislation on the setting of MRLs. Using a hazard-based approach to setting IT would be contrary to principles set out in the World Trade Organisation (WTO) agreement and could have a substantial impact on international trade. It is concluded that changes and uncertainties in the EU regulatory systems can increase the costs for new developments and the risk for innovative companies – with the strongest impact on smaller crops such as fruit and vegetables. It is also of high importance that the EU continues to comply with the WTO SPS principles when deciding on the setting of IT to support international trade. Global horticultural markets require globally harmonised regulations for plant protection products to increase productivity, profits and trade, and enhance the ability to protect public health and the environment.

Keywords: EU regulation EC 1107/2009, Maximum Residue Limit, MRL



OS 8-6:

RESEARCH AND REGULATORY INTERVENTIONS TO MITIGATE FOOD SAFETY RISKS OF ROCKMELONS OR CANTALOUPES- A CASE STUDY

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Rockmelons (*Cucumis melo*) also known as muskmelons or cantaloupes contribute greatly to the Australian melon industry. The fruit's ground contact during field production predisposes them to microbial contamination while their rough skin surface makes them a hard-to-sanitize commodity. The rockmelons contaminated with foodborne bacterial pathogens have been implicated in large scale illness outbreaks causing huge economic losses to the industry and public health. Mitigating food safety risks through best practice is thus a priority of the industry and regulators. In this project, our objective was to improve the industry practice of postharvest processing of rockmelons to ensure safe supply of fruit to consumers in domestic and export markets. We observed that postharvest sanitization practices were variable in the industry. The type and concentration of sanitisers in wash water and their application methods varied significantly among different pack-houses. Postharvest washing with a chemical sanitiser at recommended concentration reduced total plate count on the fruit surface, while uniform application of fungicide effectively reduced yeast and mould count. The lack of a chemical sanitizer in wash water and recirculation of wash water were associated with a higher microbial load and detection of foodborne bacterial pathogens on the fruit surface. Maintaining an effective sanitizer concentration and monitoring critical control parameters were identified as essential in preventing the pathogen survival and cross-contamination during postharvest sanitization. The gaps in good practice and their potential consequences for the consumers and industry were communicated to melon growers, packers, and supermarket retailers through different forums. This presentation will demonstrate the effectiveness of a whole-of-the-chain approach combined with the scientific data-based recommendations to the industry in bringing a positive change in the attitude and industry practice contributing to nurturing a food safety culture.

Keywords: rockmelons, food safety, sanitizer, fungicide, sanitization



SESSION IX: INNOVATION IN SAMPLING, ANALYSES AND PROCESSING

OS 9-1:

ARTIFICIAL NEURAL NETWORK AS ALTERNATIVE METHOD FOR PREDICTION OF SUGAR AND ACIDITY USING NEAR-INFRARED SPECTROSCOPY IN TABLE GRAPES

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In table grape production it is critical to have an accurate method to assess the external and internal quality of the fruits. Many fruit quality attributes that affect consumer acceptance and price are still tested using traditional approaches, which are either subjective or time-consuming. In this sense, Near-Infrared spectroscopy has been successful to determine maturity quality parameters non-destructively and rapidly. Furthermore, this technique enables the detection of several internal and external fruit attributes simultaneously. However, for determining quality parameters using Near infra-red (NIR) spectral data is necessary to implement several chemometrics procedures (outlier detection, spectral pre-processing, variable selection, calibration and validation) to build accurate models. This study analyses the use of a multivariate predictive modelling technique-artificial neural network (ANN) as an alternative to conventional Partial least squares (PLS) modelling using NIR spectral data of whole table grape bunches to determine the Total soluble solids (TSS), Titratable acidity (TA) and TSS/TA ratio. The results of this study show that the ANN based models developed using NIR data fits well with the reference data and can be used as an alternative method for predicting purpose with a high accuracy.

Keywords: whole table grape bunches; Total Soluble Solids; Titratable Acidity; Sugar-Acid ratio; Near-Infrared spectroscopy; Non-destructive measurements; Machine learning; Artificial Neural networks



OS 9-2:

VALIDATION OF A SIMPLIFIED METHOD FOR FRUIT PHENOLIC EXTRACTION AND ANALYSIS TO BE USED IN OLIVE BREEDING

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Phenolic compounds are generally accepted as key components of virgin olive oil with a great impact on its organoleptic and health promoting properties. However, olive phenolic components are not commonly used as quality traits in olive breeding programs mainly due to the difficulties of evaluating a large number of new genotypes with very little oil production at the early stages of breeding. In the present work, we describe and validate a fast and reliable method for the extraction and further analysis of the main phenolic compounds found in olive fruit. The analytical methodology has been validated with the two most relevant olive varieties grown in Spain, “Picual” and “Arbequina”, which possess very different phenolic profiles. The significant correlation found between specific phenolic compounds, or groups of phenolic compounds in the olive fruit, analyzed with this method and the phenolic content of virgin olive oil suggest that this method may be a very useful predictive tool which could prevent the selection of olive genotypes whose oils will never reach an optimum phenolic content

Keywords: olive breeding, virgin olive oil, phenolic compounds, organoleptic quality, nutritional quality



OS 9-3:

EFFECTS OF TEXTURE OPTIMIZATION THROUGH FIBER ADDITION IN YELLOW VEGETABLE-FRUIT BARS STABILITY AND SHELF-LIFE

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Fruit and vegetables are highly perishable materials and both industry and academy have developed different processing methods to extend their shelf life. These raw materials have proved to be naturally rich in nutrients and bioactive compounds, enhancing health worldwide. Fruit bars have been a successful way to include in various diets these kind of products, from children to adults as a practical snack that can be easily consumed as a palatable commodity. Vegetables have been included in these kinds of goods to increase the health improving potential of the product, by surpassing their sensory disadvantages. This study determine the critical factors that affects the stability of a fruit and vegetable mixture bar rich in antioxidants after a shelf-life period. Prebiotic fiber was added to the bars' formulation to improve hardness and shelf life. The stability test was performed during 12 weeks for bars stored under $30 \pm 0,2$ °C and 90% of relative humidity. Seven samples were taken every 2 weeks for color, water activity, texture, moisture, total soluble solids (TSS), pH and titratable acidity, along with the determination of carotenoids, total phenolic contents, and antioxidant capacity by Trolox equivalent antioxidant capacity and ferric Ion reducing antioxidant parameter. Microbiological stability results showed a constant value of less than 3 fecal and total coliform colony forming units per gram (cfu/g) and less than 10 molds and yeasts cfu/g. The decrease in carotenoids were the most critical factor to keep bar shelf life followed by TSS, moisture, and color that significantly changed during storage, but bar safety levels were guarantee during the whole test.

Keywords: Fruit and vegetable bar, processed products, food stability, antioxidants.



OS 9-4:

FROM FIELD TO SNACK: DEVELOPMENT OF A MOLECULAR MARKER-BASED METHOD FOR THE IDENTIFICATION OF THE HAZELNUT (*CORYLUS AVELLANA* L.) CULTIVAR ALONG THE PRODUCTION CHAIN

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Commercial frauds concerning food ingredients are rather common because there are few checks and the identification of single constituents in a processed product is not easy due to the complexity of the matrix. This is particularly true when the quality of a food is due to the presence of a plant ingredient from a specific cultivar, selected for its superior quality and sometimes associated with a territory and a production chain. In this paper we present the development of an identification system, from field to snack, for the hazelnut cultivar 'Tonda Gentile' (syn. 'Tonda Gentile delle Langhe', 'Tonda Gentile Trilobata') sold 100% to industry for processing. 'Tonda Gentile' is the best paid hazelnut cultivar in the world, due to its recognized superior quality and low availability on the market (3-4% world production); it can be commercialized under the PGI 'Nocciola Piemonte' and is mostly sold to the kernel market, or as semi-finished product (chopped or ground into paste after roasting). In these cases, the identification of the cultivar is almost impossible. An additional difficulty for the identification of seeds is due to the mandatory cross-pollination of the species. The work carried out has considered different types of molecular marker and strategies for the different steps of the production chain: nuclear SSR markers for the identification of the plant material in nursery and orchard, SNP/indel markers for clonal identification and valorization of selected clones, nSSR and chloroplast markers for the recognition of the cultivar in seed, chopped kernel, paste and processed products. NGS techniques were used for the re-sequencing of 'Tonda gentile' clones and for isolating chloroplast markers through the genome skimming strategy.

Keywords: next generation sequencing, molecular markers, traceability, SNP, SSR



OS 9-5:

ELABORATION OF PROTOCOLS TO DEFINE SENSORIAL ATTRIBUTES AND MECHANICAL PROPERTIES OF CANNED PEACHES

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Peach (*Prunus persica*) is the most important temperate fruit crop worldwide after apple and its products are destined for fresh consumption or are being consumed after processing. Notably and despite its economic importance, to the best of our knowledge, no standardized protocols to define sensorial attributes and mechanical properties of canned peaches exist. Thus, the aim of the current study was dual: initially, to set up a list of descriptors for sensorial analysis of canned peaches and thereafter to elaborate a toolkit to define textural and mechanical properties of such products. Towards this aim, peach fruit of eight clingstone cultivars were harvested at commercial maturity stage and subjected to the canning process at the premises of Venus Growers (Veria, Central Macedonia, Greece), a leading company worldwide in processing of clingstone peaches. A descriptive quantitative analysis (QDA) to characterize sensory attributes of canned peaches of the examined cultivars at two syrups was employed in order to receive a complete description of all the attributes existent in such product. Initially, a standardized vocabulary (Consensus language) was developed and a 12-person panel followed a 2-day training session. Thereafter, fifteen sensory characteristics were quantified by the panel in two successive sessions. Data were subjected to statistical analysis (SenPAQ software της Qi statistics) and differences among the examined cultivars were monitored both for sensorial and oral characteristics providing useful insights for the industry. Thereafter, mechanical and textural properties were determined using a TA-XT2i Texture Analyzer (Stable Microsystems, Godalming, Surrey, UK) interfaced to a personal computer. Fruit firmness was measured using an array of different probes [puncture test, using 6 mm flat cylinder probe, (2) Texture Profile Analysis (TPA), using 75 mm flat plunge and (3) Kramer Shear cell 10 blades]; such data were coupled with sensorial attributes related to the mechanical properties.

Keywords: *Prunus persica*, clingstone, texture, aroma, firmness, fruit processing



OS 9-6:

AN INNOVATIVE APPROACH TO REDUCE RAIN WASH-OFF WITHOUT CAUSING OXIDATIVE DAMAGE IN APPLE LEAVES

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Rain wash-off of foliar-applied agrochemical formulations (i.e. active ingredients) is a key topic to ensure crop protection under rainy conditions and for some regions will gain higher importance due to global climate change. Rain-induced wash-off is determined by intensity and amount of rain, as well as by characteristics of the active ingredients and deposit patterns on the leaf surfaces. In addition, the micromorphology and chemical properties of the exposed surfaces equally play a significant role. Traditional approaches to reduce rain-induced wash-off focus on the use of adjuvants either to raise the penetration rate of systemic and loco-systemic formulations, or to increase adhesion of active ingredients to the target surfaces. In our studies, we evaluated the potential of novel functional proteins (anchor peptides, APs) as tool to increase rainfastness of innovative microgel formulations for slow release of active ingredient (a.i.) in pest management. For this innovative approach, we tested the adhesion capacity of the APs to bind to the leaf epicuticular surfaces of an economically important fruit crop, e.g. apple. In addition, the phytotoxic potential of APs or adjuvants on apple plants was monitored. The results indicated that the simulated rain (6.5 mm hr⁻¹) wash-off of the selected functional peptide Tachystatin A2-variant was just less than 2% and had no negative effects on photosynthetic activity of apple seedlings grown under -UV/+UV conditions. Coupling of novel APs in the microgel formulations might contribute to reduce the amount of agrochemicals in horticulture, and to ensure biological efficacy of plant protection treatments.

Keywords: anchor peptides, apple, innovative adjuvants, photosynthetic activity, phytotoxicity, rainfastness



POSTER SESSIONS

SESSION I

PS 1-1:

CONTENT OF TOTAL PHENOLICS AND VITAMIN C IN COLLARDS PRODUCED IN THE FEDERAL DISTRICT, BRAZIL

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Collards leaves are nutritionally rich foods for the human diet. They contain vitamins, minerals, antioxidant compounds. Among the antioxidant components are phenolic compounds and vitamin C, important for the prevention of human diseases. In the human body phenolic compounds exert effects on various metabolic enzymes and signaling, acting against free radicals, inflammatory processes, allergies, platelet aggregation, viruses, tumors. For plants, phenolics are essential in growth and reproduction, as well as being responsible for color, astringency, aroma. Vitamin C is needed to maintain the health of the skin, formation of collagen, absorption of inorganic iron, reduction of cholesterol level, strengthening of the immune system. The objective of this work was to quantify total phenolic compounds and vitamin C in 29 genotypes of collards produced and consumed in the Federal District, Brazil. The method for phenolics was to mix to the sample of collards 70% ethanol, Folin-Ciocalteu reagent and sodium carbonate solution. The mixture was centrifuged and, after standing at room temperature, the absorbance was read at 735 nm. The method for vitamin C was that of Terada et al. (1979). The mean values of phenolic values were 0.3764 mg of phenolics / g of collards, ranging from 0.17 mg of phenolics / g of collards to 0.51 mg of phenolics / g of collards. The mean values measured for vitamin C were 114.39 mg vitamin C / 100g collards, ranging from 80,15 mg vitamin C / 100g collards to 159,96 mg vitamin C / 100g collards. This quantity is considered adequate in relation to other studies that quantified phenolic compounds and vitamin C in Brassicas. Collards is a food rich in phenolic compounds and vitamin C, important functional components of the diet, and its consumption is a good choice to take care of health preventively.

Keywords: collards, phenolics vitamin C, nutritive value



PS 1-2:

IN VITRO BILE ACID BINDING ACTIVITY AND NON-EXTRACTABLE POLYPHENOLS OF DRIED PERSIMMON AND QUINCE FRUITS

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To elucidate functional aspect of regional horticultural products, in vitro bile acid binding activity and non-extractable polyphenol (NEPP) content of dried persimmon 'Ichidagaki' and quince 'Smyrna' fruits were determined. For a comparison, apple 'Shinano Sweet' and fresh persimmon 'Fudegaki' fruits were also used for the bile acid binding assay. Fruits were lyophilized before use except for dried persimmons. Fruit samples were incubated with bile acids after simulated digestion then free bile acid concentration was determined to calculate the amount of bound bile acids. NEPP content was determined after decomposing treatment of 70% (v/v) acetone insoluble solids (AIS). Quince and dried persimmon fruits showed stronger (6 - 7 times higher) activity for bile acid binding than that of apple fruit. The bile acid binding activity of AIS prepared from the dried persimmon fruits was 34.6 $\mu\text{mol/g}$ and this corresponds approximately to 31% of the activity of cholestyramine a bile acid sequestrant. NEPP content of the dried persimmon fruits was approximately 600 mg/100 g and it comprised about 97% of total polyphenols. Butanol/HCl degradation assay also revealed that most proanthocyanidins in dried persimmon fruits are existed in non-extractable form. On the other hand, proportion of NEPPs of the total polyphenols in quince fruits was 10 – 20%. Although contribution of NEPPs to the bile acid binding activity remains to be elucidated, strong bile acid binding activity of dried persimmon AIS suggests that this fruit product may possess a certain potentiality of cholesterol lowering effect.

Keywords: Diospyros kaki, Cydonia oblonga, bile acid binding, bound phenolics, condensed tannins



PS 1-3:

SCREENING OF PHYTOMETABOLITES IN OIL FROM CAPE GOOSEBERRY (*PHYSALIS PERUVIANA* L) FRUIT POMACE

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Physalis is a common weed of the rabi season which is grown in small pockets in North India but is still underutilised in view of its nutraceutical potential. In the present study, goldenberry pomace for the production of edible oil was evaluated. Oil was extracted from pomace after processing by solvent extraction method using n-hexane as solvent. Samples were subjected to Fourier Transform InfraRed spectroscopy (FT-IR) where major functional group viz. alkanes, aromatic, phenols, aliphatic, nitro compounds, amines and aliphatic iodo compound, etc at wavelength of 3737.5 to 3471.9 cm⁻¹ and (alcohol and phenols) corresponding to delta- tocopherol and stigmasterol, 2923.3 to 2637.0 cm⁻¹ (alkanes and aldehydes), 1743.1 to 1654.0 cm⁻¹ (esters, aliphatic and ketone) corresponding to lanosterol, 1463.7 to 1281.0 cm⁻¹ (methyl and aromatic) corresponding to delta- tocopherol, beta- sitosterol, 1162.6 to 1056.2 cm⁻¹ (amine and alkyl halide) corresponding to beta- sitosterol, campesterol, 914.4 to 843.2 cm⁻¹ (carboxylic acids and aromatic) and 721.3 to 592.3 cm⁻¹ (alkyl halide and aliphatic iodo compound) were identified. *Physalis* is reported to be a rich source of withanolides and thus, further detailed analysis of the oil samples is required to understand the nutritional and pharmaceutical potential.

Keywords: Cape gooseberry, *Physalis peruviana*, goldenberry, pomace, oil, n-hexane, FT-IR



PS 1-4:

TOTAL PHENOLICS, ANTIOXIDANT CAPACITY, OIL CONTENT AND FREE FATTY ACIDS IN FRESH CHANDLER WALNUT

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Nowadays, the usage of fresh walnut kernels is more widely due to their unique and appropriate flavor. Also, walnut kernels are highly important in terms of nutritional value due to their unsaturated fatty acids and antioxidant compounds. To assess the nutritional value of fresh chandler walnut kernels some significant nutritional traits including the levels of phenolic compounds, total antioxidant capacity, total oil percentage, peroxide value and free fatty acid content was measured. The results showed that fresh chandler kernels had a phenolics content of 0.31 ± 0.35 mg gallic acid per gram fresh weight, an antioxidant capacity of 87.2 percent, a fat content of 61.0 ± 0.03 percent, and a peroxide value of as low as 0.09 ± 0.04 meq O₂ per kg oil. Also, free fatty acids such as palmitic acid (1.8%), oleic acid (12.59%), linoleic acid (2.9%) and linolenic acid (0.49%) were detected in fresh walnut kernel's oil. Thus, the results of this study indicate that fresh walnuts are rich in functional compounds as well as dried walnuts.

Keywords: antioxidant activity, extraction oil, nutrient value, gas chromatography.



PS 1-5:

JABUTICABA (*PLINIA JABOTICABA*) PEEL PHENOLIC EXTRACTS IMPROVE SERUM LIPID PROFILE IN HYPERCHOLESTROLEMIC RABBITS

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Cardiovascular diseases are considered the leading cause of death in the world and atherosclerosis is considered the pathophysiological basis for cardiovascular events. It is believed that damage caused by oxygen-reactive species to excess low-density lipoprotein (LDL-c) molecules is responsible for the early stages of atherosclerotic disease, so a reduction in serum levels of lipids becomes a primary step prevention of vascular diseases. Jabuticaba (*Plinia jaboticaba* (Vell.) O. Berg), known as the Brazilian "berrie", has aroused interest in the scientific community due to the content of phenolic compounds, especially anthocyanins, in their peel. This study evaluated the effect of administration of different doses of jabuticaba peel phenolic extract (JPFE) on hypercholesterolemic rabbits serum biochemical profile. In this trial, 36 rabbits, New Zealand, males, were divided into 6 groups: control diet, hypercholesterolemic diet (HD), HD + 0.4 mg EFJC•kg⁻¹•day⁻¹, HD + 0.8 mg JPFE•kg⁻¹•day⁻¹, HD + 0.4 mg JPFE•kg⁻¹•day⁻¹ on alternate days and HD + 0.3 mg simvastatin•kg⁻¹•day⁻¹. The animals were treated for a period of 50 days and blood was collected at 0, 30 and 50 days. The serum concentrations of triacylglycerols (TAG), total cholesterol (TC), LDL-c and high density lipoproteins (HDL-c) were evaluated. Plasma lipid concentrations were used to calculate atherogenic index (AI) and coronary risk index (CRI). The results showed that JPFE supplementation prevented elevation of TAG and LDL-c concentrations in the animals that consumed it daily. In addition, JPFE administration was able to raise HDL-c levels in all experimental groups. JPFE also reduced AI and CRI indexes. Thus, the daily consumption of JPFE minimizes the damages caused by a high cholesterol diet, exerting protective effect against cardiovascular diseases.

Keywords: antioxidant, cardiovascular risk, phenolic compounds, anthocyanins



PS 1-6:

INVESTIGATION OF BIOACTIVE MOLECULES AND ANTIOXIDANT CAPACITY OF IRANIAN POMEGRANATE CULTIVARS (*PUNICA GRANATUM* VAR. *PLENIFLORA*)

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Pomegranate was demonstrated to be high in antioxidant activity and strong in phenolic, flavonoid and tannin contents in its fruit, flower, and aerial part. Flowers of ornamental pomegranate (*Punica granatum* var. *pleniflora*) have been used in traditional Iranian medicine. In this study total phenols (TP), anthocyanins (TA), flavonoids (TF) and tannins (TT) content along with DPPH and ABTS scavenging capacity of six ornamental pomegranate cultivars (Koshe Nar Baharestan, Sarvestan, Shahdad, Zinati Saveh, Rijab, Kenar Takht) was investigated. According to our results, Sarvestan cultivar exhibited higher total anthocyanin and Zinati Saveh cultivar exhibited higher total phenols and flavonoids content. Also, Zinati Saveh cultivar exhibited higher total tannins. Also, higher DPPH and ABTS scavenging capacity observed in Zinati Saveh cultivar. Owing to higher bioactive molecules resulting higher antioxidant capacity, Zinati Saveh cultivar has promising potential for human health, results will be presented and discussed.

Keywords: pomegranate, human health, antioxidant capacity, bioactive molecule



PS 1-7:

OPTIMIZATION USING THE RESPONSE SURFACE METHODOLOGY OF EXTRACTION OF PHENOLIC OF JABUTICABA FRUITS (*PLINIA CAULIFLORA*)

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Fruits belong to a specific group of foods whose daily intake is recommended by most dietary guidelines worldwide, because they are rich in nutrients and phytochemicals that help prevent many chronic diseases. Brazil has a great diversity of native fruits, with pleasant flavor and aroma, but that are little explored commercially. The jabuticaba (*Plinia cauliflora*) is genuinely Brazilian fruit, found easily in the Atlantic Forest. Its a fruit with the same shape of grape and color that goes from deep purple to black. Its skins is a potential source of natural antioxidants. The jabuticaba matures rapidly, which leads to immediate consumption, right after harvest. Despite the popularity of jabuticaba fruits throughout the country, its commercial value is not high because it is very perishable (3 days shelf life after harvest). Ultrasound-assisted extraction has become a popular technique due to its capability of improving mass transfer, thereby shortening the time of extraction and reducing the consumption of solvents. This study was aimed at optimizing the ultrasound-assisted extraction of phenolic compounds from jabuticaba fruits using the response surface methodology (RSM). The optimized parameters were extraction time, ethanol concentration, and fruit to solvent ratio, while the experimental responses were total anthocyanin content and total phenolic content. The optimized conditions of ultrasonic assisted extraction for jabuticaba fruits for total phenolic compounds and total anthocyanins formed, extraction time of 62 minutes and ethanol concentration 47.5%. For the fruit to solvent ratio it was not possible to find an optimal point, but an optimum range between 1 and 4% of fruit:solvent for total phenolics and between 1 and 6% fruto:solvent for total anthocyanins.. The response surface methodology was successfully applied to optimize time, ethanol concentration and fruit:solvent ratio involved in the ultrasound-assisted extraction of phenolic compounds and anthocyanins from jabuticaba fruits.

Keywords: anthocyanins, *Plinia cauliflora*, phenolic compounds, bioactive compounds



PS 1-8:

VALORIZATION MULLEINS (VERBASCUMS) PETALS AS NEW FOOD IGREDIENT

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Edible petals of mullein (*Verbascum*) provide new color, texture and vibrancy to any dish. In the present work the edible petals of *Verbascum* were characterized regarding their nutritional value and composition in terms of hydrophilic and lipophilic compounds. In the petals of *Verbascum* were identified fructose, glucose and sucrose. The petals are new sources of bioactive compounds. Mullein is rich of carotene, flavonoids, ascorbic acid, tannins. The author of this research study has concluded that the valuable properties of mulleins edible petals can foster their use for production of jelly tinctures for pastry and confectionery production as a source of new taste and a bright yellow color. Mullein presented content in tocopherols, with alpha tocopherol as the most abundant.

Keywords: mullein, verbascum, carotene, flavonoids, tannins



PS 1-9:

COMPARATIVE STUDY OF CAPSAICIN, ASCORBIC ACID, PHENOLIC AND TOTAL ANTIOXIDANT CONTENT OF PEPPER VARIETIES AT DIFFERENT RIPENING STAGE OF FRUITS

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Peppers are a good source of mineral, vitamin C and antioxidants that are important in the human diet. Pepper is a vegetable with very different varieties in terms of color, shape, taste, aroma, etc. For this reason, the chemical contents of peppers may differ. These differences can also be seen in different fruit maturity periods of the same variety. The objective of present study was to find a relationship between the capsaicin, ascorbic acid, phenolic compound and total antioxidant and maturation in five Turkish varieties of pepper (*Capsicum annum* L.). For this purpose, the Illica, Seyrek, Seraderme, Hunti and Suslu varieties were cultivated under greenhouse condition and sampling was done at three different ripening stage of fruits (mature-green, green degradation and red ripe). We observed a significant difference in investigated parameters content at different ripening stage of fruits. The results of this study highlighted that the capsaicin, ascorbic acid, phenolic compound and total antioxidant content was decreased during fruits maturation in Illica, Hunti and Suslu, but it increased in Seraderme and Seyrek varieties. Therefore, we can conclude that changes in investigated parameters content during fruits maturation depend on the plant genotype.

Keywords: *Capsicum annum* L., biochemical properties, genotypes



PS 1-10:

BIOACTIVE COMPOUNDS AND ANTIOXIDANT CAPACITY IN FRUIT CROPS XOCOTUNA, TUNA AND XOCONOSTLE (OPUNTIA SPP.) IN POSTHARVEST

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In Mexico, the genus *Opuntia* is a very important plant genetic resource due to its wide variability and intrinsic characteristics. The objective of this research was to determine the content of some compounds bioactive and antioxidant potential of xocotuna in comparison with prickly pear and xoconostle (*Opuntia* spp.). Fruits at physiological maturity were harvested in the months of June, August and October of 2013 in El Orito, (22°74'6"N y 102°6'07"W) Zacatecas, México. The variables evaluated were: antioxidant capacity, total phenols content, vitamin C, betalains content, total chlorophyll and carotenes. It was noted that 'Coral' xocotuna cultivar presented statistical differences at 3, 6, 9 and 12 days of storage with the highest levels of antioxidant capacity (between 0.92 and 1.04 mg VCEAC g⁻¹) (vitamin C equivalent antioxidant capacity, VCEAC). The total phenols content was higher in 'Cuaresmeño' with initial values of 44.61 mg GAE 100 g⁻¹, while that 'Amarilla Plátano' had the lowest value with 6.27 mg GAE 100 g⁻¹, (Gallic acid equivalent, GAE). Were found significant differences in the content of vitamin C where xoconostle cultivars showed the highest levels during period evaluated (between 41.80 mg 100 g⁻¹ and 125.98 mg 100 g⁻¹). Regarding the content of betalains, total chlorophyll and carotenes, a high variability was found because the characteristic color of each cultivar. Cultivars analyzed, mainly those of xoconostle and xocotuna, they could be considered an excellent alternative source of vitamin C and antioxidants to be incorporated into the diet or as natural ingredients in other products.

Keywords: betalains, antioxidant potential, vitamin C.



PS 1-11:

PURPLE SWEETCORN - SOMETHING TASTY AND HEALTHY?

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Anthocyanins are a group of red and purple plant pigments found in a range of fruit and vegetables (e.g., strawberry, plum, red grape), but seldom associated with sweetcorn. Anthocyanins have been shown to possess various potential health benefits in relation to antihypertensive and anti-inflammatory activity, as well as preventative activity in age-related cognitive decline and memory loss. Although yellow/white sweetcorn does not normally contain anthocyanin, purple Peruvian maize contains very high concentrations in the kernel pericarp. The current study reports the anthocyanin profile of purple (supersweet) sweetcorn, recently developed from purple Peruvian maize, and the effect of kernel maturity on anthocyanin accumulation. Changes in the anthocyanin content and profile of a purple sweetcorn accession harvested at seven stages of physiological maturity were determined using an optimised extraction procedure and ultra-high performance liquid chromatography–mass spectrometry (UHPLC-MS). A total of twelve anthocyanin components, mainly cyanidin- and pelargonidin-based glycosides, were identified and quantified in purple sweetcorn samples ranging in physiological maturity from 20 to 60 days after pollination (DAP). Total anthocyanin concentration increased with increasing physiological maturity, reaching a maximum 5-6 days after optimum sweetcorn eating stage. Anthocyanin pigmentation was only present in the pericarp layer of the kernel and absent from the endosperm. As kernels matured, the coverage of purple pigment increased from a small spot at the stigma end of the kernel, gradually spreading towards the base of the kernel, and eventually covering the entire kernel. These results are important in relation to kernel colour at the time of sweetcorn harvest, which is harvested at an immature stage, and potential nutritional quality of purple sweetcorn.

Keywords: purple sweetcorn; Peruvian maize; *Zea mays*; anthocyanin; maturity; health; UHPLC-MS



PS 1-12:

ELEVATED ZN CONCENTRATION IN ZEAXANTHIN-BIOFORTIFIED SWEETCORN KERNELS COMPARED TO A COMMERCIAL HYBRID

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Zinc (Zn) and zeaxanthin are components of the nutritional formulation used to reduce the progression of age-related macular degeneration (AMD). A trial was conducted to assess the potential of biofortifying sweetcorn (*Zea mays* L. var *rugosa*) with Zn in a variety biofortified with zeaxanthin, thus allowing sweetcorn to become a dietary source of both Zn and zeaxanthin for AMD amelioration. Two sweetcorn varieties, a standard commercial supersweet 'Hybrix 5' and a zeaxanthin-biofortified hybrid '10-3 × 14-6', were grown in Vertisol in individual pots in a glasshouse and harvested at the eating stage. Five rates of ZnSO₄ provided an equivalent of 0, 0.75, 1.5, 3 and 6 kg Zn ha⁻¹. On a fresh weight (FW) basis, there was a significant varietal difference ($p < 0.001$) in kernel Zn concentration, with 'Hybrix 5' having 2.57 ± 0.15 mg Zn kg⁻¹ and '10-3 × 14-6' having 7.13 ± 0.22 mg Zn kg⁻¹; approximately a three-fold difference. Fertilisation rate, however, was not significant ($p = 0.677$), with only a maximum of 0.9 mg Zn kg⁻¹ FW difference between the lowest and highest rate. Interestingly, the pollination of '10-3 × 14-6' was generally poorer than 'Hybrix 5', resulting in higher kernel numbers per cob developing on the latter. Hence pollination differences may possibly have influenced the Zn concentration in '10-3x14-6' by reducing inter-kernel competition for Zn transported into the cob. These results suggest that sweetcorn kernels have potential to accumulate high Zn concentrations and therefore could be a target crop for Zn biofortification. The lack of a Zn fertilisation effect also indicates that genetic biofortification could be more effective at achieving elevated Zn concentrations in sweetcorn kernels than agronomic biofortification. Further work is required to ensure that the effect of kernel fill percentage on kernel Zn concentrations is not confounding results.

Keywords: zinc, sweetcorn, biofortification, micronutrient deficiency, agronomic, genetic, *Zea mays* L.



PS 1-13:

CONTROL EFFICACY OF CA-CONTAINING FOLIAR FERTILIZERS ON BITTER PIT IN 'FUJI' APPLE AND EFFECTS ON THE CA AND N CONTENTS OF APPLE FRUITS AND LEAVES

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The preharvest application of Ca-containing foliar fertilizers can reduce BP incidence in apples and improve fruit quality by increasing the Ca content and decreasing both the N content and the N/Ca ratio in fruits. In this study, we aimed to investigate the control efficacy of Ca-containing foliar fertilizers on BP in apples and the effects on the Ca and N contents in 'Fuji' apple by spraying the foliar fertilizer containing calcium chloride (CaCl_2), calcium nitrate [$\text{Ca}(\text{NO}_3)_2$] or calcium formate [$\text{Ca}(\text{HCOO})_2$] at the early stage [5 days after full bloom (DAFB) + 40 DAFB] and at the late stage (80 DAFB + 125 DAFB). The Ca content of apple fruits was increased and the N content and N/Ca ratio of apple fruits were decreased, however the Ca content, N content and N/Ca ratio of apple leaves were differentially influenced. The BP incidences were reduced significantly with the reduce percentage of 43.2~73.0%, and the efficacy of spraying at the early stage was significantly higher than that of spraying at the late stage. The foliar fertilizer containing $\text{Ca}(\text{HCOO})_2$, CaCl_2 or $\text{Ca}(\text{NO}_3)_2$ could be used at preharvest for the control of BP in apples and quality improvement of apple fruits.

Keywords: Bitter pit in apple, Ca-containing foliar fertilizer, Ca content, N content, N/Ca ratio



PS 1-14:

PEACH ALFA-EXPANSIN PPEXP1 HAVE POTENTIAL OF HYDROLYSIS ACTIVITY AGAINST CELLULOSE

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Expansins are cell wall-loosening proteins known for the endogenous functions in cell wall extensibility during plant growth and development. Also, expansins have closely related peach fruit softening. However, the exploration of the function of alfa-expansin is rarely reported. In the present study, the function of alfa-expansin as a protein was conducted to investigate the potential of hydrolysis activity against cellulose. The results indicated that PpEXP1 could not hydrolyze to cellobiose, cellotriose, and cellotetraose. However, PpEXP1 hydrolyzed not only cellopentaose but also cellopentaose. Furthermore, PpEXP1 significantly decreased in viscosity of carboxymethyl cellulose (CMC) and other polysaccharides which using AMVn automated microviscometer. These results suggested that PpEXP1 have cellulose-like hydrolysis activity.

Keywords: expansin, cell wall, recombinant PpEXP1



PS 1-15:

CHANGES IN SUBCELLULAR LOCALIZATION OF ENZYMES INVOLVED IN ASCORBATE-GLUTATHIONE CYCLE DURING THE MATURATION OF SWEET PEPPER (*CAPSICUM ANNUUM* L.) FRUIT

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Ascorbate-glutathione cycle is implicated in the scavenging of reactive oxygen species, and has an important role in defensive processes against oxidative damage. In previous study it was found that the ascorbate content and the enzyme activities of ascorbate-glutathione cycle in sweet pepper (*Capsicum annuum* L.) fruit increased during maturation, and that these processes were correlated (Imahori et al. 1998). Thus, changes in subcellular localization of enzymes involved in ascorbate-glutathione cycle during the maturation of the sweet pepper fruit were investigated. The process of fruit maturity was divided into four stages: the Green stage, the fruit has no yellow pigment. At the Green/Yellow stage, the fruit has 10-20 % yellow surface, whereas, in the Yellow/Green stage, the fruit has 50-60 % yellow surface. In the Yellow stage, the fruit is completely yellow. Subcellular fractions were prepared by differential centrifugation. From the determination of marker enzyme activities in each fraction, all four enzymes (ascorbate peroxidase (APX), monodehydroascorbate reductase (MDHAR), dehydroascorbate reductase (DHAR) and glutathione reductase (GR)) were found in chloroplast, mitochondrial, microsomal, and cytosolic fractions. APX and MDHAR activities during the maturation of the sweet pepper fruit increased in chloroplast and cytosolic fractions but not in mitochondrial and microsomal fractions. GR activity during maturation increased in cytosolic fraction but not in chloroplast, mitochondrial and microsomal fractions. However, DHAR activity during maturation remained nearly constant in all fractions. Considering the ubiquitous distribution of enzymes involved in ascorbate-glutathione cycle in sweet pepper fruit, it is thought these enzymes constitute the main scavenging of reactive oxygen species during maturation. These results indicate that the increases of APX and MDHAR activities during the maturation in chloroplast and cytosolic fractions could be enhanced the ascorbate metabolism during the maturation of the sweet pepper fruit.

Keywords: sweet pepper, maturation, ascorbate-glutathione cycle, subcellular localization



PS 1-16:

THE COMPOSITION AND CHANGE OF AROMATIC SUBSTANCES IN THE FRUIT DEVELOPMENT OF TWO COLORS TOMATO

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In order to explore the volatiles change law of two different color tomato fruit in the development process, aromatic substances were identified and analyzed by headspace solid phase microextraction (SPME)-gas chromatography-mass spectrometry (GC-MS) technology. The results indicated that the total numbers of aromatic substances of green color tomato were 28, 28 and 15 more than the red one at green stage, turning stage and full mature stage, respectively, while the red color tomato were 7 more than the green one at mature stage. The total numbers of hydrocarbons, phenols, esters, alcohols, ketones, and aldehydes substances of green color tomato were 12, 11, 3, 2, 1 and 1 components more than the red one in the whole development period, respectively. The acids and others substances of green color tomato were 3 and 7 components less than the red one. The phenols substances of red color tomato were not identified at mature stage. The total mass concentration of aromatic substances of the red tomato were 359.59 µg/kg, 2099.64 µg/kg, 4579.16 µg/kg and 6055.95 µg/kg higher than the green one successively from green stage to full mature stage. At mature stage, the mass concentration of the alcohols, aldehydes and ketones substances of red color tomato were 1803.01 µg/kg, 1592.1 µg/kg and 1013.87 µg/kg higher than the green one while the relative mass concentration of these substances of red color tomato were 12.7%, 8.72% and 13.63% higher than the green one. At the same time, the relative mass concentration of the esters, acids and phenols substances of green color tomato were 19.68%, 7.66% and 8.03% more than the red one. The differences of aromatic substances were obvious between the two color tomato at different ripening stages.

Keywords: tomato, fruit color, aroma, gas chromatography-mass spectrometry (GC-MS)



PS 1-17:

DESCRIPTIVE ANALYSIS AND CONSUMER ACCEPTABILITY OF LOCALLY GROWN AND COMMERCIALY GROWN SPINACH

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The consumer demand for locally grown fresh produce is continuously increasing in the United States. The high tunnel systems have been successfully utilized by small acreage growers for local production. Consumers are typically assessing appearance, freshness, flavor and aroma when purchasing produce. A common perception is that locally grown produce tastes better than non-local. However, there is not much information about the effect of locality on the consumer acceptability and sensory characteristics of spinach. The objective of this study was to identify consumer acceptability and the sensory characteristics of locally grown spinach in open field or in high tunnel and non-local commercially grown spinach. The consumer study (n=205) was conducted at Kansas State University, Olathe campus, and the descriptive sensory analysis was conducted by a highly trained descriptive analysis panel in the Center for Sensory Analysis and Consumer Behavior at Kansas State University, Manhattan campus, in spring 2017. Spinach, *Spinacia oleracea* cv. “Corvair” was grown in open field and in high tunnel at Kansas State University Olathe Horticulture Research and Extension Center (OHREC) in spring 2017 and the commercially grown spinach was purchased at a local retail store. Consumer questionnaires evaluated the preference of the three types of spinach on the basis of appearance, overall liking, flavor and texture using a 9-point hedonic scale. The consumer test showed that high tunnel spinach scored significantly higher in overall liking.

Keywords: consumer testing, descriptive sensory analysis, local food production, quality, spinach



PS 1-18:

EFFECTS OF BAGGING PRACTICES ON STRAWBERRY QUALITIES AND THEIR MECHANISMS

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Non-woven fabric is widely used in modern agriculture to replace polyethylene because of its ventilation and environment friendly. Some chemicals have to be used to control disease and pest in strawberry production. Chemical residues become more and more concerned since strawberries are not easy to wash and sometimes consumers like to eat without washing in pick your own farm. This experiment tried strawberry bagging production using non-woven berry bag to solve the problems of chemical residues and to guarantee a clean strawberry production. The berry bags made of white non-woven which is ventilated and 85% of transmittance, were used for strawberry cultivars 'zhangji' and 'fengxiang' in greenhouses. Four different bagging times, 4, 8, 12 and 16 days after bloom, were design to screen the proper time of bagging by evaluating some berry qualities. Some anthocyanin biosynthesis and regulated gene expressions were studied after finding a significant increase in anthocyanin content because of bagging. The main results showed that bagging significantly increased soluble solid content, Vc content, firmness, the indices of appearance and taste evaluation, and lowered weight loss rate. The results also showed that bagging increased anthocyanin accumulation and its related gene expression in both cultivars. Bagging significantly increased the expression of CHI, DFR, ANS, ANR, bHLH3 and TTG1 genes in both cultivars and significantly lowered the expression of MYB1. It is concluded that bagging with non-woven bags improves strawberry quality and influences the expression of anthocyanin synthesis genes. The appropriate bagging time is suggested to be 8 to 12days after bloom.

Keywords: strawberry, Non-woven bags, berry quality, anthocyanin content, anthocyanin bioynthesis genes



PS 1-19:

THE EFFECTS OF THE SUPPLY CHAIN ROUTES AND PRE-STORAGE TREATMENTS ON THE MICROBIAL QUALITY OF TOMATOES

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The effect of disinfecting tomatoes with different solutions (anolyte water, chlorinated water and hot water) or coating tomatoes (with Gum Arabic), on the microbiological quality of tomatoes during storage after transportation in non-refrigerated trucks along three different supply chain routes was evaluated. Pink-matured tomatoes were treated, stored at either ambient (25 °C) or cold (11 °C), and sampled on day 0, 16 and 30 for quality assessment. An experiment was laid out as a factorial design, split-plot, with supply routes as main plots, storage conditions as subplots and a random allocation of disinfection treatments within subplots. There was highly significant difference ($P < 0.001$) in the total aerobic bacteria load ($\log \text{cfu cm}^{-2}$) and marketability (%) of tomatoes in different supply routes, storage environments, and different treatment with disinfectants. Anolyte water was the most effective treatment, which reduced the initial microbial load significantly ($P < 0.001$) from 4.828 to 3.779 and 2.835 $\log \text{cfu cm}^{-2}$, under ambient temperature and cold storage, respectively. This represented the highest log reduction of 1.049 and 1.993 $\log \text{cfu cm}^{-2}$, for ambient storage and cold storage, respectively, when compared to untreated samples from Letaba. Furthermore, three-way interaction of supply route, disinfectants, particularly anolyte water, with low temperature storage remained the most superior treatment in controlling microbial load (by 3.779 $\log \text{cfu cm}^{-2}$ reduction) and maintaining marketability of pink-matured tomatoes.

Keywords: postharvest losses, supply chain routes, microbial quality, treatments



PS 1-20:

TOWARDS PRELIMINARY TESTING FOR GMO'S IN AGRICULTURAL SEEDS IMPORTED TO LEBANON

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The great progress in agricultural biotechnology and the production of genetically modified organisms (GMOs) have raised a global concern towards their potential risks on agrobiodiversity. Although Lebanon and most countries in the Near East region are not producers of GMOs, they have started addressing this issue through the ratification of the Cartagena Protocol on Biosafety (CPB), a protocol which controls the handling, transboundary movement and placing in the market of GM crops. Lebanon has also developed its national biosafety framework, whereby a specific law was developed in the context of the implementation of the CPB; however, this law has not been endorsed yet. On the other hand, the existing national sanitary and phytosanitary measures law bans the importation of GM seeds and seedlings. To implement this law, the country relies on the certificates that accompany the seed samples from the countries of export. Accordingly, performing confirmatory GMO testing becomes a must. In this regard, this study is the first GMO analysis of agricultural seeds imported to Lebanon. Maize, tomato and cucurbits will be screened for several GM elements, including the most frequent GM sequences P35S and TNOS, using conventional and real-time PCR.

Keywords: seeds for cultivation; imports; GMOs screening; P35S; TNOS; PCR.



PS 1-21:

SHELF LIFE ENHANCEMENT OF FRESH CUT FRUITS OF AVOCADO TREATED WITH THE ESSENTIAL OILS FROM AERIAL PARTS OF ARTEMISIA AFRA, INCORPORATED IN GUM ARABIC EDIBLE COATING

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The bio-preservation activity of 1% and 3% concentrations of essential oil from the aerial parts of *Artemisia afra* distilled through Solvent Free Microwave Extraction method (SFME) and incorporated into an edible coat from Gum Arabic, on the enhancement of shelf life of fresh cut of Avocado fruits were assayed for 28 days at $4 \pm 1^\circ\text{C}$. The essential oil was analyzed using GC-MS system. The antioxidant components (total phenolics, ascorbic acid and carotenoid contents), pH, browning potential, total soluble solids, microbial loads, fruits microstructures analysis with the aid of scanning electron microscope, colour determination, antioxidant capacity through DPPH method and visual acceptability were used to determine the potential of coated essential oil from *A. afra* as an agent of preservation of fresh cut of Avocado fruits. Results showed that the coated essential oils at 1% and 3% concentrations significantly ($P < 0.05$) enhanced the shelf life of the fresh cut fruits of Avocado compared to uncoated fresh cut fruits of Avocado. The study showed that the 3% coated oil concentration showed higher enhancement than 1% concentration. Based on our findings, the preservation potential of essential oil incorporated in Gum Arabic showed that it could enhance the shelf life of fresh cut of Avocado fruits.

Keywords: Avocado fruits, Essential oils, Gum Arabic, *Artemisia afra*, Shelf Life, SFME



PS 1-22

AGRONOMIC EVALUATION OF SOME STRAWBERRY CULTIVARS UNDER HIGH PLASTIC TUNNEL IN MENEMEN CONDITIONS

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The study was carried in 2011-2012 at Ege University Agricultural Faculty Menemen Research Station and Horticulture Department Laboratories. Some strawberry varieties such as Rubygem, Ventana, Diamante, Sweet Charlie, Elsante, Camarosa, Caminoreal, Albion and Aromas were evaluated in terms of yield and quality parameters according to conventional principles in Menemen conditions. According to the results obtained from the study as well as in those of conventional farming, the Rubygem is widely produced in the region Camaros and Sweet Charlie was determined that yield very similar characteristics in terms of quality. For this reason; Sweet Charlie, the Camaros and Rubyge varieties are considered to be the most suitable varieties for organic and conventional farming. Because of red spider damage Elsanta, Ventana, Albion and Diamante showed significant yield and quality losses.

Keywords: Strawberry, Quality Parameters



PS 1-23:

EFFECT OF FORMULA FERTILIZATION ON FRUIT QUALITY AND TREE NUTRITIONAL STATUS OF 'QIUYUE' PEAR

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At present, there are many problems on fertilizing in pear orchards, such as excessive chemical fertilizers, especially excess nitrogen, even no less organic fertilizer, nutritional elements imbalance and so on. These problems lead to the decrease of fruit quality and economic benefits, which directly hinders the healthy development of pear industry. Using "Qiuyue" pear as materials, through soil fertilization, this test studied effects of five organic-inorganic formula fertilizer treatments (i. e. formula fertilizer, formula fertilizer + N, formula fertilizer + P, formula fertilizer + K, and formula fertilizer + K + B) on fruit quality and tree nutritional status, which was aimed at selecting appropriate fertilizer formulas and providing a scientific basis for reasonable fertilization. Results were shown as follows. 1. in the effects of formula fertilizers on fruit quality, the treatment of formula fertilizer had the best effects on improving fruit quality among the five treatments. Compared with other treatments, the treatment of formula fertilizer increased soluble solids content 0.77%-1.71%, total sugar content 2.98%-9.74%, sugar-acid ratio 2.92%-21.85%, single fruit weight 9.42%-23.18% and reduced titratable acid 0%-10% of "Qiuyue" pear. 2. in the effects of formula fertilizers on tree nutritional status, the treatment of formula fertilizer + K had the best effects on improving tree nutritional status among the five treatments. Compared with other treatments, the treatment of formula fertilizer + K increased branch length 9.75%-17.76% and branch diameter 5.76%-9.86% of the "Qiuyue" pear. Keywords: pear orchard, pear industry, fertilization, nutritional elements imbalance, chemical fertilizer, organic fertilizer, organic-inorganic formula fertilizer



PS 1-24:

ISOLATION AND IDENTIFICATION OF BACTERIAL MICROORGANISMS WITH PUBLIC HEALTH IMPLICATIONS IN TOMATOES SOLD IN PIETERMARITZBURG, KWAZULU-NATAL

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Apart from fruits and vegetables being considered as nutritious and healthy foods, a rising concern of these foods being vectors for human pathogens to their human hosts exists. This study was aimed at identifying and isolating bacterial pathogens that pose a threat to human health from tomatoes sold in Pietermaritzburg. 40 tomato samples were collected from two sources (supermarket and street vendor). This resulted in four batches (AR, AO, BR, BO): ripe samples from source A, overripe samples from source A, ripe samples from source B and overripe samples from source B. These tomato samples were homogenised and serial dilutions from dilution 10^{-2} to 10^{-4} were prepared. Spread plates on Nutrient agar (NA), MacConkey (MAC) agar and eosin methylene blue (EMB) agar were conducted and incubated at 37°C for 24 hours. Colony counts and morphologies were recorded and the obtained colonies were subjected to bacterial staining. Biochemical test were conducted and the isolates were identified. A positive correlation between the average pH and the average CFU/ml was observed. Sample type BO had the highest average CFU/ml followed by sample type AO, AR and BR. Nine bacterial genera were identified and all of them are known to be pathogenic to humans. The most prevalent genus was *Enterobacter* spp. followed by *Klebsiella* spp., *Escherichia* spp. and *Bacillus* spp. The average CFU/ml for the aerobic, coliform and faecal coliform counts exceeded the acceptable limit. Therefore, the consumption of these tomatoes could present health effects upon human ingestion suggesting a need for control measures.

Keywords: Foodborne pathogens; tomatoes; coliforms; food safety



PS 1-25:

DECOMPOSITION OF CARBARYL INSECTICIDE IN OYSTER AND JEW'S EAR MUSHROOM

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The carbaryl residues in oyster mushroom, Jew's ear mushroom and cube of mushroom by spraying insecticide at the instruction (850 ppm) and doubling rates (1,700 ppm) was also investigated and compared with the control group (distilled water). They were sprayed three times; before flower opening 7 days, the day flower opening and after flower opening 7 days. Samples were collected on 0 (immediately after spraying), 1, 3 and 6 days. Sample was extracted and analyzed for the amount of insecticide residue by GC-MS. The result showed that oyster mushroom when sprayed at the instruction rate, the residues on 0, 1, 3 and 6 days were 40.52, 3.13, 0.37 and 0 ppm, respectively. Carbaryl residues of Jew's ear mushroom were 49.60, 13.44 and 0.45 ppm, respectively. Beside, in the cube of oyster mushroom gave insecticide residue on day 0 as amount of 1.86 ppm, in the cube of Jew's ear mushroom gave insecticide residue amount of 0.13 ppm. At doubling rate of instruction in oyster mushroom, the carbaryl residues on days 0, 1, 3 and 6 were 90.36, 8.48, 0.76 and 0.35 ppm, respectively. While of Jew's ear mushroom, insecticide residues were 94.21, 33.89, 21.62 and 0.63 ppm, respectively. In cube of oyster mushroom, the insecticide residues on day 0 were 3.75 ppm, in the cube of Jew's ear mushroom gave carbaryl residue amount of 0.80 ppm. In addition, the control group was not detected residue.

Keywords: dissolution, carbaryl, oyster mushrooms, jew's ear mushrooms, residue



PS 1-26:

STORABILITY AND SHIPPING POTENTIAL OF MODIFIED ATMOSPHERE PACKED 'SAMAR BAHISHT CHAUNSA' MANGOES AT TWO DIFFERENT STORAGE TEMPERATURES

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The study was conducted to evaluate the storability and shipping potential of Modified Atmosphere packed Samar Bahisht Chaunsa. The fruit was harvested from a commercial orchard at the physiological mature stage. After harvesting, the fruit was physically de-sapped and subjected to prochloraz (0.5ml/L) dip followed by air drying, packaging and transport to PRTC in a reefer van at 18°C. The mangoes fruit were divided into two lots followed by packaging in MAP bagged (Fresh 'n' Smart® type of MAP bags) and un-bagged (control). These packed fruits were stored at two different storage temperature (12°C and 17°C; 85-90% RH) for four 8, 18, 25 and 30 days storage. The Color development was greater in un-bagged fruits kept at 17°C during ripening stage, while as concerned with chilling injury; more symptoms of discoloration were observed at 12°C as compared to 17°C. Fruit weight loss and skin shriveling were significantly different regarding packaging, storage temperatures and storage periods. Similarly, un-bagged fruits had more lenticels and sap index than bagged. At 17°C and in un-bagged fruits, weight loss was higher, while minimum weight loss was observed at 12°C in MAP bagged fruits. As regards the MAP environment, a consistent increase in CO₂ was observed at both temperatures and was higher on the 18th day of storage (18% at 12°C and 25% at 17°C). At both temperatures (12°C & 17°C), the taste was significantly better in the fruit that removed after 8 days of cold storage; where the non-MAP bagged mangoes had a better taste as compared to MAP bagged at 12°C and vice versa in case of 17°C. At both temperatures, the taste score was significantly decreased after 18 days storage period. Further studies are needed to explore optimal MAP bagging type, understand the physiological changes in S.B. Chaunsa and rectify the issue of poor skin color development and off-flavor production.

Keywords: mangoes, modified atmosphere packaging, post-harvest quality



PS 1-27:

GROWTH AND PHYSIOLOGICAL RESPONSE OF BABY-LEAF VEGETABLES *CREPIDIASTRUM DENTICULATUM* AS AFFECTED BY LIGHT INTENSITY AND QUALITY IN ENVIRONMENTAL-CONTROLLED PLANT SYSTEM

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The social structure change of one-person household formed the convenience food market and consumption of baby-leaf vegetables predicts to increase further. To diversity and refine the baby-leaf vegetables market, looking for new vegetables is important. *Crepidiastrum denticulatum* is Korean native wild vegetables which has a bitter taste and aroma. Light affects the growth, quality and flower of plant and there are many studies on light environment. The objective of this study was to find out the effect of light intensity and quality on the growth and physiological responses of baby-leaf vegetables '*Crepidiastrum denticulatum*'. When cultivated for 21 days at four light intensity treatments (50, 100, 250 and 500 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$), the highest shoot growth was showed at 100 and 250 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ while root growth was good at 500 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$. And plants were grown at five light quality treatments (Red, Blue, White, RBW and RB-UV) under 150 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ LED light source for 25 days. Plant height, leaf length and leaf width were the longest at Red treatment and number of leaves was higher in Blue treatment. But dry matter ratio was higher at RBW treatment. There was no significance in fresh weight of shoot between treatments. As a result, the response of growth characteristics was different in light quality treatments. On the other hands, the color of leaves was showed reddish in over 250 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ and RB-UV treatment with 1% or more UV wavelength band.

Keywords: dry matter ratio, fresh weight, leaf color, wild vegetables



PS 1-28:

COMPARISON OF PHENOLIC COMPOUNDS AND ANTIOXIDANT CAPACITY OF UZUN PISTACHIO (*PISTACIA VERA* L.) VARIETY

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Nut consumption has positive effect on human health due to the rich in phenolic and antioxidant content. As a valuable member of Anacardiaceae, pistachio (*Pistacia vera* L.;;) nuts are also abundant in phenolic compounds and antioxidant capacity. In this study, it was aimed to characterize phenolic composition and antioxidant capacity seeds and skins (testa) of “Uzun” pistachio variety. Based on the HPLC results, the total content of phenolic compounds in pistachio nuts was shown to be significantly higher in skins than in seeds. Similar results were obtained by total antioxidant capacity by means of two different assays (DPPH and Folin-Ciocalteu colorimetric method.

Keywords: Pistachio, phenolics, total antioxidant capacity, HPLC.



PS 1-29

EFFECTS OF STORAGE CONDITIONS ON THE RATE OF WALNUT QUALITY DETERIORATION

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Walnut quality deteriorates during storage after harvest and the rate of deterioration can be influenced by environmental conditions during storage. The influence of temperature and relative humidity on the rate of quality deterioration was determined during 12 months of storage for four walnut varieties. Quality evaluation included kernel color, fungal decay, oil oxidation and sensory quality, and these parameters were associated with storage temperature and walnut moisture content and water activity. Walnuts were stored at 5, 15 and 25°C at 20, 40 and 60% RH in year 1 and at 40, 60, and 80% RH in year 2. Lower relative humidity in storage (40% and 20%) resulted in higher water activity relative to moisture content, and higher relative humidity in storage (60% and 80%) resulted in walnuts with lower water activity relative to moisture content. Kernel color darkens over time. Temperature had a more obvious effect on kernel darkening than relative humidity. Kernels stored at 5 or 15°C darkened during the first 6 months, but remained stable thereafter. Kernels stored at 25°C continued to darken throughout the storage period. Kernel color darkened more at lower relative humidity. Temperature played a greater role than relative humidity oil oxidation, with higher temperatures promoting faster oxidation. Peroxides from oil oxidation increased significantly for 6 to 9 months and then stabilized or decreased. Nuts stored at low relative humidity showed greater oil oxidation. Fungal decay was found in walnuts stored at 25°C. Sensory results will also be discussed. Overall, results show that storage temperature is very important to reduce the rate of deterioration followed by relative humidity in storage. The relationships between water activity and quality deterioration will be determined for each variety.

Keywords: oxidation, peroxide value, relative humidity, temperature, water activity



PS 1-30:

THE IMPACT OF PACKAGING MATERIALS ON THE QUANTITY OF ACTIVE COMPOUNDS IN CHRYSANTHEMUM TEA

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Chrysanthemum is an herbal tea which is important traditional Chinese tea. Carotenoids and flavonoids are generally considered as the bioactive compounds. Carotenoids in yellow chrysanthemum flowers have medicinal properties to nourish the eyes and the liver. The objective of this work is to investigate the effect of packaging materials on the quantity of active compounds in chrysanthemum tea. Chrysanthemum tea is packaged in different packaging materials, polyethylene bags (PE), polyamide bags (PA), and aluminum bags (AL) for food packaging. The chrysanthemum tea is packaged in polyethylene bags under atmospheric air (PE), polyamide bags under atmospheric air (PA), polyamide bags under nitrogen condition (N-PA), and aluminum bags under atmospheric air (AL) and stored at 4°C, 25°C and 35°C. Chrysanthemum tea is analyzed the quantification of total phenolic by Folin-Ciocalteu methods and β -carotenes by using UV-visible spectrophotometer. Total phenolic and β -carotene contents are determined every 2 weeks interval for 12 weeks. The results showed that packaging materials and storage temperature significantly affected the quality of chrysanthemum tea. AL could maintain quality of the product significantly better than N-PA, PA and PE, respectively. High temperature makes the quantity of β -carotenes in chrysanthemum tea decreases.

Keywords: chrysanthemum tea, packaging materials, total phenolics, β -carotenes



SESSION II

PS 2-1:

QUANTITATIVE AND QUALITATIVE ATTRIBUTES OF TWO NEW BELL PEPPER CULTIVARS, IDEAL AND CARMIN, GROWN IN CONVENTIONAL AND ORGANIC FARMING SYSTEMS

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Bell pepper crop has found favorable pedoclimatic conditions in Romania, especially in the south of the country where it has been registering higher temperature. Currently, the range of bell peppers grown in the country has been being plentiful with foreign cultivars. For example, a percentage of 95% of bell peppers cultivars grown in the greenhouses were from seeds coming from abroad. Due to climatic conditions of Romania, some of the foreign cultivars did not adapt to their true potential and some have been being lack of nutrient value. As a result of all this, a research program for obtaining autochthonous cultivars has been developing to meet the requirements of farmers, processors and consumers. Recently, two new cultivars of bell peppers, Ideal and Carmin have been obtained at Vegetable Research and Development Station, Buzau. The aim of this study was to evaluate the quantitative and qualitative attributes of those cultivars in two different crop farming systems: conventional and organic. The experiment has been carried out for two years (2016-2017) at Vegetable Research and Development Station site. During the vegetation period, biometric and phenological observations were made and for physico-chemical analysis, fruits were harvested in two mature stages: green and red. Samples from both crops have been harvested on the same day and the analyzes have been carried out on fresh fruit. An important observation from this study was the significantly higher levels of β -carotene and lycopene registered in the organic crop. Regarding yield potential, significantly higher values were recorded on Ideal cultivar in conventional farming system.

Keywords: *Capsicum annuum* L. Romania, VRDS, Buzau, carotene, lycopene, yield



PS 2 -2:

CARBOHYDRATE CONTENT DURING COLD AND ROOM TEMPERATURE STORAGE OF CARROT AND CENOURETE CULTIVARS

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The composition of soluble sugars is dependent on the developmental stage and biotic and abiotic factors by which the plant is subjected, as well as changes occur during storage. The objective was to characterize the content of soluble carbohydrates in three varieties of processed and whole carrots treated with ethylene and stored at two temperatures. The cultivars Alvorada, Brasília and Esplanada were harvested and the separation of whole carrots and baby carrots type cenoureteã. In each of the groups, half received application of ethylene (10 ppm for 24 hours) and the other half control. Afterwards, carrots were conditioned in plastic bags and stored at 8 °C and 25 °C for 6 days. Samples were taken at every three days three days for analyses of the total soluble sugars, starch, reducing sugars and non-reducing. It was observed that there was increase in total soluble sugar content in the three cultivars and for all treatments, and less pronounced in the cultivar Esplanada. With the exception of the cultivar Alvorada, carrots and baby carrots of the other cultivars had slight increase in starch values during storage. Reducing sugars contents increased over the days, while non-reducing sugars values increased until day 3, respectively, regardless of the cultivar and treatments applied. Thus, the soluble carbohydrates content has slight variation between cultivars processed or unprocessed, application or not of ethylene and storage temperature.

Keywords: *Daucus carota*, minimally processed, total soluble sugars, starch, reducing sugars and non-reducing



PS 2-3:

DEVELOPMENT OF NEW MEAT SAUCES USING FRUIT PROCESSING BY-PRODUCTS

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European food industries generate millions of tons of plant processing by-products annually. Fruit and berry processing industries do not fully utilize potentially valuable raw materials (peels, scores, seeds) that contain a significant amount of vitamins, minerals and dietary fibre. Therefore, is of high importance to develop zero waste technologies to reduce the volume of waste generated by the food processing industry. Dietary fibre has many health benefits, it can reduce risk of heart disease, diabetes and some cancers, and also help weight control. The study is related to new functional food production from fruit and berry processing by-products. The objects of the research: dried press cake of raspberries, American cranberries, sea buckthorn, black currant and red currant, score and flesh part of Japanese quince, and sea buckthorn young leaves with shoots. For the development of the new product, meat sauce “chatny” olive oil, salt, honey and spices are used. The nutrition value of new product including amount of dietary fiber, as well as sensory analyses using line scale were studied. Sensory analyses indicate that all samples of chatny are acceptable as a perspective additive for meat dishes. As the best evaluators noted chatny samples with raspberry and red currant. The fibre content in the chatny varied from 7.4g to 17,1g per 100 g of product. According to Regulation No 1924/2006 of the European Parliament and of the Council on nutrition and health claims made on foods all chatny samples can be labeled to indicate that the product contains high fiber content.

Keywords: Fibre, waste-free technologies, functional food



PS 2-4:

NUTRITIONAL, NUTRACEUTICAL AND FUNCTIONAL PROPERTIES OF BROCCOLI FLOURS OBTAINED FROM CROP REMAINS BY DIFFERENT DEHYDRATION TEMPERATURES

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Broccoli (*Brassica oleracea* L. italica) has been marketed as a health-promoting food because it naturally has high content of bioactive phytochemicals. Florets are the main edible part of broccoli and only represent 30% of the plant, this means that more than 70% of the plant is discarded, generating high quantities of crop remains. However, there is little information published about the use of broccoli crop remains in the food industry. This study presents an alternative to utilize the broccoli residues produced in the field, which represents a problem with respect to its handling and disposal. The aim of this study was to analyze the nutritional, nutraceutical and functional properties of broccoli flours obtained by different dehydration temperatures from several crop remains: florets, footstalks, stalks, leaves and petioles. The crop remains were blanched and dried in a forced air oven at 60, 70 and 80°C. The flours obtained were analyzed for proximate and nutraceutical composition (total phenolics, total flavonoids, total glucosinolates, and ABTS and DPPH antioxidant capacity methods) and physicochemical properties. To determine kinetic parameters, the drying data were fitted to a 4P Gompertz model. The results indicate that the drying temperatures evaluated have no significant statistical effect on nutritional composition. The florets, petioles and leaves flours showed the highest protein, carbohydrate and lipid contents, respectively. The results also reflect that the drying temperature and portion of broccoli plant have significant statistical effect on nutraceutical composition. The leaves flour had the highest phenolic and flavonoid content, whereas florets and stalks flours the highest amount of glucosinolates. All flours presented a high antioxidant capacity. The footstalks, stalks and petioles flours showed high water absorption index and water solubility index. All flours presented similar oil absorption index values. Broccoli flours obtained are good source of nutrients and could be utilized as food ingredients.

Keywords: *Brassica oleracea*, crop remains flour, drying temperatures, functional properties, nutraceutical composition



PS 2-5:

SALICYLIC ACID EFFECTS MAIN QUALITY COMPONENT OF PEAR CV. DR. JULES GUYOT

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The effects of different postharvest salicylic acid (SA) doses on vitamin C and sugar content of “Dr. Jules Guyot” pear were investigated. Fruits were immersed in 0, 1, 2, and 4 mM of salicylic acid, containing 0.01% Tween-20, for 5 minutes. After treatments, fruits were stored for 3 months at 0°C and 90±5 % relative humidity. During the storage period, monthly taken fruit samples were analysed for vitamin C and sugar content using high-performance liquid chromatography (HPLC) equipped with DAD and RID detectors. The total phenolic content was determined by using Folin-Ciocalteu assay, the antioxidant capacity was determined by using ferric reducing antioxidant power (FRAP). Fructose was the dominant sugar in the treatments, followed by glucose and sucrose. The ranges of vitamin C content were between 2.0 to 8,80 mg 100 g⁻¹. The results indicated that antioxidant capacity ranged from 3.30 to 8,55 µmol TE/gFW and that the total phenolic content from 143,70 to 261.22 mg GAE/100 gFW. Results showed that different salicylic acid treatments and storage time significantly affected sugar and ascorbic acid composition of “Dr. Jules Guyot” pear.

Keywords: Pear, HPLC, sugar, ascorbic acid, total phenolic, FRAP



PS 2-6:

EFFECTS OF DIFFERENT DEFICIT IRRIGATION STRATEGIES ON FRUIT QUALITY OF SWEET CHERRY AFTER HARVEST

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The effect of different deficit irrigation strategies on the fruit quality of '0900 Ziraat' sweet cherry variety grafted on Gisela 6 rootstock was investigated after harvest. For this purpose, three different deficient irrigation treatments were applied to fruit of sweet cherry. These different deficient irrigation treatments were non-deficit irrigation (I₁), 25 % deficit irrigation between 30 days after full bloom and harvest time (I₂) and 50 % deficit irrigation between 30 days after full bloom and harvest time (I₃). Fruit were picked at optimum harvest stage and transported to the laboratory immediately. Harvested fruit were placed modified atmosphere packages (MAP) and stored at 0°C and 90±5 % relative humidity for 40 days. During storage, some physical and chemical analyses (weight loss, fruit firmness, soluble solids content, titratable acidity, gas composition in MAP and fruit color) were performed at 10-day intervals. According to the results, different deficit irrigation practices affected fruit quality of sweet cherry cv. 0900 Ziraat after harvest.

Keywords: *Prunus avium*, 0900 Ziraat, MAP, cold storage



PS 2-7:

DURATION OF SUPPLEMENTAL LIGHTING AFFECTS GROWTH AND DEVELOPMENT OF GRAFTED TOMATO PLUG SEEDLINGS

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Tomatoes are an important crop for Korean greenhouse growers. However, successful tomato production is not easily achieved. Tomato production requires highly intensive management and production skills. This study was conducted to find the optimal duration of supplemental lighting for the growth and development of grafted tomato plug seedlings grown in a glasshouse. Two cultivars of tomato (*Lycopersicon esculentum* Mill.) 'Super Sunload' and 'Super Dotaerang' grafted onto the 'B-Blocking' rootstock were grown for 10 days in a glasshouse with an average daily maximum light intensity of $490 \mu\text{mol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$ PPFD coming from the sun with 8, 12, or 16 h/day of mixed LEDs (white: red: blue = 1: 2: 1) at the $100 \mu\text{mol} \cdot \text{m}^{-2} \cdot \text{s}^{-1}$ photosynthetic photon flux density (PPFD). The culture environment had 32°C/25°C day/night temperatures, 85% relative humidity, and a natural photoperiod of 14 h. The results showed that the leaf area had no significant differences among three treatments in both cultivars. For the 'Super Dotaerang', shoot fresh weight, number of leaves, leaf width, leaf thickness, and chlorophyll content in the 12 h/day or 16 h/day treatment were significantly larger than that in the 8 h/day treatment. For the 'Super Sunload', the largest shoot length, shoot fresh weight, shoot dry weight, shoot diameter, leaf length, leaf width, leaf thickness, chlorophyll content, and specific leaf weight were found in the 16 h/day treatment. Overall, the results suggest that the optimal duration of supplemental lighting is 16 h/day for these two cultivars of grafted tomato plug seedlings. This study was carried out with a support from the Korea Rural Development Administration (Project No. PJ01277302). Dong Il Kang, Hao Wei, Chen Liu, Hai Kyoung Jeong, Xiuxia Ren and Luc The Thi were supported by a scholarship from the BK21 Plus Program, Ministry of Education, Republic of Korea.

Keywords: Grafted seedling, supplemental lighting, lighting duration, seedling morphology



PS 2-8

A NEW LOQUAT VARIETY, AYKUT

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AYKUT variety selected from private orchards in the North Cyprus. This variety was elected in an adaptation study conducted in Antalya that was about comparing 46 loquat varieties and selective types (Antalya region and North Cyprus). It was the first registered variety by the Variety Registration and Seed Certification Center in 2015 in Turkey. Some observations of phenological and physical parameters belong to AYKUT variety were performed. Physical parameters were width/length index, fruit weight, flesh to seed ratio, number of seed per fruit, total soluble solids (TTS) and TTS/ acid ratio. Fruit characteristics were recorded at ripe stage when the greenness of the fruits disappeared completely. According to results; AYKUT loquat variety has upright tree and broad elliptic fruits, average width/length index of fruits is 1.08, average fruit weight is 46 g, average flesh to seed ratio is 17%, and average number of seed per fruit is 3.42. Average TTS of fruits is 15 Brix°, TTS/ acid ratio is 3.84. The variety has yellow orange skin color and cream flesh color. Fruits of Aykut variety ripen in late April, 7-10 days earlier than other commercial varieties. Fruits of Aykut variety has high TTS and lower seed ratio, thus, fruits can be consumed freshly and also used for jam and jelly.

Keywords: New cultivar, loquat, quality



PS 2-9:

EFFECT OF LED LIGHT INTENSITY ON GROWTH AND DEVELOPMENT OF GRAFTED WATERMELON PLUG SEEDLINGS

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Watermelon is one of the most popular fruit vegetables with great edible and economic values and is widely grown all over the world. Insufficient amount of light may result in lower quality and longer production period of seedlings in greenhouses for plug growers. Supplement of artificial lighting to plug seedlings may be one solution to this problem. The objective of this study was to assess the effect of light intensity of supplemental lighting on the growth and development of two watermelon cultivars, 'Speed' and 'Sambok Honey' grafted onto the 'RS-Dongjanggun' bottle gourd rootstock (*Lagenaria siceraria* Stanld.). Seedlings were grown for 10 days in a glasshouse with an average daily maximum light intensity of $490 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD coming from the sun with 12 h/day of mixed (white: red: blue = 1: 2: 1) LED at the light intensity of 50, 100, 150 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ photosynthetic photon flux density (PPFD). The culture environment had 32°C/25°C day/night temperatures, 85% relative humidity, and a natural photoperiod of 14 h. The results showed that shoot length, shoot weight, shoot diameter, leaf area, leaf thickness, and root length in seedlings grown in the light intensity of 100 and 150 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD were significantly larger than those grown in the light intensity of 50 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD, while there were no significant differences between 100 and 150 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD. Chlorophyll content, specific leaf weight, and root length showed no significant differences in all three treatments. What's more, no significant differences were observed between two cultivars. Considering the cost, 100 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD would be a better choice. Overall, the results suggest that light intensity of 100 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD is the optimal supplemental light intensity for growth and development of grafted watermelon seedlings.

Keywords: Grafted seedling, supplemental lighting, lighting intensity, seedling morphology



PS 2-10:

EFFECT OF SUPPLEMENTAL LIGHT INTENSITY ON GROWTH AND DEVELOPMENT OF GRAFTED TOMATO PLUG SEEDLINGS

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Light is one of the most important factors influencing the growth and development of plants, especially for those vegetable plug seedlings which have great economic values. Insufficient light will affect the production quality and cultivation time which will cause losses for growers. This research was conducted to determine the optimal supplemental light intensity for two tomato (*Lycopersicon esculentum* Mill.) cultivars 'Super Sunload' and 'Super Dotaerang' grafted onto the 'B-Blocking' rootstock. Seedlings were grown for 10 days in a glasshouse with an average daily maximum light intensity of $490 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ photosynthetic photon flux density (PPFD) coming from the sun with 12 h/day of mixed (white: red: blue = 1: 2: 1) LEDs at the light intensity of 50, 100, or $150 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD. The culture environment had 32°C/25°C day/night temperatures, 85% relative humidity, and a natural photoperiod of 14 h. For 'Super Sunload' the result showed that shoot biomass, shoot length, and specific leaf weight of seedlings grown in the light intensity of 100 and $150 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD were significantly larger than those grown in the light intensity of $50 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD, while for 'Super Dotaerang' shoot biomass had no significant differences in all three treatments. In addition, as compared to the treatment of $50 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD, seedlings grown in the light intensity of 100 or $150 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD showed improved roots with significantly larger root biomass and root length in both cultivars. As the growth characteristics in both cultivars grown in the light intensity of 100 and $150 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD had no significant differences, the supplemental light intensity of $100 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ PPFD would be the best choice considering the lighting cost.

Keywords: Grafted seedling, supplemental lighting, light intensity, seedling morphology



PS 2-11:

THE DIFFERENCES BETWEEN SOME BIOCHEMICAL PROPERTIES OF MINIMAL PROCESSED CHESTNUTS FROM DIFFERENT REGIONS OF TURKEY

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In this research, the differences of some biochemical properties of minimal processed chestnut from different regions were studied. For this purpose; chestnuts from Black sea Region (Samsun), Marmara (Canakkale) and Egean (Kutahya) were initially minimal processed and separated from the peel at optimal harvest maturity. Some biochemical properties such as total sugars, invert sugars, total polyphenols and some aromatic compounds were assessed. According to the results there were significant differences between regions including aromatic compounds, total sugars and total polyphenols.

Keywords: Chestnut, region, minimal processed, biochemical properties



PS 2-12:

RESPONSE OF SWEET PEPPER (*CAPSICUM ANNUUM* L.) TO PLANT DENSITY UNDER FIELD CONDITIONS*

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This study was conducted to determine the effects of different plant densities (2050cm, 3050cm, 20100cm, 30100cm) on plant growth characteristics and fruit yield of sweet pepper (*Capsicum annuum* L.) in open field. Plant height, flower number, plant yield, fruit seed number, 1000 seed weight and vitamin C were assessed at immature and mature. The results indicated that vegetative growth characteristics (plant height, lateral stem number, and leaf number) reduced as plant density increased. The highest plant height, lateral stem number and leaf number were obtained in plants density 30 × 100cm. It was observed that reproductive factors (flower number, fruit weight, plant yield and seed number in fruit) decreased with increasing plant density, but total yield per hectare increased as plant density increased. The highest and lowest yields per hectare were obtained by plant densities 20×50cm and 30×100cm respectively. Also plant density significantly affected on vitamin C and the highest vitamin C was observed in 30×100 cm spacing.

Keywords: Plant density, yield, fruit quality, pepper



PS 2-13:

INFLUENCES OF PLANT DENSITY AND NITROGEN FERTILIZER ON GROWTH, YIELD AND FRUIT QUALITY OF PAPRIKA PEPPER (*CAPSICUM ANNUUM* L.)

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The present research was carried out to evaluate response of paprika pepper (*Capsicum annuum* L.) to plant density and nitrogen fertilizer under field conditions. Plant density at four levels (20 50 cm, 30 50cm, 20 100 cm and 30 100 cm) and nitrogen treatments at four levels (0, 50, 100 and 150 kg/ha) were applied. The results indicated that vegetative growth characteristics (plant height, lateral stem length and leaf number) and reproductive parameters (fruit weight and plant yield) decreased with increasing plant density, but total yield increased with increasing plant density. The highest and lowest yields per hectare were obtained by plant density 20×50 cm and 30×100cm, respectively. Nitrogen rate increasing affected significantly plant height and leaf chlorophyll content. It was observed that fertilization with 50 Kg N/ ha resulted to the best fruit volume and plant yield. There were significant different between some characteristics (fruit weight, plant yield and vitamin C) by interaction plant density and nitrogen treatments.

Keywords: Plant density, nitrogen fertilizer, vegetative growth, yield, pepper



PS 2-14:

COMPETITIVENESS OF SPANISH ORANGE SECTOR IN THE MEDITERRANEAN AREA

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The agricultural matter has always played an important role in holding back the Mediterranean integration process due to the strong complementarity of the agricultures of the coastal countries, which share excellent products including citrus fruits in general and orange fruit, in particular. This research offers some economic information about the competitiveness of the Spanish oranges fruit sector in the Mediterranean Region. Spain is the sixth-largest citrus and oranges producer in the world. In addition, Spain is the largest producer of citrus for fresh consumption. Oranges represent 45% of the total Spanish production of 2016, followed by tangerines, lemons, and grapefruit (less than 1%). In Spain, orange fruit cultivation and production are of clear strategic importance in terms of economic, social and environmental development is mainly located in four regions: Catalonia, the Comunidad Valenciana, Murcia, and Andalusia. However, the globalization of markets has had a huge impact on the traditional concept of the comparative advantage enjoyed by Spain in orange production and exports, highlighting the necessary determinants for competitiveness in the international scenario. A clear dualism emerges among the coastal countries: on the one hand, the North-African and the Near-East countries -extra-EU members- show a dynamic and competitive citrus in general and oranges fruit in particular production mainly thanks to the implementation of effective government policies consistent with the aim to increase the competitiveness of the sector. In fact, this analysis of the competitive advantage of the Spanish orange sector in the Mediterranean over the last 20 years highlight on the whole a positive trend of the orange fruits sector in the Mediterranean countries which, although characterized by an adequate productive structure, suffer in some cases from competitiveness limits. Spain is still the main exporters of Oranges to the EU puts Spain ahead of traditional competitors.

Keywords: Spain, citrus, Mediterranean Region, competitiveness index, exports-imports.



PS 2-15:

EFFECT OF PACKING UNITS DURING LONG DISTANCE TRANSPORTATION ON THE QUALITY AND SHELF-LIFE OF TOMATOES UNDER COMMERCIAL SUPPLY CONDITIONS

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The effect of various packing units on tomato fruit shelf-life and quality was studied, where fruit of three maturity stages (red, pink and green) were transported using plastic bulk bins (468 kg capacity) and carton boxes (8 kg capacity). The fruit was transported along three supply routes, with each route having varying distances and road quality. The fruit was thereafter stored under ambient or cold storage environment (11°C) after treatment using chlorinated water or tap water. Sampling and analysis of fruit colour, firmness, weight loss, pH and marketability was carried out over a 30-day storage period. Fruit harvested at green maturity stage had a mean hue angle of 68 while fruit harvested at pink and red maturity stages had a hue angle of 55 and 49°, respectively. Fruit maturity at harvest and storage environment had a significant ($p \leq 0.05$) effect on all the fruit quality parameters measured. Fruit stored in cold storage had significantly ($p \leq 0.05$) better physicochemical quality attributes compared to fruit stored in ambient conditions. The EM route had a shorter distance and the best road quality (70% of road had IRI values less than 2.5 m km⁻¹) compared to PD (58%) and ZZ (63%) route. Fruit transported through EM had 5 and 10% higher mean marketability compared to fruit transported through PD and ZZ, respectively. Handling using boxes rather than bins improved the fruit marketability by 8% and reduced the cumulative weight loss by 1%. The study recommends the use of modular bins made of softer materials to minimize tomato fruit damage. Similarly, the study has shown that timely maintenance of farm roads and maintenance of the cold chain as important avenues of mitigating postharvest losses in commercial tomato supply chains.

Keywords: IRI, road quality, handling conditions, postharvest quality, tomato fruit injuries



PS 2-16:

EFFECT OF DIFFERENT PARAMETERS ON DRYING TIME IN INFRARED DRYING OF QUINCE

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Quince (*Cydonia oblonga* Mill.) an important winter plant fruit, contains glucose, tannin, pectin, apple acid, sucrose, fiber, potassium and vitamin C and it helps to protect against colds and diseases in winter months, when used regularly. In addition, the high fiber ratio strengthens the intestines and facilitates digestion. In this study, the effect of drying air temperature, slice thickness, dipping solution type, dipping time and dipping solution concentration rate on thin layer infrared drying of quince. According to the results, drying temperature affected the drying time, while it was 196 min at 60 °C, it decreased to 108 min at 80 °C at constant slice thickness of 3 mm. The drying time was 95 min at 2 mm and 195 min at 4 mm slice thicknesses at drying temperature of 70 °C. Dipping quince slice at 3 mm thickness into different solution increased the drying time, while it was 120 min for control samples, it was reached to 213 min for lemon juice applied samples at drying temperature of 70 °C. Changing dipping time in lemon juice for pre-treatment affected the drying time and reached its lowest value as 155 min for 3 min than 1 or 5 min at 70 °C drying temperature and 3 mm slice thickness. According to the results, changing the concentration rate of lemon juice did not affected the drying time.

Keywords: Quince, *Cydonia oblonga*, drying, infrared



PS 2-17:

EFFECT OF DRYING CONDITIONS ON DRYING KINETICS, TEXTURE AND CONSUMER ACCEPTABILITY OF MARULA (*SCLEROCARYA BIRREA*) FRUIT LEATHER

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The effect of different drying temperature and sugar content on the drying kinetics and texture characteristics of Marula fruit pulp was investigated. The drying experiments were conducted in a commercial scale convective dryer. The experimental drying conditions were set at 50, 60 and 70 °C with a sugar percentage level of 0, 5 and 10%. The relative humidity was kept constant (20%) and air flow speed of 0.3 m/s was used. Six empirical mathematical models (Newton, Page, Henderson and Pabis, Logarithmic, Midilli-Kucuk and Approximation of Diffusion) were used to determine the drying kinetics. The texture characteristics of the fruit pulp was determined by using a Texture Analyser. The effective moisture diffusivity increased with increasing temperature and sugar content. The drying of marula fruit pulp occurred in the falling rate period. The moisture diffusivity and temperature followed an Arrhenius relationship. Logarithmic model was the concluded to be the most suitable model for predicting the drying kinetics of marula fruit pulp, since its drying rate constant, k , consistently varied with temperature and sugar content. The texture analysis and sensory evaluation indicated that there was a correlation between the drying parameters texture and sensory attributes of the marula fruit leathers. The results indicate a possibility of controlling the acceptability of marula fruit leathers through controlling the drying conditions.

Keywords: Drying kinetics, texture, moisture diffusivity, Marula



PS 2-18:

EVALUATION OF SOME QUINCE (*CYDONIA OBLONGA* MILL.) CULTIVARS IN TERMS OF JAM PROCESSING

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Quince (*Cydonia oblonga* Mill.) fruit has a share of 3.7% in Turkey's pome fruit production and Turkey has a lot of quince cultivars and types. Fresh quince fruit has been generally consumed as jam/gel/marmalade or sweet. It has been known that quince fruit has rich in health benefit compounds. In this research we investigated the effect of jam processing on health benefit compounds in Cukurgobek, Ekmek, Esme, Kalecik, Limon and Yerkoy cultivars and we tried to select the most suitable quince cultivar for jam processing industry based on jam color and content of phenolic compounds after jam processing in two consecutive years. For this reason phenolic compounds analysis and color measurements were done in samples taken from either fresh fruit or jams. In fresh fruit and also in jams, 3-caffeoylquinic acid, 4-caffeoylquinic acid, 5-caffeoylquinic acid and rutin were quantified and the amount of these health benefits significantly changed among cultivars ($P>0.05$). We observed that jam processing caused significant decrease in phenolic compounds for all cultivars in both years. Similar decreases were important for also Chroma values. A color change from yellow-orange to light brown, slight browning was observed during jam processing in Ekmek and Yerkoy cultivars for both years. Overall, within these cultivars Limon cultivar fruit was evaluated as the most suitable cultivar for jam processing and this was followed by Çukurgobek, Kalecik, Esme and Yerkoy cultivars, respectively. According to the results of two years, Ekmek cultivar fruit was attributed as the most inadequate cultivar for jam processing.

Keywords: Quince, phenolic compounds, color, caffeoylquinic acid



PS 2-19:

YIELD AND QUALITY EVALUATION OF PROCESSING TOMATOES CULTIVARS OBTAINED AT V.R.D.S. BUZAU ROMANIA

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In Romania, tomatoes occupy the largest cultivated area of all vegetable crops, being the most appreciated vegetable due to its multiple possibilities of use. At the beginning, in Romania, foreign cultivars, mostly Bulgarian, have been widely used, but since 1927 the first local cultivars were bred from heirloom tomatoes and they were intensively cultivated. Since that time it have been obtained many Romanian cultivars, most of them being patented and promoted as mixed cultivars, both for fresh consumption and for processing. Of these, only two cultivars were strictly bred for processing as Vidra 533 and Romec tomatoes. Over time, they have been replaced by imported processing cultivars. As a result of this deficiency, since 1996, Romanian research was focused to obtain strictly specialized cultivars. Consequently, five new processing cultivars have been obtained so far, four of which were patented and widely cultivated. This work is aimed to present the newly obtained cultivars that have been evaluated for six years. In the experiment the renowned Rio Grande tomato cultivar was used as control for yield evaluation. Rio Grande and Rio Fuego were used as controls in order to assess the fruits quality. Phenological and biometric measurements and also biochemical analyses of the fruits were carried out during the vegetation period and the results obtained showed that the new cultivars correspond to the undertaken objectives. In what concerns crops yield, all five cultivars surpassed the control yield. Of these, Darsirius and Mariuca have plum-shaped fruits, Kristinica and Florina 44 R have rounded fruits, Florina 44 T has rounded slightly pointed blossom end fruit. Concerning the earliness, Kristinica ranked the first place, its fruits reach physiological maturity at 90 days after planting, and the latest is Mariuca, whose fruits ripen at 130 days after planting.

Keywords: Acidity, sugar, heirloom, dry matter, breeding



PS 2-20:

CALCIUM ASCORBATE TREATMENTS TO CONTROL THE FRESH-CUT APPLE QUALITY REDUCTION WHEN STORED AT HIGH TEMPERATURE

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Previous studies have demonstrated that apple slices dipped into 20% of calcium ascorbate (CaAsc) reduced the browning, allowing a shelf life of 28 days when stored at 4 °C. However, the use of low temperature of storage for fresh-cut fruits could be a tool difficult to implant in some markets or countries. For that reason, the effect of temperature of storage (0, 4 and 8 °C) in 'Braeburn' apple slices dipped in CaAsc (0 and 20% w/w), stored in air for up to 28 days was studied. Changes in antioxidant levels were measured using reducing activity (FRAP) and ascorbic acid content (AA). Changes in browning and sensorial quality were measured to indicate eating quality. CaAsc dips increased the initial levels of AA from 0.19 g kg⁻¹ in the untreated slices to 3.94 g kg⁻¹ for the 20% CaAsc treatment. After 28 days of storage, the AA reduction in treated apples was 33% for slices stored at 0 and 4 °C and 74% when they were kept at 8 °C. For FRAP, the antioxidant activity decrease was of 42; 65 and 69% for slices stored at 0, 4 and 8 °C, respectively. Concerning the overall quality, untreated slices could not reach a shelf life of 7 days at any studied temperature. However, treated apples extended the shelf life to less than 21 days when stored at 8 °C and 28 days when temperature of 0 or 4 °C was used. Then, the use of CaAsc dips in apple slices can moderate the overall quality reduction when high temperatures of storage are used.

Keywords: Ready to use, vitamin C, antioxidant capacity, appearance.



PS 2-21:

PROCESSING FRUITS FROM VANGUERIA INFAUSTA (MAPHILWA) TO OBTAIN INTERMEDIATE MOISTURE PRODUCT

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Fruit leathers are made by drying a very thin layer of fruit pulp to obtain products with an intermediate moisture content. The wild fruits such as *Vangueria infausta* (maphilwa), are seasonal and abundant in some parts of the year in Mozambique, being usually consumed in their natural fresh form so, high amounts are wasted. The study was conducted to prepare fruit leathers of “maphilwa”, by drying in oven at 50 °C, for 48 hours, five samples of fresh or cooked pureé, with or without sugar added. The mass proportions were: (1) 100% of fresh pulp; (2) 100% of cooked pulp; (3) 90% of cooked pulp with 10% sugar; (4) 80% of cooked pulp with 20% sugar and (5) 70% of cooked pulp with 30% sugar. Sample of formulation (5) was also dried in a tunnel dryer at 50 °C, and 3 m/s air velocity. All fruit were then analyzed for physical and chemical characteristics such as color, acidity, water activity, moisture content, Brix and pH. Fruit leathers of 100% of fresh or cooked pulp resulted in acidity between 3.16 and 3.74 and Brix 3.77 ± 0.28 . The results also revealed that addition of sugar, reduced the water activity to 0.547-0.628 and acidity but increased Brix, 4.57-5.00 and intensified the color. Dried fruit letters in tunnel dryer resulted in higher water activity of 0.652 ± 0.001 and Brix (6.93 ± 0.23), and 2.249 ± 0.016 of acidity. The products were within the recommended parameters for this type of products. The combination between low water activity and high acidity show that the products are microbiologically stable.

Keywords: *Vangueria Infausta*, fruit leathers, intermediate moisture, drying



PS 2-22:

THE EFFECTS OF DIFFERENT AVG APPLICATION ON HARVEST TIME, FRUIT YIELD AND QUALITY OF AKÇA PEARS

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Akca pear is early varieties and one of the most grown pears among these varieties in Turkey. Although it is of high quality, it forms smaller fruits in the earlier varieties of pears. In order to investigate the role of AVG (aminoethoxyvinylglycine) application on harvest time, fruit yield and quality of 'Akca' pears. For this reason, this study was carried out for 2 years in 2012 and 2013; an orchard in Isparta-Egirdir Fruit Research Institute. ReTain plant growth regulator was used for AVG. ReTain containing 15% aminoethoxyvinylglycine (AVG) was applied to the 'Akca' pear fruits and leaves. Four concentrations of AVG (0, 100, 125, 150 ppm) and three application times [30, 21, 7 days before commercial harvest (DHB)] were evaluated using field system. Harvest time, fruit yield, fruit size, fruit weight, fruit flesh firmness, titratable acidity (TA), soluble solid contents (SSC), fruit color, ethylene production and respiration rate were determined at the harvest time. As a result, 30 and 21 DBH AVG applications delayed harvest time by 3 days. AVG applications reduce ethylene production and respiration rate. All AVG applications dramatically increased fruit size (%2-16) and fruit weight (%7-57) and fruit flesh firmness (%1-55) of 'Akca' pear. Extra and 1. class fruits were obtained by AVG treatments. SSC, TA has changed according to years and AVG applications, but pH has been found to decrease with AVG applications. When all results are evaluated together, it is considered that 21 DBH AVG applications at 100 ppm will be suitable for 'Akca' pear in terms of both harvest time and fruit quality.

Keywords: Akca, ethylene inhibitor, fruit quality, pear, pre-harvest application



PS 2-23:

INFLUENCES OF PRE-HARVEST PUTRESCINE TREATMENTS ON SOME QUALITY PARAMETERS OF 'ANGELENO' PLUM

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The effects of putrescine on fruit quality and harvest time of 'Angeleno' plum were investigated. For this purpose, putrescine (PUT) was applied with 10 mM and 5 + 5 mM to plum trees 28 days (single spray) and 14 days (double spray) before optimum harvest. All PUT treatments had significant positive effect on the fruit length (mm), fruit width (mm) and weight (g) compared to control treatment. PUT treated fruit had significantly firmness than control fruit. Especially 10 mM PUT, in comparison with untreated fruit, was increased in 9 % fruit weight, 8 % firmness and 6 % SSC. The obstructive effect of all treatments on production of ethylene and respiration rate was clear. All treatments decreased both ethylene production and respiration rate of fruit. As a conclusion, putrescine application to 'Angeleno' plum can be suggested successfully to improvement of the fruit quality.

Keywords: Putrescine, firmness, quality, prunus salicina, ascorbic acid



PS 2-24:

PRE-HARVEST PUTRESCINE TREATMENT CAN BE A PROMISING TOOL FOR POSTHARVEST QUALITY OF SWEET CHERRY CV. 0900 ZIRAAT

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Effects of pre-harvest putrescine (PUT) treatments on storage life and quality of 0900 Ziraat sweet cherry were investigated. Different doses (2.5, 5 ve 7.5 mM) of Putrescine and Tween-20 (0.01 %) (as a surfactant) were sprayed on sweet cherry trees as well as distilled water with Tween-20 (pre-harvest control group) 3 weeks before commercial harvest. Sweet cherry were harvested at optimum harvest maturity and placed in MAP. Packaged fruit were stored at 0°C and 90±5% relative humidity conditions for 50 days. The weight loss, soluble solid contents (SSC), titratable acidity (TA), fruit firmness, fruit stem and skin color, respiration rate, gas composition in package and sensory evaluation (external appearance, taste, decay and pitting) were determined initially and at 10-day intervals. As a result, all doses of PUT treatments gave better results than control samples for investigated quality parameters. The best results in term of stem and skin colour and sensory evaluation were obtained from fruit treated with 2.5 and 5.0 mM PUT. Fruit treated with PUT could be stored with marketable quality for 40 days, but control samples only 30 days. If it is demanded unblemished fruit surface without pitting, these periods can be taken into consideration as 20 and 30 days, respectively.

Keywords: Quality, modified atmosphere packaging, *Prunus avium* L, putrescine



PS 2-25:

A RAPID AND ACCURATE METHOD TO IDENTIFY THE AUTHENTICITY OF PROCESSED MANGO PRODUCTS

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Mango is a very popular tropic fruit and has been widely used in processing products including puree, snacks, drinks, etc. Adulteration of processed mango products is a recurrent and serious problem. Common methods of adulteration include addition of less expensive puree, pulp wash, colorants, and other undeclared additives either alone or in combination to replicate the flavor and taste profiles of true mango. Therefore, authenticity identification methods and techniques are highly demanded by commercial markets and consumers. This study presents a novel rapid and accurate molecular approach in the identification and semi-quantitation of authenticity of processed mango products. DNA sequence between trnL and trnF region were studied and primer pairs MGF3/MGR3 were designed specifically which could detect mango content at levels as low as 0.2%. The sensitivity and specificity of this simple PCR based method were confirmed by testing both of simulated and commercial processed mango products even when samples were boiling cooked and in the complex food system such as mixed vegetable and fruit juices.

Keywords: Mango Products, Specific Primer, Authenticity



PS 2-26:

INFLUENCE OF FRUIT DEVELOPMENTAL STAGE AT TIME OF HARVEST ON QUALITY PROGRESS OF PEAR ALONG FOOD SUPPLY CHAIN

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Pear quality requirements differ along food supply chain. Particularly, fruit flesh firmness is both, crucial for consumer's acceptance and needs of distributors. Post-harvest treatment with 1-Methylcyclopropene (1-MCP) may maintain mechanical properties of pear. However, 'Conference'-pear treated with 1-MCP sometimes stay too firm; not reaching the varietal characteristics of buttery and soft fruit flesh. In the present study, fruit developmental stage at time of application and mechanical properties of pear after 1-MCP treatment were analysed in European pear (*Pyrus communis* L.) 'Conference' grown in commercial orchards in Germany in five consecutive years. Defect free pear were treated with 312 µg kg⁻¹ 1-MCP one day after harvest at 1 °C in airtight container. Storage experiments were carried out in 2015 and 2016 considering fruit quality after storage and in shelf-life. Storage took place 8 weeks in sealed chambers at 1 °C in controlled atmosphere (CA: 1 - 3 % CO₂, 1.5 - 2.5 % O₂) and in air (NA) followed by post-storage shelf-life at 20 °C. Ethylene production was recorded gas chromatographically, while CO₂ emission was measured in a closed system by optical infrared sensors. Fruit flesh firmness [N cm⁻²] was measured according to Magness-Taylor in the equatorial region on a peeled area using a 11.13 mm diameter convex plunger with a velocity of 4 mm s⁻¹ and 8 mm depth of penetration. The results revealed pre-harvest respiratory patterns that were used to determine the harvest date for 1-MCP application. ANOVA results revealed an influence of treatment at the end of shelf-life (CA: F-ratio= 584.48, n=359; NA: F-ratio= 1699.01, n=180), whereas at removal from storage fruit flesh firmness of pear is more influenced by harvest date (CA: F-ratio= 59.84, n=359; NA: F-ratio= 36.62, n=180). Concluding, pre-harvest characterisation of developmental stage is crucial for quality development along supply chain of pear.

Keywords: Pear Quality, Harvest Date, Fruit Flesh Firmness, Respiration Rate



PS 2-27:

EFFECT OF IRRADIATION TREATMENT ON QUALITY AND ORGANOLEPTIC CHARACTERISTICS OF PITAYA (*STENOCEREUS PRUINSUS*)

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After many years of an oil based economy the Mexican government has decided to look back to horticultural crops as important elements of it. Using the exportation rules of the North American Free Trade Agreement (NAFTA) in 2015 they included Pitaya de Mayo and some other cacti fruits to the exportation group. Therefore, these fruits are required to follow the agreed sanitary techniques, among these are the use of Gamma Rays Irradiation of at least 150 Grays. Pitaya is considered an exotic item, hence, no studies have been done on the effect of this process on this fruit. Eighteen fruits of each of two variates of Pitaya, 'Olla' and 'Jarro', were brought from the field and submitted to irradiation treatment at the National Institute of Nuclear Research. They were submitted to 150 and 350 grays for 20 Minutes. Doses were determined based on the minimum required by the Mexico-USA agreement and the capacity of the only Commercial Irradiator located in Matehuala, Mexico. After irradiation Pitayas were brought to the lab and divided in two uneven parts. The first part was submitted to chemical quality tests where we determined pH, total soluble solids (°Brix) and titratable acidity. The second part was used for sensory two ways tests using 50 trained panelists samples. Statistical analysis (ANOVA) for the Chemical Analysis found no differences in any of the measured parameters for varieties, irradiation dose or the interaction between factors. For sensory measurements we used the R rank. Comparing treated vs control samples, we found no difference between tested samples values. In conclusion irradiation showed no effect on quality attributes of Pitaya. This process could be used as a successful quarantine process for exportation.

Keywords: Tropical Fruits, Safety, Cacti Fruit, Quality



PS 2-28:

BIOACTIVE COMPOUND IN FRESH, FRESH-CUT, FROZEN PINEAPPLE AND BIOACTIVE COMPOUND CHANGES IN FROZEN PINEAPPLE DURING STORAGE

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Processing steps of frozen fruit include preparation of the raw material such as trimming, cutting and peeling followed by freezing step. These processes may effect on nutrition and bioactive compound in fruit. Moreover, long term storage also may effect on nutrition and bioactive compound as well. The purpose of this research is to gain the scientific data of effect of fresh-cut preparation step and freezing step on bioactive compound changes in pineapple. Bioactive compounds of fresh, fresh-cut and frozen pineapple was investigated. Fresh, fresh-cut, blanching and frozen pineapples were sampled to measure bioactive compound. Fresh-cut, blanching and frozen processing of pineapple had no effect on flavonoid and β -carotene but decreased in phenolic, vitamin C and antioxidant activity of DPPH radical and FRAP radical. These bioactive compounds were gradually reduced after blanching and freezing process except β -carotene. Fresh-cut, blanching and freezing process had no effect on flavonoid content. Vitamin E of pineapple in all samples showed less than 0.05 mg/100g FW and less than 7 μ g/100g FW of vitamin A. Bioactive compound of pineapple contained 3.91-6.38 mg/g FW of vitamin C, 0.50-0.67mg/100g FW of flavonoid, 38.27-45.01 μ g/ 100g FW of β -carotene, 33.89-39.93mg GAE/g FW of phenolic, antioxidant activity of DPPH radical as 462.96-637.91 μ mol Trolox equiv./g and antioxidant activity of FRAP radical as 12.63-13.94 μ molTrolox equiv./g. Effect of packaging and storage time on bioactive compounds changes in frozen pineapple was also studied. Frozen pineapple kept in vacuum bag (VAC) had higher flavonoid and β -carotene than polyethylene bag (PE) during storage. No significant different of phenolic, vitamin C, antioxidant activity of DPPH radical in both PE and VAC bag was observed. Those bioactive compounds were gradually decreased in both packaging during storage.

Keywords: Bioactive Compound, Frozen Fruit, Pineapple



PS 2-29:

EFFECT OF ACIDIFIED SODIUM CHLORITE AND PACKAGING ON MICROBIAL REDUCTION AND QUALITY MAINTENANCE OF SHREDDED GREEN PAPAYA

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Shredded green papaya is the important raw material for cooking Thai salad (papaya salad) which is the most popular Thai cuisine for both of Thai and foreigner. Major problem of green shredded papaya is the microbial contamination and desiccation caused of short shelf life. This research was studied on dipping green shredded papaya in acidified sodium chlorite (ASC) at various concentrations for 1 min after that it was rewashed with cold water for 1min. The washed shredded papaya was dried by centrifugation and they were kept on polystyrene tray in PE bag without sealing at 10°C. The result showed that 200 ppm ASC reduced microbial contamination when compared with other treatments. The next research was focused on the study of ASC and various packages on maintaining quality of green shredded papaya. Green shredded papaya was packed in polystyrene tray in PE bag without sealing, semi rigid packaging and active packaging. The results revealed that 200 ppm ASC treated shredded papaya was packed in active packaging showing the best quality. This treatment inhibited microbial growth including coliform and also maintained the quality of shredded papaya. It maintained ascorbic acid content and texture, reduced weight loss and got higher score of consumer acceptance than other treatments during 8 day of storage.

Keywords: Acidified Aodium Chlorite, Modified Atmosphere Packaging, Shredded Green Papaya



PS 2-30:

THE EFFECTS OF ETHYLENE ON THE PHYSIOLOGICAL AND BIOCHEMICAL PROPERTIES OF POSTHARVEST LONGKONG FRUITS

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In the exportation of longkong (*Aglaia dookoo* Griff), a common problem facing the exporters is the premature post-harvest shedding of the fruits from the bunch. To cast more light on the issue, this experimental research thus utilized ethephon (i.e. at 0, 200 and 400ppm concentrations) to investigate the effects of ethylene on the physiological and biochemical properties of postharvest longkong fruits, particularly the fruit drop. In the experiments, the longkong fruits were either untreated (0ppm) or dipped in 200 or 400ppm ethephon. The findings revealed that the ethephon treatment significantly increased the fruit abscission and respiration rate. On the other hand, the untreated fruits exhibited a greater amount of ethylene production and the increased polygalacturonase (PG), pectinmethylesterase (PME) and cellulase (Cx) enzyme activities, while the weight loss was noticeably delayed compared to the ethephon-treated fruit group. Nonetheless, the firmness and peroxidase (POD) activity of the untreated and treated fruits were insignificantly different.

Keywords: Longkong, Fruit Drop, Pectinmethylesterase (PME), Cellulase (Cx), Peroxidase (POD), Polygalacturonase (PG)





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WORKSHOP

FRUIT JUICE: From Farm to Glass

Keynote 1. New approaches to production and quality assessment of fruits

Peter M.A. Toivonen

Keynote 2. Sustainability in processing facilities in fruit juice industry

Selim Yildiz

Keynote 3. Economic development of fruit and fruit juice sector in Turkey

Erdogan Gunes

Keynote 4. Sustainable and Integrated Sourcing in Juice Business.

Aslihan G. Kaya



WORKSHOP KEYNOTE.1

NEW APPROACHES TO PRODUCTION AND QUALITY ASSESSMENT OF FRUITS

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Production of the highest quality processed fruit products, including juices, requires sourcing of the fruit with the highest internal quality. There are three components to ensuring the fruit has the highest internal quality; 1) orchards which produce the fruit adopting production practices focused on generating high quality, 2) harvest practices and logistics of delivery to the production plant focused on preserving the at-harvest quality as best as possible, and 3) quality assurance practices to allow the processor to segregate high quality fruit from fruit of lower and/or unacceptable quality prior to processing. In my work regarding evaluation of orchard practices leading to enhanced fruit internal quality, it has become clear that canopy management strategies, irrigation strategies and nitrogen nutrition are all important determinants of internal quality affecting processing value. At harvest and after harvest logistics practices can also have significant influence on fruit quality at the time of processing. Quality changes during this phase can be accentuated if a storage or long distance shipping component is required to either manage product supply for processing or to source product from distant production areas. Despite good production and after harvest logistics, there continues to be a need for fruit quality assessment to allow the processor to segregate poor or sub-optimal quality from the processing stream. There have been many recent advances in measuring internal quality of fruit using non-destructive techniques and there is promise in the future to place such technologies into sorting lines to automate the process of ensuring that only the best quality fruit is used for the production of juices.

Keywords: Maturity, preharvest factors, postharvest performance, vis-NIR spectrometry, storage disorders



WK.2

SUSTAINABILITY IN PROCESSING FACILITIES IN FRUIT JUICE INDUSTRY

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At Tetra Pak the approach to sustainability is shaped by the brand promise: PROTECTS WHAT'S GOOD. Clearly, that's about protecting food through the processing, packaging and servicing activities that have long been at the core of the business. But it goes further. It is about protecting futures: by developing the products and services that will support the future business growth of the customers; by acting and operating in ways that best protect the future of our environment. At Tetra Pak, we work in the design and development of processing and packaging solutions that minimise product losses and the use of water and energy. With climate concerns, fresh water scarcity and environmental legislation all increasing, we are convinced that sustainability – reducing impacts throughout the value chain - is the only way forward. We also understand how the environment and good housekeeping (economy) reinforce one another. So, protecting the environment in which you operate not only reflects good corporate citizenship; it also makes good business sense. The only way forward for sustainability:

- Energy reductions result in reduced CO2 emission and lower operational costs.
 - Decreased water consumption saves money and reduces the strain on fresh water resources.
 - Lower product losses limit environmental impact in the whole supply chain, emit less effluent load and at the same time reduce raw material and sewage treatment costs
- Keywords: Fruit, economy, juice industry, market, growing

Keywords: Sustainability, environment, resources, energy, product losses, future, processing



WK.3

NEW APPROACHES TO PRODUCTION AND QUALITY ASSESSMENT OF FRUITS

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Turkey has suitable climatological conditions for fruit growing in most of regions and country is one of the luckiest because of a lot of fruit species such as hazelnut, pistachio, walnut, apple, pear, quince, apricot, sweet and sour cherries. The fruit sector has tended to development in recent years in Turkey and it will develop not only production but also export values. Nowadays, Turkey is the first producers of the world at hazelnut, sweet cherry and fig production, and is the second for apricot production and is the third biggest producer country for sour cherry, chestnut, olive, pistachio and quince. The cultivation of fruit species mentioned above has been realized since very old years in Turkey' land. Many factors involved in fruit growing positively affected fruit sector in Turkey. It can be seen that consumer consciousness about health benefits of fruit, application of advanced fruit growing techniques and supports and encouragements by Government effected increase in fruit sector inside of country. Fruit sector is attractive for foreign capital investment and for this reason foreign companies are willing to agricultural investment, especially fruit growing. Low-interest credit applications for greenhouse cultivation, use of certified nursery plant, production of certified plant production, organic agriculture, good agricultural practices etc. are available today. Changes in consumption forms of fruit over time encourages fruit sector. Fruit juice plants cause to increase fruit demand in this sector. Contract farming applications between the fruit juice plants and producers have increased grower's tendency to grow fruit species and/or cultivars whose market is ready.

Keywords: Fruit, economy, juice industry, market, growing



WK.4

SUSTAINABLE AND INTEGRATED SOURCING IN JUICE BUSINESS

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As the world population is expected to reach 9 billion people by 2050, agriculture will be one of the top sectors facing multiple challenges. Sustainable agriculture and sourcing has the potential to help address these challenges by playing a vital role in providing quality food, tackling climate change and protecting life on land. Anadolu Etap, as Turkey's largest fruit grower and fruit juice producer, has been established in 2010 to meet the market demand for high quality fresh fruits. On a land of 3.000 ha with 8 farms and 5 million trees, more than 100 different types of fruits are grown. The farms are located throughout Turkey to benefit from geographical advantages at its best and to provide sustainable and long term high quality fruits. Experienced Turkish and foreign engineers apply best practices in the world together with modern hi-tech growing techniques. It is also the first agricultural company in Turkey to publish and commit itself to Sustainable Agriculture Principles. To increase the standards in fruit growing and to provide sustainability, Anadolu Etap established a training center called "AgroAcademy" and supports women workforce in the farms and trains women farmers (70%); who then become sourcing partners as fruit suppliers. As Turkey's first large-scale fruit juice production company Anadolu Etap exports 50% of total processed fruits to Europe, the USA, Latin America and Japan. On the way to change the rules of the game in the industry, Anadolu Etap considers social, economic and environmental sustainability as its most important values and supports local economic development in all the areas it operates in and represents a global best practice in integrating sustainable agriculture in the agro-industrial system.

Key Words: Agrobusiness, Sustainability, Sustainable Agriculture, Sustainable Sourcing, Integrated Sourcing, Fruit Juice, Juice Industry, Industrial Agriculture.

