

SELECTIVE DISSEMINATION OF INFORMATION
As of August 2020

ANTHRISCUS

Maleki, H., Reza, L., & Shahi-gharahlar, A. (2020). Essential oil components, phenolic content and antioxidant activity of *Anthriscus cerefolium* and *Anthriscus sylvestris* from Iran. *Journal of Horticulture and Postharvest Research*, 3(2), 355–366. Doi: 10.22077/jhpr.2020.3056.1118

Abstract

The Apiaceae family (Umbelliferae) is one of the largest families of flowering plants. The genus *Anthriscus* of this family is considered of high importance because of its use in folk medicines and flavoring throughout the world. Three species of this genus are represented in the Flora of Iran. The main objective of this study was to evaluate the essential oil composition, phenolic content and antioxidant activity of *Anthriscus cerefolium* and *Anthriscus sylvestris*. Research Method: The essential oil samples were isolated by hydrodistillation in a Clevenger type apparatus and analyzed using GC and GC–MS methods. The antioxidant activity and total phenolic content were determined by DPPH scavenging assay and Folin-Ciocalteu method, respectively. Findings: Oxygenated monoterpenes constituted the principal fraction of essential oils obtained from *A. cerefolium* (rich in estragole), while aliphatic esters were detected to be the main class of compounds isolated from *A. sylvestris* (rich in chrysanthenyl acetate). Among the essential oils and methanolic extracts from two *Anthriscus* species at vegetative stage the highest antioxidant activity was observed for essential oil of *A. sylvestris* (IC₅₀=71.3 µg.ml⁻¹) followed by essential oil of *A. cerefolium* (IC₅₀=115 µg.ml⁻¹). In addition, the amounts of total phenolic contents of *A. cerefolium* and *A. sylvestris* methanolic extracts at full flowering stage (76.7 and 74.6 mg GAE.L⁻¹) were determined. Other important groups of compounds and their biological properties need to be studied in *Anthriscus* species due to their potential pharmacological and food industry value. Research limitations: No limitations were founded. Originality/Value: Since the essential oil of *A. sylvestris* at vegetative stage demonstrated the noticeable antioxidant ability which makes it well qualified to be used as natural ingredients to synthetic antioxidants in the food industry.

Keywords: /*Anthriscus cerefolium*/ /*Anthriscus sylvestris*/ /Free radical scavenging/ /Total phenols/

APPLE

Teh, S. L., Coggins, J. L., Kostick, S. A., & Evans, K. M. (2020). Location, year, and tree age impact NIR-based postharvest prediction of dry matter concentration for 58 apple accessions. *Postharvest Biology and Technology*, 166, 111125. doi: 10.1016/j.postharvbio.2020.111125

Abstract

Conventional assessments of postharvest traits, like dry matter concentration (DMC) require destructive sampling that can often be limited by fruit availability of apple trees in early years. Alternatively, nondestructive prediction of postharvest traits using NIR spectroscopy has been demonstrated to be rapid and robust in various fruits and vegetables, including apples. With most prediction models built using one to few cultivars, it remains largely unknown if NIR-based prediction can be applied in an apple breeding program with numerous selections that are added, replicated, and evaluated annually. In this study, 2252 fruit from 58 accessions grown at three orchard sites were destructively measured for DMC, and nondestructively measured for NIR spectra. Nondestructive prediction of DMC exhibited high accuracies in most analyses. In characterizing DMC predictive performance of within- versus between-years, both models were highly predictive and comparable, albeit slightly higher for the former. Further analysis of location's year effects revealed that location was a more important factor than year in influencing

predictive performance. Finally, in cultivar-specific models, prediction made using fruit from more established trees as a calibration set consistently yielded higher prediction accuracy. Overall, the use of three statistical metrics enhanced our understanding of NIR prediction accuracy, while a control calibration set in all analyses provided a statistical baseline for comparing accuracy outputs. This study provides a framework for understanding the impacts of location, year and tree age on NIR prediction accuracy of DMC in diverse apple breeding accessions. In addition, this study demonstrates the importance of assessing predictive performance using multiple statistical metrics.

Keywords: /Near-infrared/ /Nondestructive/ /Diverse germplasm/

APRICOT

Singh, S. (2020). Effect of different packaging materials on quality and storability of osmotically dehydrated wild apricot fruit under ambient storage condition. *Journal of Horticulture and Postharvest Research*, 2020 3(2), 173–182. doi: 10.22077/jhpr.2019.2586.1069

Abstract

Wild apricot fruit is a rich source of carbohydrates, minerals and vitamins. Its shelf life is very short due to its perishability characteristics. High perishable nature, high acidity and low sugar content of wild apricot fruits are the major limitations for their utilization as fresh fruits. Research method: In this research, Wild apricot fruits were osmotically dehydrated and packed in different packaging materials viz. polyethylene, aluminium laminated and shrink packages were then stored under ambient conditions for six months and analysed for quality and sensory parameters at two months intervals. Osmotic dehydration is a technique where moisture is partially removed and the sweetness is increased by dipping the fruits in concentrated sugar solution, followed by final drying in hot air. Potassium metabisulfite is added in sugar solution as a preservative and to improve colour of the final product. After draining the syrup, the fruits are dried in a mechanical dehydrator to a constant weight. Main findings: Results showed that aluminium laminated packaging material proved to be best among the all packaging materials in maintaining superior quality up to six months of storage as indicated by higher mean titratable acidity (5.78%), reducing sugars (10.11%), total sugars (37.71%), ascorbic acid (4.77mg/100g) and lower moisture content (11.14%). All the sensory parameters including colour, taste, texture, flavour and overall acceptability declined significantly during storage period of six months. Limitations: There were no limitations to report. Originality/Value: It was found that the most suitable packaging material was aluminium laminated whereas the greatest change in sensory parameters was observed in polyethylene packaging.

Keywords: /Osmotically dehydrated/ /Packaging material/ /Sensory quality/ /Wild apricot/

CHERRY

Momeny, M., Jahanbakhshi, A., Jafarnejhad, K., & Zhang, Y. D. (2020). Accurate classification of cherry fruit using deep CNN based on hybrid pooling approach. *Postharvest Biology and Technology*, 166, 111204. doi: 10.1016/j.postharvbio.2020.111204

Abstract

The most important quality parameter of a product is its nutritional value, but marketability of agricultural products depends primarily on the overall appearance and shape of the products. This study was carried out with the aim of developing cherry fruit packing methods and thus reducing waste and increasing its exportability and marketability. Therefore, the purpose of research was to use the improved Convolutional Neural Network (CNN) algorithm to detect the appearance of cherries and provide an efficient system for their grading. In order to identify and classify images cherry on two classes (regular and irregular shaped)

was prepared. After preprocessing the images, the proposed method utilized its ability to improve generalization in the CNN through a combination of max pooling and average pooling techniques, to grade cherries. In order to compare the proposed method (CNN) with HOG and LBP methods, the properties of the images extracted by KNN, ANN, Fuzzy and Ensemble Decision Trees (EDT) algorithms were categorized. The proposed method based on hybrid pooling is also compared with CNN with baseline pooling methods such as average pooling. Comparisons based on the results of simulation demonstrate the superiority of the proposed improved CNN over other methods presenting an accuracy of 99.4 %. Therefore, the CNN and image processing methods are effective in managing the marketability and exportability of the cherry fruit and can replace the traditional methods applied for grading cherries.

Keywords: /Cherry/ /Grading/ /Image processing/ /Deep learning/ /Convolutional Neural Network/

CHINESE DATE (*Ziziphus jujuba*)

Deng, B., Shi, H., Liu, H., Li, S., Tian, S., & Zhao, X. (2020). Soaking with an essential mineral (Fe, Zn, Cu, Mn and Se) mixture delays senescence and improves nutrient accumulation in postharvest fruit of *Ziziphus jujuba*. *Postharvest Biology and Technology*, 166, 111186. doi: 10.1016/j.postharvbio.2020.111186

Abstract

Fresh jujube is a healthy climacteric fruit with a high medicinal value. However, it is highly perishable during harvest and storage. In addition, essential minerals (EMs) and antioxidants are indispensable nutrients for human health. In the present study, the effects of an EM mixture (containing 1 mM Fe, Zn, Cu, Mn, and Se) on postharvest jujube fruit senescence, and antioxidant and mineral nutrient accumulation, were investigated. The results showed that soaking with the EM mixture delayed fruit senescence by decreasing the reddening index, coupled with reduced weight loss and decay incidence, and maintained firmness. In addition, greater total antioxidant capacity, as well as higher accumulation of iron, zinc, copper, manganese, selenium and total phenolics, was detected in the EM mixture-treated fruit compared with those in the control. However, the EM-delayed senescence and improved antioxidant capacity could be partly abolished by dimethylthiourea (a specific ROS scavenger) or diphenyliodonium chloride (a specific inhibitor of NADPH oxidase (NOX)). Further experiments showed that higher H₂O₂ levels and NOX activities could be detected in EM-treated fruit compared with those in the control. However, the EM-enhanced H₂O₂ content and NOX activity were partly attenuated by diphenyliodonium chloride. These results showed that the NOX-mediated H₂O₂ is required for EM-delayed postharvest jujube fruit senescence. Thus, EM soaking provides us a new method to delay postharvest fruit senescence and improve nutrient quality.

Keywords: /Antioxidant nutrient/ /essential mineral/ /jujube/ /NADPH oxidase/ /senescence/

CUTFLOWER

Naing, A. H., & Kim, C. K. (2020). Application of nano-silver particles to control the postharvest biology of cut flowers: A review. *Scientia Horticulturae*, 270, 109463. doi: 10.1016/j.scienta.2020.109463

Abstract

The postharvest longevity and quality of cut flowers are affected by floral senescence and petal abscission, which primarily result from both ethylene production in the floral organs (such as the petals and gynoecium) and microbial growth in the xylem vessels in ethylene-sensitive flowers, while microbial growth plays a more crucial role in ethylene-insensitive flowers. Several approaches have been proposed

to improve these postharvest traits, many of which use chemicals to inhibit ethylene biosynthesis and bacterial growth. However, the use of nanotechnology in the agricultural industry has been increasing in the last decade due to its ability to increase agricultural production and reduce postharvest waste. In particular, nano-silver (NS) particles have been used as ethylene inhibitors and antimicrobial agents in packaging to extend the vase life of horticultural products (i.e., fruits, vegetables, and flowers). In this review, we outline the role of NS particles in the suppression of ethylene production and microbial growth in cut flowers and discuss how the concentration and size of NS particles, incubation time, and plant genotype affect postharvest longevity. In addition, we highlight recent results on the application of biologically synthesized NS particles in packaging and postharvest management within the horticultural industry. We expect that this review will provide useful information on the benefits of using NS particles to control the postharvest biology of horticultural products, particularly with respect to improving the vase life of cut flowers.

Keywords: /Bacteria/ /Ethylene/ /Flower longevity/ /Nanotechnology/

DATE FRUIT

Bhatt, K., & Jampala, S. S. M. (2020). Influence of pre-harvest foliar spray of fungal culture filtrates on postharvest biology of date fruit harvested at Khalal stage. *Postharvest Biology and Technology*, 166, 111220. doi: 10.1016/j.postharvbio.2020.111220

Abstract

There is a high prevalence of saprophytic fungi in date fruit and date fruit products. Some of these fungi isolated from the infected plants in date palm orchards were identified as *Aspergillus niger* and *Rhizopus oryzae*. These fungi cause fruit loss during later stages of maturation and are responsible for severe post-harvest losses of date fruit. They may also deteriorate the overall health of plants. The fungal culture filtrates (FCF) from *A. niger* (ANFCF) and *R. oryzae* (ROFCF) were prepared and used as elicitors for the experimentation. These FCFs were foliar sprayed on the date palm plants in the field after the fruit set. Various quality attributes such as weight, firmness and total soluble solids and biochemical properties like total sugars, total proteins, total phenols, ascorbic acid, and antioxidant activity of fresh date fruit (khalal stage) harvested from the FCF treated and untreated plants were studied. The fruit harvested from plants treated with ROFCF showed enhanced levels of total sugar, total proteins, ascorbic acid, and DPPH scavenging activities followed by the fruit from plants treated with ANFCF in comparison to fruit collected from untreated plants. The shelf life of fruit from plants treated with ROFCF and ANFCF increased beyond 14 d at room temperature while the fruit from untreated plants started to deteriorate after 7 d from harvest. The study indicates that the use of fungal culture filtrates as elicitors can help the plant to build up its defense mechanism by elevating the activity of protective enzymes like, Peroxidase (POX), Polyphenol oxidase (PPO) and Phenylalanine ammonia lyase (PAL). It also enhances the growth of plants and improves the quality as well as increases shelf life of fruit.

Keywords: /Biocontrol/ /Bio-elicitor/ /Date fruit/ /Foliar spray/ /Quality/ /Shelf life/

FRUITS AND VEGETABLES

Bhowmik, O., Yeasmin, S., M Mominul Islam, A. K., Parvez Anwar, M., & Shukor Juraimi, A. (2020). Assessment of allelopathic potential of *Aphanamixis polystachya* on selected field crops. *Journal of Horticulture and Postharvest Research*, 3(2), 257–268. doi: 10.22077/jhpr.2020.3038.1117

Abstract

Purpose: *Aphanamixis polystachya* (Wall.) R.N. Parker, belonging to the Meliaceae family is very well known for its medicinal properties. But its allelopathic potentiality has not yet been reported. Hence, aqueous extracts of different parts of *Aphanamixis polystachya* were examined to investigate their allelopathic potentiality. Research Method: Different parts of *A. polystachya* extracts at four different concentrations (1:5, 1:10, 1:15 and 1:20 (w/v)) along with control (distilled water without extracts) were tested against jute, mungbean, mustard, radish, rice, wheat and tomato. The experiments were conducted following completely randomized design with three replicates. Findings: Among the test crop species, shoot growth of mustard was most sensitive (43% average inhibition (a.i.)) followed by radish (41% a.i.) to the extracts of different parts of *A. polystachya*., whereas shoot growth of tomato (14% a.i.) was less sensitive to the extracts followed by rice (25% a.i.) and mungbean (29% a.i.). Root growth of radish was the most sensitive (41% a.i.) species followed by mustard (39% a.i.) and jute (36% a.i.) to the extract of different parts of *A. polystachya*. Root growth of mungbean (13% a.i.) was less sensitive to the extracts followed by tomato (18% a.i.) and rice (20% a.i.). Among the plant parts, the leaf showed most phytotoxic activity on the shoot growth (41%) and twig on the root (40%) growth of the test plants. However, stem extract was less sensitive to both shoot and root growth of the test species. These results confirm that *A. polystachya* have allelopathic properties and may possess allelochemicals. Research limitations: There was no significant limitation to the report. Originality/Value: To the best of our knowledge this is the first report about the allelopathic potential of *Aphanamixis polystachya*.

Keywords: /*Aphanamixis polystachya*/ /Inhibition/ /Meliaceae/ /Oil enrich plant/ /Phytotoxicity/

Wang, S., Shi, X., Wang, R., Wang, H., Liu, F., & Laborda, P. (2020). Melatonin in fruit production and postharvest preservation: A review. *Food Chemistry*, 320, 126642. doi:10.1016/j.foodchem.2020.126642

Abstract

Melatonin (MLT) is a versatile biological signal that is involved in a number of plant processes, including germination, development, flowering, photosynthesis and defence. The need to develop new methodologies for enhancing crop yields and extending fruit postharvest preservation, together with the beneficial effects of dietary MLT, have stimulated the study of the availability and biological roles of MLT in fruit. Here, we are reviewing for the first time the effects of endogenous and exogenous MLT on fruit production and postharvest preservation. The signalling pathways implicated in MLT response and the applications of MLT in fruit decay, abiotic stress and pathogen infection have been traced in order to provide new insights on the biological significance of MLT in fruit.

Keywords: /Melatonin/ /Fruit postharvest preservation/ /Fruit production/ /Chilling stress/ /Fruit pathogens/ /Antioxidant/ /Crop promotion/

Nor, S. M., & Ding, P. (2020). Trends and advances in edible biopolymer coating for tropical fruit: A review. *Food Research International*, 134, 109208. doi:10.1016/j.foodres.2020.109208

Abstract

Nowadays, many of the tropical fruits have been commercialized worldwide due to increasing demand. In 2018, global tropical fruit has reached an unprecedented peak of 7.1 million tonnes. As such, a lot of large scale farming has been initiated to cultivate the fruit for commercialization. The nature of tropical fruit is perishable and makes the fruit easily undergo post-harvest losses especially when the fruit travels a long distance for distribution. Losses of tropical fruit is estimated around 18–28% after harvesting. Then, the losses will continually develop during the trading process. Applying fruit coating on the fruit can minimize substantial privation. This article compendiously reviews the needs of coating and discusses different types of coating materials. The efficiency of different coating materials; polysaccharide, protein, lipid and

composite based coating on tropical fruit is highlighted. There are various types of coating available for major fruit such as banana, mango, pineapple and avocado that can effectively extend the post-harvest life, minimize water loss, reduce chilling injuries and fight against postharvest disease. Coating from minor fruit such as durian, rambutan, passion-fruit and mangosteen are still limited especially made from lipid and protein coating. In choosing the most appropriate coating for tropical, the nature of fruit needs to be understood. In addition, the chemistry of coating components and techniques of application is important in modulating the fruit quality.

Keywords: /Tropical fruit postharvest problem/ /Tropical fruit preservation/ /Tropical fruit shelf-life extension/ /Epidermal characteristics/ /Lipid's coatings/ /Protein's coatings/ /Composite coatings/ /Carbohydrate's coating/

GLADIOLUS

Azimi, M. H. (2020). Assessment and ranking of new gladiolus hybrids in Iran. *Journal of Horticulture and Postharvest Research*, 3(2), 235–244. doi: 10.22077/jhpr.2020.2972.1112

Abstract

Purpose: The aims of this research were to collect reliable information about economic traits, introducing superior genotypes for production, exportation and breeding programs in new hybrids of gladiolus. Research Method: 48 promising genotypes with 4 parents of gladiolus evaluated on the basis of a randomized complete block design in three replications. The Research was conducted in Ornamental Plants Research Center in Mahallat from 2017-2018. Main findings: The results showed that the highest number of florets was observed in OPRC16 (19.0 florets) and the lowest in OPRC412, OPRC413, and OPRC99 (8.00 florets). The highest floret width of 12.00 cm was related to OPRC16 and the lowest of 7.00 cm to OPRC712. The longest spike was 71.00 cm observed in OPRC16 and the shortest was 33.00 cm observed in OPRC411. OPRC311 and OPRC61 exhibited the highest and lowest plant height of 210 and 132 cm, respectively. It was found that the flowers of the new hybrids were almost whitish in color. It was also indicated that the diversity in the traits was mostly related to the genetic factors and the environment was less influential on them. According to the North American Gladiolus Council, the length of the cut branch (spike and branch length) of all hybrids (48 hybrids) and the parents P1, P2, and P3 were categorized in the fantasy group. The hybrids that were placed in the fantasy group in terms of the spike length were more marketable. Research limitations: No limitations were founded. Originality/Value: The results revealed high diversity among the hybrids and parents in traits. Therefore, hybrids that are superior (fantasy groups) in these commercial traits can be introduced as new cultivars.

Keywords: /Cut branch/ /Floret/ /Hybrid/ /Spike/

GRAPEFRUIT

Behshti, M., Jahani, M., Aminifard, M. H., & Hosseini, S.A. (2013). Essential oils to control *Botrytis cinerea* in vitro and in vivo on plum fruits. *Journal Horticulture and Postharvest Research*, 3(2), 161-172. doi: 10.22077/jhpr.2019.2644.1079

Abstract

Purpose: The effect of abusing chemical biocides in controlling pests and diseases has drawn the attention of policymakers to the development of methods potentially available in nature for this purpose. Research method: In the present study, the inhibitory effects of four different essential oils against *Botrytis cinerea* were tested at various concentrations (0, 200, 400, 600, and 800 $\mu\text{L L}^{-1}$) in vitro and in vivo. Main findings: The in vitro results showed that the growth of *B. cinerea* was completely inhibited by the

application of anise oil at concentrations of 800 $\mu\text{L L}^{-1}$. The in vivo results indicated that treated fruits with marjoram oil had more total soluble solids, and anthocyanin content in comparison to anise, chamomile, and black caraway oil. Furthermore, among essential oils, treated fruits with black caraway essential oils had the lowest pH, while anise, chamomile, and marjoram oil had the highest pH. The highest anthocyanin content and pH were obtained at 200 and 400 $\mu\text{L L}^{-1}$ concentration and lowest values were found at a control treatment (respectively). The most total soluble solids were observed at control treatment and the lowest values were recorded at 600 $\mu\text{L L}^{-1}$. The application of each essential oil decreased the percentage loss in fresh weight significantly and increased the storage-life of the fruit. Limitations: Higher cost of application was a limitation. Originality/Value: This research confirms the antifungal effects of anise, fennel, chamomile, and marjoram essential oils both in vitro and in vivo on grape fruits postharvest. Therefore, these essential oils could be an alternative to chemicals to control postharvest phytopathogenic fungi on grape fruits.

Keywords: /Antifungal/ /Essential oils/ /Gray mold/ /Vitis vinifera/

Faghihi, R., Larjani, K., Abdossi, V., & Moradi, P. (2020). Silver nanoparticles produced by green synthesis using Citrus paradise peel inhibits Botrytis cinerea in vitro. Journal of Horticulture and Postharvest Research, 3(2), 151–160. Doi: 10.22077/jhpr.2019.2540.1063

Abstract

Purpose: Our objective was to undertake the green synthesis of silver nanoparticles using Grapefruit(Citrus paradise)peel extract and evaluate the effects of silver nanoparticles on Botrytis cinerea. Research method: The silver nanoparticles formation was evaluated at different temperatures and concentrations of AgNO₃.The experiment was conducted during 2015 at Science and Research Branch, Islamic Azad University, Tehran, Iran. Main findings: Silver nanoparticles were successfully synthesized by Grapefruit's peel through a simple green and eco-friendly route. Aqueous extract of Grapefruit's peel was used to synthesize nanosilver. The size of nanoparticle was determined at 5-65 nm, with SPR absorption at 420 nm in UV-Vis spectroscopy. Transmission electron microscopy (TEM) and X-ray diffraction spectroscopy(XRD) revealed that the synthesized nanoparticle was face centered. The silver nanoparticles are characterized for their size and shape using scanning electron microscopy and TEM, respectively. XRD was used to determine the concentration of metal ions. Results indicated that nanosilver reduced the growth of Botrytis cinerea in vitro culture. The highest antifungal effect was seen in the treatment with 40g/l nanosilver. On the other hand, the effect of nanosilver and time on diameter growth of Botrytis cinerea was not significant, individually ($p \leq 1\%$). Limitations: No limitations were founded. Originality/Value: Green Synthesis of Nano is a reliable method for the nanoparticles synthesis and environmentally friendly approach.

Keywords: /Botrytis cinerea/ /Citrus paradise/ /Green synthesis/ /Silver nanoparticles/

KIWI

Sui, Y., Sun, Z., Zou, Y., Li, W., Jiang, M., Luo, Y., ... Wu, H. (2020). The Rlm1 transcription factor in Candida oleophila contributes to abiotic stress resistance and biocontrol efficacy against postharvest gray mold of kiwifruit. Postharvest Biology and Technology, 166, 111222. doi: 10.1016/j.postharvbio.2020.111222

Abstract

Biological control utilizing antagonistic yeasts has been actively pursued as an alternative to synthetic fungicides for the management of postharvest diseases. Abiotic stress resistance is an important attribute for antagonistic yeasts, directly associated with their biocontrol efficacy. The MADS-box transcription

factor, *Rlm1*, has been reported to regulate the response of model yeasts to cell wall stress. *Rlm1* in the antagonistic yeast, *Candida oleophila*, was found to play a role in resistance to salt, heat, and oxidative stress. Two *Rlm1* mutants ($\Delta Rlm1-1$ and $\Delta Rlm1-2$) were generated. Compared to the wild-type (WT), *C. oleophila* I-182, $\Delta Rlm1-1$, and $\Delta Rlm1-2$ were more sensitive to a variety of stresses, including heat, salt, and oxidative stress. The mutants also exhibited lower biocontrol efficacy against gray mold caused by *Botrytis cinerea*, and slower growth in kiwifruit wounds with respect to the WT. This study provided the information to understand the relationship between the *Rlm1* transcription factor, stress resistance, and biocontrol efficacy of antagonistic yeasts used for the biocontrol of postharvest diseases.

Keywords: /Biocontrol/ /*Candida oleophila*/ /Gray mold/ /Kiwifruit/ /*Rlm1*/ /Stress resistance/

LETTUCE

Azarmi-atajan, F., & Sayyari-zohan, M. H. (2020). Alleviation of salt stress in lettuce (*Lactuca sativa* L.) by plant growth-promoting rhizobacteria. 3, 67–78. doi: 10.22077/jhpr.2020.3013.1114

Abstract

Purpose: The effect of *Pseudomonas* Sp. rhizobacteria as plant growth-promoting rhizobacteria (PGPR) in alleviating salt stress in the lettuce plant was studied under greenhouse condition. Research Method: The experiment was conducted following a completely randomized design with three replicates. The treatments include four *Pseudomonas* sp. strains (B0(non-inoculated), B1, B2 and B3) as PGPR and three levels of irrigation water salinity (0, 4 and 8 dS m⁻¹ as NaCl). Findings: The results showed that with rising salinity levels the lettuce fresh and dry weight, chlorophyll and carotenoids content and K concentration decreased but, the content of membrane stability index (MSI), Na and Na/K ratio increased. However, inoculation of the lettuce plants by PGPR significantly increased the lettuce fresh and dry weight, chlorophyll and carotenoids content, K concentration and K/Na ratio under various salinity levels. Among the PGPR strain, the B2 strain was more effective in the improvement of the lettuce resistance to salinity stress. Research limitations: If antioxidant compounds and enzymes were measured in this study, it would be helpful to interpret the results. Originality/Value: with regards to the useful impact of the PGPR on the lettuce plant under soil salinity, these microorganisms can be used as biofertilizer to provide nutrients and increase plant resistance to salt stress.

Keywords: /Biofertilizer/ /Environmental stress/ /Lettuce/ /Membrane stability/ /NaCl/

Hernandez, I., Alfaro, B., Rodríguez-Ezpeleta, N. (2020). High throughput sequencing unveils changes in bacterial communities during ready-to-eat lettuce spoilage. *Journal of Horticulture and Postharvest Research*, 3(2), 297–310. doi: 10.22077/jhpr.2020.3029.1115

Abstract

Purpose: Spoilage flora is critical in vegetable ready to eat (RTE) product shelf-life and selecting efficient spoilage control technologies depends on the microorganisms present. This manuscript describes the evolution of the bacteriome of Batavia RTE lettuce, from fresh lettuce up to completely spoiled (day 14) and correlates these results with the sensorial characteristics. Research Method: The microbiome of vegetal RTE was examined using culture-dependent and culture-independent (16S rRNA metabarcoding) methods. Culture-dependent methods were related with the metagenomic results and sensory analysis to describe the evolution during spoilage and shelf-life. Findings: Our results demonstrated that the RTE lettuce bacteriome during spoilage is dominated by Gram-negative bacteria, mainly *Flavobacterium* and *Pseudomonas*. A bacterial population of 22 operational taxonomic units (OTUs) represent up to 96% of total bacterial reads and is maintained during the spoilage, representing the bacterial core of RTE lettuce. A high correlation was detected between culture-independent and culture-dependent results, both in

general and selective culture media. Sensorial analysis of lettuce demonstrated that "odor" was the key parameter to determine the sensorial spoilage time and is related to total microbial load and to high concentrations of spoilage-related bacterial genera. Limitations: Hereby presented results are limited by the lettuce variety and by the storage conditions (MAP, 6°C, up to 14 days). Originality/Value: This paper describes an overview of the microbial and sensory evolution during spoilage of Batavia lettuce under MAP. A combination of culture-dependent and independent methods and sensorial analysis were used up to 14 days of storage.

Keywords: /Batavia/ /MAP/ /Metagenomic analysis/ /Sensorial/ /Shelf-life/

LICHI

He, M., Ge, Z., Hong, M., Hongxia, Q., Duan, X., Ze, Y., ... Jiang, Y. (2020). Alleviation of pericarp browning in harvested litchi fruit by synephrine hydrochloride in relation to membrane lipids metabolism. *Postharvest Biology and Technology*, 166, 111223. doi: 10.1016/j.postharvbio.2020.111223

Abstract

This study investigated the effect of synephrine hydrochloride (Syn-HCl) on litchi pericarp browning and the potential regulating mechanism. Results showed that 0.5 g L⁻¹ Syn-HCl significantly inhibited the development of pericarp browning. Compared to control, Syn-HCl treatment reduced malondialdehyde and H₂O₂ content and inhibited activities of polyphenol oxidase (PPO) and peroxidase (POD). Meanwhile, Syn-HCl-treated litchi fruit exhibited higher amounts of USFA (unsaturated fatty acids) as well as lower amounts of SFA (saturated fatty acids) through regulating activities of membrane lipids-degrading enzymes: lipase and lipoxygenase. Additionally, higher ratio of USFA to SFA and double bond index were shown in Syn-HCl-treated fruit. Further analysis showed that key genes involved in fatty acid synthesis were also regulated by Syn-HCl treatment. Taken together, these findings indicated that Syn-HCl alleviated litchi pericarp browning resulting from regulation of fatty acid metabolism and maintenance of membrane integrity, which inhibited the enzymatic browning caused by PPO and POD.

Keywords: /Litchi fruit/ /Pericarp browning/ /Fatty acids/ /Gene expression/ /Synephrine/

LONGAN

Chen, Y., Xie, H., Tang, J., Lin, M., Hung, Y., & Lin, H. (2020). Effects of acidic electrolyzed water treatment on storability, quality attributes and nutritive properties of longan fruit during storage. *Food Chemistry*, 320, 126641. doi:10.1016/j.foodchem.2020.126641

Abstract

The aim of this study was to use acidic electrolyzed water (AEW) to treat longan fruit and evaluate the effects of AEW treatment on storability, quality attributes and nutritive properties of longans during storage. The data indicated that, as compared to the control samples, AEW treatment could effectively reduce the respiration rate and pericarp cell membrane permeability, retard the occurrences of pericarp browning, pulp breakdown and fruit disease, keeping a higher rate of commercially acceptable fruit. Additionally, AEW treatment could suppress the decrease of chromaticity values of *L**, *a** and *b** of the fruit surface, keep higher amounts of pericarp carotenoid, chlorophyll, flavonoid and anthocyanin, maintain higher amounts of pulp total soluble solid (TSS), total soluble sugars, sucrose and vitamin C. These results demonstrated that AEW treatment at pH of 2.5, ACC of 80 mg/L could maintain higher quality attributes and nutritive properties, and display better storability of harvested longans.

Keywords: /Longan (*Dimocarpus longan* Lour.)/ /Quality attributes/ /Nutritive properties/ /Storability/ /Acidic electrolyzed oxidizing water (AEW)/ /Storage/

MANGO

Abu, M., Sakyiwa, N., & Darko, J. O. (2020). Effects of different storage temperature conditions on ripening quality and shelf life of mango (*Mangifera indica*) fruits in. *Journal of Horticulture and Postharvest Research*, 3(2), 245–256. doi: 10.22077/jhpr.2020.2846.1096

Abstract

Purpose: Physiologically matured fruits of Haden, Kent, Palmer, and Keitt mango varieties were used for experiment. The fruits were held at ambient (29-31 °C) and simulated-transit temperature (10-13 °C) conditions. Quality which includes fruit firmness, weight, and spoilage, were assessed and used to determine shelf life of stored fruits. Research Method: A Completely Randomized Design with four replications was used. For each of the four varieties, five mango trees were sampled at random in each of the four replications of a mango plantation when fruits were physiologically matured. Findings: For the ambient and simulated-transit temperature conditions, Kent (4.09 days and 3.85 days, respectively) and Keitt (4.08 days and 3.92 days, respectively) fruits stored longer. Haden fruits ripened significantly earlier (9.50 days and 3.5 days, respectively) than Keitt fruits (11.01 days and 5 days, respectively). Ripening time was statistically not different among Haden, Kent, and Palmer fruits. Softness, colour, and decay were limiting quality factors for all mango fruits stored at both conditions. Higher shriveling rates were observed in Haden and Palmer fruits with a slight preponderance of the former, for both conditions. Average weight loss was highest (6.50 % and 3.31 %, respectively) for Haden and lowest (4.09 % and 2.34 %, respectively) for Keitt, but generally lower in fruits stored under transient conditions. Research limitations: No limitations to report. Originality/Value: A single quality attribute cannot be used to express loss of quality of mango fruit over the normal physiological range of mango fruit growth and development.

Keywords: /Mango fruit/ /Ripening/ /Shelf life/ /Storage quality/ /Temperature/

Lehner, T. B., & Siegmund, B. (2020). The impact of ventilation during postharvest ripening on the development of flavour compounds and sensory quality of mangoes (*Mangifera indica* L.) cv. Kent. *Food Chemistry*, 320, 126608. doi:10.1016/j.foodchem.2020.126608

Abstract

The postharvest ripening behaviour of mangoes (*Mangifera indica* L.) and particularly the development of colour, volatiles, sensory properties and texture, were investigated. Mangoes cv. Kent from Peru were arranged in a postharvest ripening chamber in two different ways enabling different ventilation of the fruits. Fruit properties were investigated in comparison to reference fruits after postharvest ripening for 78 h. Volatile compounds were analysed by HS-SPME GC-MS; an expert panel performed sensory analysis using descriptive methods. The arrangement of the mangoes significantly impacted the ripening procedures. Dense fruit arrangement induced a degradation of terpenes, a reduced formation of reaction products from the lipoxygenase pathway and less pronounced fruitiness and mango flavour. Principal component analysis based on volatile compounds and sensory properties showed a high correlation with the position in the ripening chamber. These data demonstrate the urgent need for further investigations of the postharvest ripening processes to increase mango quality.

Keywords: /Mango (*Mangifera indica* L.) cv. Kent/ /Postharvest ripening/ /Ventilation/ /Volatile compounds/ /GC-MS/ /Sensory evaluation/

Gabriëls, S. H., Mishra, P., Mensink, M. G., Spoelstra, P., & Woltering, E. J. (2020). Non-destructive measurement of internal browning in mangoes using visible and near-infrared spectroscopy supported by artificial neural network analysis. *Postharvest Biology and Technology*, 166, 111206. doi: 10.1016/j.postharvbio.2020.111206

Abstract

Visible and near infrared spectroscopy (VNIRS) (400–1000 nm) is a key emerging non-destructive technique for fruit quality assessment. This, because it is a unique method which allows rapid access to fruit pigments and chemical properties linked to fruit quality. In the present work, VNIRS has been used to predict the internal browning in 'Keitt' mangoes halves. The reference analysis was performed by cutting individual mango into halves and quantifying the extent of internal browning with a standardized color imaging (CI) cabinet as a browning index (BI). The CI provided a value for the "browning index" for each mango reflecting the presence and severity of internal browning. The data modelling involved both regression and classification analysis. The regression was performed to link the VNIR spectra with the BI values obtained from the internal color analysis. The classification analysis was performed for binary classification of mango into healthy or brown. Two different analysis techniques i.e. artificial neural network (ANN) and partial least square (PLS) were utilized. The study shows that VNIRS combined with ANN can classify mangoes as healthy or having internal brown with an accuracy of over 80 %. A robust and reliable classification system can potentially improve quality decisions through the mango supply chain, thereby reducing post-harvest losses.

Keywords: /Near infrared spectroscopy/ /Artificial neural networks/ /Multivariate analyses/ /Internal defects/ /Internal browning/

MULBERRY

Azarmdel, H., Jahanbakhshi, A., Mohtasebi, S. S., & Muñoz, A. R. (2020). Evaluation of image processing technique as an expert system in mulberry fruit grading based on ripeness level using artificial neural networks (ANNs) and support vector machines (SVM). *Postharvest Biology and Technology*, 166, 111201. doi: 10.1016/j.postharvbio.2020.111201

Abstract

Image processing and artificial intelligence (AI) techniques have been applied to analyze, evaluate and classify mulberry fruit according to their ripeness (unripe, ripe, and overripe). A total of 577 mulberries were graded by an expert and the images were captured by an imaging system. Then, the geometrical properties, color, and texture characteristics of each segmented mulberry was extracted using two feature reduction methods: Correlation-based Feature Selection subset (CFS) and Consistency subset (CONS). Artificial Neural Networks (ANN) and Support Vector Machine (SVM) were applied to classify mulberry fruit. ANN classification with the CFS subset feature extraction method resulted in the accuracy of 100 %, 100 %, and 99.1 % and the least mean square error (MSE) values of 9.2×10^{-10} , 3.0×10^{-6} , and 2.9×10^{-3} for training, validation, and test sets, respectively. The ANN structure with the CONS subset feature extraction method resulted in the acceptable model with the accuracy of 100 %, 98.9 %, and 98.3 % and calculated MSE values of 4.9×10^{-9} , 3.0×10^{-3} , and 3.1×10^{-3} for training, validation, and test sets, respectively. In general, the machine vision system combined with the ANN and SVM algorithms successfully classified mulberries based on maturity. Finally, the ANN model with four features (R, B, b^* , and Cr) selected through the CONS subset method with the least number of inputs and acceptable high classification accuracy with low MSE value was proposed as the proper model for online applications.

Keywords: /Mulberry/ /Maturity detection/ / Classification/ /Machine vision/ /Artificial intelligence/

MARIGOLD

Fadda, A., Palma, A., Azara, E., & D'aquino, S. (2020). Effect of modified atmosphere packaging on overall appearance and nutraceutical quality of pot marigold held at 5 °C. *Food Research International*, 134, 109248. doi:10.1016/j.foodres.2020.109248

Abstract

The effectiveness of passive modified atmosphere packaging (MAP) on chemical and quality properties of calendula flowers was studied during ten days of storage at 5 °C. Weight loss of flowers wrapped with continuous and micro-perforated-films (2–3%), was significantly lower than control (unwrapped flowers) (about 30%) and those wrapped with macro-perforated film (about 7%). At the end of storage unwrapped flowers were judged unmarketable being severely wilted and shriveled, while all packaged ones were still fresh and marketable. On day 10, the fructose concentration of control flowers decreased by 74%. Continuous and micro-perforated films delayed the decline of fructose concentration over storage. Sucrose concentration decreased with storage in control flowers, while in continuous film wrapped flowers it increased. After 10 d of storage, the total phenols' concentration of all packaged flowers was significantly higher than control and similar to the initial value (2.58 ± 0.02 g 100 g⁻¹ d.w.). Thirteen carotenoids were identified by HPLC-MS. The initial β carotene concentration (65.72 ± 0.09 mg 100 g⁻¹ d.w.) did not change in flowers wrapped with macro- and micro-perforated films, in contrast to the other treatments. Lycopene concentration strongly decreased in control flowers, while minor losses occurred in packaged ones. Laser micro-perforated film, being a good compromise between humidity retention inside the packages and the permeability of the film, seems to be the best choice to extend the storage life of calendula flowers.

Keywords: /Edible flowers/ /Packaging/ /Visual quality/ /Antioxidants/ /Carotenoids/ /Cold storage/

MORINGA OLEIFERA

Bridgemohan, P., Goordeen, A., Mohammed, M., & Bridgemohan, R. S. H. (2020). Review of the agro-ecology, phytochemistry, postharvest technology and utilization of moringa (*Moringa oleifera* Lam.). *Journal of Horticulture and Postharvest Research*, 3 (2), 311–332. doi: 10.22077/jhpr.2020.3037.1116

Abstract

Purpose: This paper provides an in-depth critical review and analysis of current and recent research undertaken on the agro-ecology, phytochemistry, postharvest physiology and utilization of *Moringa oleifera* Lam. Findings: This treatise provided a comprehensive review of current and relevant research on the horticultural practices, its agro-ecological conditions, and pre- and post-harvest operations and treatments. It showed the alignment of the biochemical production of the various phytochemicals to the ecophysiology of the plant particularly the variety and ecotypes, micro climatic and edaphic conditions, and the crop growth patterns. The detailed aggregation of the different phytochemicals and the sites of synthesis in the plant revealed that the plant produces in excess of 36 phytochemical compounds that manifest its biological efficacy in over 16 different human physiological activities and medicine. Additionally, it revealed the many approaches to the postharvest physiology of the plant parts and the extension of the shelf life and quality for processing opportunities. Research limitations: There were no significant limitations to the conducting of this exercise as the literature was available and accesses to communicate with authors were easily facilitated by the internet. Directions for future research: This is the only review which collated the findings on the agro-ecology, phytochemistry, postharvest physiology and utilization of *Moringa oleifera* Lam., and how it is linked to the world of ethno-medicine, and pharmacology. Further research is necessary to determine the efficacy of extracts from all parts of the

moringa plant as potential and promising eco-friendly alternatives to common chemicals used as novel food preservatives.

Keywords: /Ecophysiology/ /Phytochemistry/ /Postharvest/ /Utilization/

MUSHROOM

Liu, Q., Kong, W., Hu, S., Kang, Y., Zhang, Y., & Ng, T. B. (2020). Effects of *Oudemansiella radicata* polysaccharide on postharvest quality of oyster mushroom (*Pleurotus ostreatus*) and its antifungal activity against *Penicillium digitatum*. *Postharvest Biology and Technology*, 166, 111207. doi: 10.1016/j.postharvbio.2020.111207

Abstract

The effects of a water-soluble polysaccharide from *Oudemansiella radicata* (ORWP) on the postharvest quality of *Pleurotus ostreatus* were investigated. In the present work, oyster mushroom was divided into four groups which were treated separately with distilled water (control), and ORWP at 5, 10 and 15 g L⁻¹ concentration, respectively, and kept at 4 °C for 15 d. The results showed that treatment with ORWP was effective in maintaining the sensory quality of oyster mushrooms. Mushrooms that were ORWP-coated displayed, compared to the control, reduction in the following parameters: weight loss, relative electrolyte leakage, phenol peroxidase (PPO) activities and malondialdehyde (MDA) content. In addition, ORWP-coated mushrooms maintained activities of superoxide dismutase (SOD) and catalase (CAT), contents of ascorbic acid, carbohydrate, soluble protein and phenolic compounds which were all higher than those of the control. Furthermore, the antifungal activity and underlying mechanisms of ORWP against *Penicillium digitatum* were investigated. The minimum inhibitory concentration (MIC) was 0.25 g L⁻¹ and the minimum fungicidal concentration (MFC) was 1.00 g L⁻¹. A combination of hyphal membrane permeability analysis, scanning electron microscopy (SEM) and transmission electron microscopy (TEM) revealed that the antifungal activity of ORWP was attributed to disruption of hyphal cell membrane integrity, leading to leakage of intracellular materials, and impaired cellular metabolism, thereby thwarting the growth of *P. digitatum*. Therefore, ORWP is a promising preservative agent for postharvest oyster mushrooms and could be used as an inhibitor of fungi in food and medicine.

Keywords: /Polysaccharide/ /Postharvest quality/ /Antifungal/

Yan, M., Yuan, B., Xie, Y., Cheng, S., Huang, H., Zhang, W., ... Cao, C. (2020). Improvement of postharvest quality, enzymes activity and polyphenoloxidase structure of postharvest *Agaricus bisporus* in response to high voltage electric field. *Postharvest Biology and Technology*, 166, 111230. doi: 10.1016/j.postharvbio.2020.111230

Abstract

High voltage electric field (HVEF) is an innovative technology used in non-thermal food processing. To explore effects of HVEF on the postharvest quality and its possible mechanisms of *Agaricus bisporus* (mushroom), *Agaricus bisporus* were stored in the HVEF at 4 °C for 12 days. The results revealed that HVEF could reduce the loss of firmness and maintain the whiteness index for *A. bisporus* samples after 12 days of storage. Furthermore, HVEF treatment significantly prevented the accumulation of malondialdehyde (MDA), delayed loss of total phenolic, enhanced the superoxide dismutase (SOD) and catalase (CAT) activity, and had the better microstructure compared with that in the control group. In addition, HVEF treatment induced the rearrangement of secondary structure and irreversibly disrupted the tertiary structure of the polyphenol oxidase (PPO) to bury the active site, resulting in inactivation of PPO. These results indicated that HVEF treatment is a potential approach to prolong the shelf life of *A. bisporus*, maintaining its postharvest quality and consumer acceptance during storage.

Keywords: /*Agaricus bisporus*/ /High voltage electric field/ /Postharvest quality/ /PPO/ /Scanning electron microscopy/

Braaksma, A., Schaap, D., Donkers, J., & Schipper, C. (2001). Effect of cytokinin on cap opening in *Agaricus bisporus* during storage. *Postharvest Biology and Technology*, 23(2), 171–173. doi: 10.1016/s0925-5214(01)00114-4

Abstract

This study investigated changes in endogenous polyamine (PA) content, PA-related amino acid content, and the expression of PA-related genes in different tissues (cap, gill, and stipe) of the edible mushroom (*Agaricus bisporus* J.E. Lange Imbach) during postharvest storage. The results showed that the putrescine (Put) content increased substantially and continuously in all tissues, and was highest in stipe during storage. Strong positive correlations were observed between Put content and the extent of cap opening. Minor changes in spermidine (Spd) and spermine (Spm) contents were observed during storage, both of which were highest in gills during spore production. PA-related amino acid content and PA-related gene expression were also developmentally and tissue-specifically regulated. The expression levels of *AbASS*, *AbASL*, *AbARG*, and *AbOAT* increased in gills and reached the highest level when the pileus started cap opening; however, at the same time, in the stipe these expression levels decreased rapidly to the lowest level. The expression levels of *AbODC* and *AbSAMDC* increased in gills with storage duration, which possibly contributed to the highest Spd level. Furthermore, proline and glutamate contents presented an opposite changing trend during storage, indicating that they are likely generated in a coordinated way in different tissues. In addition, Put biosynthetic pathways are likely differently regulated in gill and stipe: Put production in gills mainly happens via ornithine decarboxylase, while Put in stipes may be synthesized via an alternative pathway. These results indicate that PA biosynthesis and its distribution correlate positively with the continuing development of *A. bisporus* postharvest.

Keywords: /Mushroom/ /Postharvest development/ /Cap opening/ /Gene expression/ /Put biosynthetic pathway/

ORANGE

Yao, S., Wang, Z., Cao, Q., Xie, J., Wang, X., Zhang, R., . . . Zeng, K. (2020). Molecular basis of postharvest granulation in orange fruit revealed by metabolite, transcriptome and methylome profiling. *Postharvest Biology and Technology*, 166, 111205. doi:10.1016/j.postharvbio.2020.111205

Abstract

Postharvest granulation is a serious physiological disorder during storage in navel orange fruit, while the molecular basis remains largely unknown. Orange fruit exhibited an obvious gradient of total soluble solids, which gradually increased from stem to styler region, and granulation occurrence often initiated at the stem and extended towards the rest. Here, we performed systematic analysis of metabolites, coding transcriptome, lncRNAs and single-base resolution methylome in juice sacs during granulation. Through a comparison of RNA-Seq data generated from stem and mid juice sacs of either normal or incipient granulated fruit, 6022 genes were reliably identified to be differentially expressed upon granulation, which uncovers various metabolic pathway underlying the decreasing of sugars and organic acids, and increasing of cell wall components. Further, 486 lncRNAs were differentially expressed in granulated juice sacs, predicted to regulate cell wall metabolism. Genome wide analysis of fruit methylome during granulation indicated that DNA methylation might be unlikely involved in the granulation process. A series of transcription factors, including homolog of *E2Fc* and *UPB1*, potentially play crucial roles in the

granulation process, mainly *via* regulating the secondary cell wall synthesis. It is the first study to unravel the molecular mechanism underlying postharvest granulation in sweet orange fruit.

Keywords: /Postharvest granulation/ /Navel orange/ /Transcriptome profiling/ /Cell wall metabolism/ /Transcription factors/ /Inc/ /RNA/ /Methylome/

PAK CHOI

Song, L., Yi, R., Luo, H., Jiang, L., Gu, S., & Yu, Z. (2020). Postharvest 1-methylcyclopropene application delays leaf yellowing of pak choi (*Brassica rapa* subsp. *chinensis*) by improving chloroplast antioxidant capacity and maintaining chloroplast structural integrity during storage at 20 °C. *Scientia Horticulturae*, 270, 109466. doi: 10.1016/j.scienta.2020.109466

Abstract

The aim of this study was to uncover the regulatory mechanism underlying the leaf yellowing of pak choi after 1-methylcyclopropene (1-MCP) treatment at (20 ± 0.5) °C. The ultrastructural, physiological and biochemical metabolism changes of the chloroplast in pak choi were investigated. Chlorophyll degradation was effectively alleviated by 1-MCP treatment, and the market life of pak choi was extended by 2 days compared with that of control. Electron microscopy confirmed that the chloroplast breakdown was reduced by 1-MCP. This treatment not only preserved the high activities of chloroplast antioxidant enzymes (superoxide dismutase SOD and ascorbic peroxidase APX) and non-enzymatic antioxidants (ascorbate-glutathione (AsA-GSH)) for scavenging reactive oxygen species (ROS) (superoxide anion O₂⁻ and hydrogen peroxide H₂O₂), but also decreased the chloroplast chlorophyll-degrading peroxidase (Chl-POX) activity, thus retarding chlorophyll degradation in the peroxidase-H₂O₂ system. Abundant O₂⁻ and H₂O₂ may function as major toxic molecules to enhance the activities of chloroplast phospholipase (PLD), lipoxygenase (LOX) and lipase. The loss of the chloroplast structural integrity and function caused by the high activities of PLD, lipase and LOX aggravated the enzymatic degradation of chlorophyll in pak choi, which was rescued by using 1-MCP that retarded the degradation of the chloroplast membrane, as well as maintained high unsaturated fatty acid levels and low malondialdehyde (MDA) level. In conclusion, 1-MCP fumigation may augment the chloroplast antioxidant capacity for scavenging ROS (O₂⁻ and H₂O₂), which attenuated the activities of chloroplast PLD, lipase and LOX, inhibited the degradation of the chloroplast membrane and kept the membrane integrity and normal function, ultimately relieving the yellowing of pak choi.

Keywords: /Yellowing/ /Chloroplast structure and function/ /Chloroplast membrane lipid metabolism/

PEAR

Ma, M., Wang, L., Zhang, S., Guo, L., Zhang, Z., Li, J., . . . Zhang, S. (2020). Acid vacuolar invertase 1 (PbrAc-Inv1) and invertase inhibitor 5 (PbrII5) were involved in sucrose hydrolysis during postharvest pear storage. *Food Chemistry*, 320, 126635. doi:10.1016/j.foodchem.2020.126635

Abstract

In pear, sucrose was mainly distributed in vacuole; and the alternation of sucrose abundance was associated with the change of vacuolar invertase (VI) activity during fruit storage. However, the molecular mechanism beneath such a phenomenon has not been clarified until recently. For this, a combination of metabolite, enzyme activity, transcriptome, quantitative real-time PCR (qRT-PCR), bioinformation, subcellular localization, and transient overexpression assay was conducted in this study to identify the acid invertase 1 (PbrAc-Inv1) and invertase inhibitor 5 (PbrII5) involved in sucrose degradation during 'Housui' pear storage. Both PbrAc-Inv1 and PbrII5 were located in the vacuolar membrane. PbrAc-Inv1

could accelerate sucrose degradation; on the other hand, PbrII5 could bind with PbrAc-Inv1 to form an inactive complex, downregulate the VI activity, and suppress sucrose decomposition. Based on Bio-layer interferometry (BLI) result after domain substitution, the domain on the left of catalytic 'WEC-P/V-D' box in PbrAc-Inv1 might play a key role in its interaction with PbrII5.

Keywords: /Pear fruit/ /Vacuolar invertase/ /Vacuolar invertase inhibitor/ /Sucrose hydrolysis/ /Postharvest storage/

Sun, H., Zhou, X., Zhou, Q., Zhao, Y., Kong, X., Luo, M., & Ji, S. (2020). Disorder of membrane metabolism-induced membrane instability plays an important role in pericarp browning of refrigerated 'Nanguo' pears. *Food Chemistry*, 320, 126684. doi:10.1016/j.foodchem.2020.126684

Abstract

Refrigeration is used to retard senescence and extend the storage life of 'Nanguo' pears, but fruits subjected to long-term refrigeration are prone to pericarp browning during subsequent shelf life. To uncover the potential effects of membrane lipid changes during fruit pericarp browning, changes in fruit appearance and cell ultrastructure were observed after different storage durations. Membrane lipid content as well as the activity and gene expression of enzymes involved in membrane lipid metabolism and membrane stability were analyzed. Results showed that long-term refrigeration increased the activity and expression of PLD, LOX, lipase, and membrane stability-related genes that promoted membrane lipid degradation and peroxidation, reduced membrane lipid unsaturation, and led to severe browning. Overall, membrane instability induced by disordered membrane lipid metabolism under low temperature stress may account for pericarp browning of cold stored 'Nanguo' pears.

Keywords: /'Nanguo' pears/ /Pericarp browning/ /Membrane lipid metabolism/ /Membrane stability/ /Membrane lipid peroxidation/

PEPPER

Seo, J., Yi, G., Lee, J. G., Choi, J. H., & Lee, E. J. (2020). Seed browning in pepper (*Capsicum annuum* L.) fruit during cold storage is inhibited by methyl jasmonate or induced by methyl salicylate. *Postharvest Biology and Technology*, 166, 111210. doi:10.1016/j.postharvbio.2020.111210

Abstract

Chilling injury in pepper (*Capsicum annuum* L.) fruit during cold storage and market distribution results in quality loss. In the present study, seed browning, a major chilling injury symptom, was observed in pepper fruit stored at 2 °C, but not at 13 °C. To alleviate this symptom, we applied vapour treatments of 50 µM methyl jasmonate (MeJA) or 250 µM methyl salicylate (MeSA), or a combination of both, and investigated the effect of treatments on seed browning in pepper fruit during cold storage. When treated with 50 µM MeJA, seed browning was highly inhibited and endogenous jasmonic acid (JA) production was increased via earlier activation of JA synthesis-related genes. However, MeSA treatment induced more severe and faster seed browning than the other treatments by decreasing endogenous JA content and by increasing salicylic acid (SA) content. The content of glutamate, sucrose, and galactinol, which are well-known antioxidant metabolites against chilling stress, was higher in MeJA-treated pepper fruit than in MeSA-treated pepper fruit, suggesting the role of MeJA in reducing chilling injury. In conclusion, JA may play an important role in reducing low temperature-induced seed browning in pepper fruit and SA seems to be involved in inducing chilling sensitivity in pepper fruit.

Keywords: /Cold stress/ /Hormone/ /Postharvest/ /Physiological symptom/ /Storage/ /Subtropical crop/

PERSIMMON

Kou, J., Wei, C., Zhao, Z., Guan, J., & Wang, W. (2020). Effects of ethylene and 1-methylcyclopropene treatments on physiological changes and ripening-related gene expression of 'Mopan' persimmon fruit during storage. *Postharvest Biology and Technology*, 166, 111185. doi: 10.1016/j.postharvbio.2020.111185

Abstract

'Mopan' persimmon (*Diospyros kaki* L. cv. Mopan) is an economically important persimmon cultivar that is widely grown in northern China areas. Expanded understanding of postharvest fruit physiological changes and the role that ethylene plays will enhance the efficiency of fruit storage and marketing. Treatments with ethylene and 1-MCP on 'Mopan' persimmons showed opposite effects on softening, color, total soluble solid (TSS), total and soluble tannin contents, ethylene production and respiration rate during fruit storage. Ethylene and 1-MCP treatments also affected the expression of five ethylene signaling genes *DkCTR1*, *DkETR1*, *DkETR2*, *DKERF22* and *DKERF19*, three de-astringent related genes *DkADH1*, *DkPDC1* and *DkPDC2*, and four cell wall-hydrolyzing enzyme genes *DkPG1*, *DkXTH2*, *DkPME1* and *Dkβ-GAL1* during fruit storage. High correlations were observed between ethylene signal pathway genes, physiological characters and ripening related gene expression. The results indicate that ethylene greatly accelerates fruit ripening, and the ripening process can be inhibited by 1-MCP treatment both on physiological and molecular levels. The application of 1-MCP delayed seven to ten days on fruit ripening compared to controls. The overall information obtained from this study demonstrates that ethylene plays the critical roles in postharvest ripening, gene expressions and physiological property changes of 'Mopan' persimmon fruit during storage. The suppression of ethylene activity by 1-MCP provides the industry with an applicable technology to improve postharvest processing and 'Mopan' persimmon fruit value.

Keywords: 'Mopan' persimmon (*Diospyros kaki* L.) / Ethylene / 1-Methylcyclopropene (1-MCP) / Gene expression / Postharvest fruit ripening / Persimmon astringency

POMEGRANATE

Hosseini, S. A., & Khayyat, M. (2020). Chlorophyll fluorescence response of 'Yusef Khani' and 'Malas - e- Yazdi' pomegranate varieties under salinity stress. *Journal of Horticulture and Postharvest Research*, 3, 79–90. doi: 10.22077/jhpr.2020.2913.1107

Abstract

Purpose: The present research was done to evaluate the responses of 'Yusef Khani' (Y) and 'Malas-e-Yazdi' (M) Iranian pomegranates to salt stress under field conditions. Research method: Treatments included different salinized water (EC=1.05 as control, 4.61 and 7.46 dS m⁻¹) and two commercially Iranian pomegranate varieties. Main findings: Interaction of salinity×variety showed the lowest chlorophyll (chl) and potassium (K) level, and the highest chloride (Cl) and sodium (Na) in M variety, under high level of salinity. Although the lowest non-photochemical quenching, and effective quantum yield of photochemical energy conversion in PSII observed in this variety under 7.46 dS m⁻¹, however, basal quantum yield of non-photochemical processes in PSII increased. Accumulation of Na and Cl in leaf tissue increased with increasing salinity in both varieties. Moreover, lower accumulation of calcium (Ca), magnesium (Mg) and iron (Fe) observed in both varieties. More Na and Cl was obtained within leaves of M variety, compared with other one. We found that there were some differences between these varieties and 'Yusef Khani' was more tolerant to salinity compared with 'Malas-e-Yazdi'. Limitations: It might be better to evaluate several varieties for salinity resistance, however, it was impossible to us. Originality/Value: Iran is the main source of genetic variability for pomegranate.

There is a huge diversity within pomegranate germplasm that should be studied for salinity and drought resistance. Thus, here we conducted a research to find a salt resistant pomegranate.

Keywords: Chloride/ /Nutrient uptake/ /NPQ/ /Punica granatum/ /Salt stress/

POSTHARVEST DISEASE

Calvo, H., Mendiara, I., Arias, E., Gracia, A. P., Blanco, D., & Venturini, M. E. (2020). Antifungal activity of the volatile organic compounds produced by *Bacillus velezensis* strains against postharvest fungal pathogens. *Postharvest Biology and Technology*, 166, 111208. doi: 10.1016/j.postharvbio.2020.111208

Abstract

It is known that Volatile Organic Compounds (VOCs), among several other mechanisms, are responsible for the antagonistic activity produced by microorganisms. In this work the volatilome of three biocontrol *Bacillus velezensis* strains (BUZ-14, I3 and I5) was tested *in vitro* and on fruit against *Botrytis cinerea*, *Monilinia fructicola*, *M. laxa*, *Penicillium italicum*, *P. digitatum* and *P. expansum*. *In vitro*, pathogens growth was significantly inhibited, in particular *M. laxa*, *M. fructicola* and *P. italicum* (66, 72 and 80 %, respectively) by BUZ-14 and *B. cinerea* (100 %) by I3 and I5, compared to the control. *In vivo* tests also showed significant inhibitions since volatile metabolites of I3 reduced grey mould in grapes by 50 % and those of BUZ-14 decreased brown rot severity in apricots, especially by *M. fructicola*, from 60 to 4 mm. VOCs were identified by solid phase microextraction (SPME) coupled with Gas Chromatography-Mass Spectrometry (GC-MS) and the antifungal activity of some of them was tested both *in vitro* and *in vivo* against the fungal pathogens. The main volatiles identified ranged from 12 to 15 compounds including 2-nonanone, 2-undecanone, 2-heptanone, 1-butanol, acetoin, benzaldehyde, butyl formate, diacetyl, nonane, or pyrazine, among others. Benzaldehyde and diacetyl obtained the lowest minimum inhibitory concentrations *in vitro*, ranging from 0.005 to 0.125 mL L⁻¹ depending on the pathogen tested. Moreover, diacetyl was able to control grey mould caused by *B. cinerea* in table grapes with only 0.02 mL L⁻¹ and to reduce blue rot in mandarins at the same dose up to 60 %. In this study, diacetyl and benzaldehyde have been identified as promising compounds to apply in active packaging during the postharvest commercialization of fruit. However, prior to the application, it is crucial to determine not only the active dose but also the phytotoxic, since some fruit species such as apples and apricots have proven to be highly sensitive.

Keywords: /Volatilome/ /*Bacillus velezensis*/ /diacetyl/ /Benzaldehyde/ /Antifungal activity/

Chiu, Y. C., Shen, C., Farnham, M. W., & Ku, K. M. (2020). Three-dimensional epicuticular wax on plant surfaces reduces attachment and survival rate of *Salmonella* during storage. *Postharvest Biology and Technology*, 166, 111197. doi: 10.1016/j.postharvbio.2020.111197

Abstract

Salmonella is the second most common foodborne pathogen for leafy vegetables, therefore understanding how to reduce *Salmonella* attachment onto the produce surface is crucial to combat salmonellosis. Epicuticular wax is the outermost layer on the leaf surface that directly interacts with food pathogen attachment. The hydrophobic nature of epicuticular wax was found to increase pathogen resistance, however, there is limited study on if three-dimensional epicuticular wax on the leaf can reduce *Salmonella* attachment. This study aims to test whether the presence of three-dimensional epicuticular wax crystals decreases the attachment of *Salmonella* on leafy green surfaces. Using gum arabic paste, three-dimensional epicuticular wax was removed from three waxy plants (USVL188-NG, USVL115-NG, and 'Top Bunch' collard). Leafy surfaces in disks were dip-inoculated with a mixture of *Salmonella*

Typhimurium and Tennessee at day 0, followed by aerobic storage at 4.0 ± 0.2 °C for 14 d. After 30-minute inoculation, significantly lower ($P < 0.05$) *Salmonella* were attached to plants with three-dimensional epicuticular wax, resulting in 3.27, 2.76, and 4.51 \log_{10} CFU cm^{-2} respectively when compared to three glossy plants (USVL188-GL, USVL115-GL, and 'Green Glaze' collard greens) on XLT-4 agar. Attached *Salmonella* on gum arabic-treated plants were significantly lower than the untreated plants, suggesting that three-dimensional epicuticular wax reduced the attachment efficiency of *Salmonella*. The survival rate of *Salmonella* populations on three waxy plants were usually significantly lower ($P < 0.05$) than glossy plants during storage. From day-9 to day-14, the *Salmonella* population on 'Top Bunch' collard greens decreased faster and resulted in lower ($P < 0.05$) numbers than 'Green Glaze' collard greens (2.88–3.47 vs 4.41–4.82 \log_{10} CFU cm^{-2}). The results implied that plant cultivars with three-dimensional epicuticular wax may be a safer choice for producers in terms of minimizing foodborne outbreak risks.

Keywords: /Plant surface/ /Epicuticular wax/ /*Salmonella*/ /Storage/

POTATO

Feng, Y., Liu, Q., Liu, P., Shi, J., & Wang, Q. (2020). Aspartic Acid Can Effectively Prevent the Enzymatic Browning of Potato by Regulating the Generation and Transformation of Brown Product. *Postharvest Biology and Technology*, 166, 111209. doi: 10.1016/j.postharvbio.2020.111209

Abstract

Enzymatic browning is a crucial factor affecting the quality of fresh-cut potatoes. In this study, the effects of aspartic acid (Asp) on browning, polyphenol oxidase (PPO) activity, and phenolic substrates were investigated. The results showed that all the Asp solution treatments significantly reduced the browning of fresh-cut potato chips. At 2–4 °C, control chips had lost saleability on day 1, while 1.0 % Asp treated chips were still acceptable on the day 7 evaluation. Asp can prevent the discoloration of potato pulp completely and also partly decolorize the brown color. Addition of Asp decreased the PPO activity of potato pulp. At the same pH, the PPO activities of potato pulps treated with Asp were lower than those treated with phosphoric acid (H_3PO_4). With the recovery of pH to the control level, the activity of the Asp-treated pulp did not improve completely like those treated with H_3PO_4 . Moreover, the addition of copper acetate solution to the Asp-treated pulp significantly increased PPO activity. As browning progressed, tyrosine and chlorogenic acid content in the Asp-treated potato pulp was higher than that of the control, but caffeic acid, gallic acid, and protocatechuic acid content did not increase. In vitro simulation experiments demonstrated that Asp prevented the discoloration of tyrosine and chlorogenic acid solution, and also caused the fading of the discoloration to a certain degree. These results indicated that Asp is a promising anti-browning agent for fresh-cut potato and the mechanism involves the reduction of PPO activity via a decrease in pH and chelating Cu^{2+} by Asp, inhibiting the formation of brown color from tyrosine and chlorogenic acid solution and enhancing the fading of the brown color.

Keywords: /Browning/ /Aspartic acid (Asp)/ /PPO activity/ /Polyphenol substrate/ /Potato/

Shimira, F., Afloukou, F., & Maniriho, F. (2020). A review on challenges and prospects of potato (*Solanum tuberosum*) production systems in Rwanda. *Journal of Horticulture and Postharvest Research*, 3, 97–112. doi: 10.22077/jhpr.2020.2854.1099

Abstract

Purpose: Potato (*Solanum tuberosum*) is an important food and cash crop globally, particularly in Rwanda whereby it is ranked fourth most grown food crops after banana, sweet potato and cassava. The purpose

of this review study is to analyze and understand potato yield production systems in Rwanda and to find out related constraints. Main findings: After key informants and various research work, it was found that the low potato yield (with on average 11.6 t/ha compared to yield potential of 50.6 t/ha), pests and diseases are the main constraints for potato production in Rwanda. However, it was revealed that the latter are highly related to an inadequate supply of good seed tubers. Indeed, it was reported that the actual mini-tubers seed production systems can cover up to 30% of the national demand; and hence farmers recycle their own seeds or get them from informal sources. This situation is leading to persistent pests and diseases particularly potato bacterial wilt (PBW) and late blight disease hampering potato productivity. Limitations: Soil erosion exacerbated by land fragmentation and use of steep land, and poor fertilization practices both in quantity and quality are reportedly highlighted in this review as secondary bottlenecks for potato production in Rwanda. Directions for future research: Active involvement of the private sector in seed production in conjunction with aeroponic systems and integrated pest and disease management (IPDM) is the promising future research path and most effective approach to be adopted for sustainable potato production and food security in the country.

Keywords: /Climate change/ /Pest and diseases/ /Potato production/ /Rwanda/ /Seeds/

PUMPKIN

Huynh, A. T., & Nguyen, H. V. H. (2020). Effects of ethanol and chitosan treatments on the quality and storage life of minimally processed pumpkin (Cucurbita moschata Duch). *Journal of Horticulture and Postharvest Research*, 3(2), 221–234. doi: 10.22077/jhpr.2019.2837.1095

Abstract

Purpose: Pretreatments of ethanol and chitosan immersion were examined for their potential to maintain physicochemical attributes of fresh cut pumpkin. Research method: Fresh cut pumpkin cubes were dipped into different ethanol solutions (20%, 30%, 40%, 50%) or chitosan concentrations (0.5%, 1%, 1.5%). All samples were stored for 15 days at 10°C. Main findings: Among four concentrations being applied, the 30% ethanol sample (ET 30) sustained the highest sensory quality until the final day and effectively retained fruit firmness, total soluble solids, total phenolic content compared to the 20% ethanol treatment (ET 20) stored at the same condition. Chitosan application retained better content of carotenoid, phenolic compounds, firmness, and reduced weight loss compared to non-chitosan treatment but there was no significant difference among concentrations. As a result, the overall quality index of the coated samples surpassed control ones, especially 1% chitosan. The coating did not affect total soluble solids and antioxidant capacity. Limitations: The investigations of antioxidant and cell wall degrading enzymes were absent to support the study's results. Originality/Value: The combination of 30% ethanol and 1% chitosan suggested a possible application in practical context as it outperformed in maintaining the quality and prolonging storage time of the product up to 15 days at 10°C.

Keywords: /Edible coatings/ /Fresh-cut/ /Postharvest quality/ /winter squash/

STRAWBERRY

Khalid, S., Majeed, M., Ullah, M. I., Shahid, M., Riasat, A. R., Abbas, T., Aatif, H. M., & Farooq, A. (2020). Effect of storage conditions and packaging material on postharvest quality attributes of strawberry. *Journal of Horticulture and Postharvest Research*, 3(2), 195–208. doi: 10.22077/jhpr.2019.2826.1093

Abstract

Purpose: Strawberry (*Fragaria× ananassa*) is highly perishable fruit with a limited postharvest life at room temperature and is vulnerable to postharvest decay due to its high respiration rate, environmental stresses and pathogenic attacks. Research method: To increase the postharvest life of strawberries, a combination of packaging material (polyethylene and perforated polyethylene) along with control and storage conditions {zero energy cool chamber (ZECC) and ambient conditions in laboratory} were tested. Main findings: Mass loss (1.59%) and internal temperature (22.24°C) were significantly reduced while shelf-life (more than 3 days) was enhanced in ZECC as compared to ambient conditions in laboratory with 6.46% mass loss, 23.04°C internal temperature and less than 3 days shelf-life. Packaging material significantly influenced mass loss (%) and electrical conductivity (S/m) of strawberry juice irrespective of its interaction with storage conditions and storage durations. Maximum mass loss (9.11%) and EC (3.74S/m) were recorded in control samples while, minimum mass loss (1.24%) and EC (3.52S/m) was recorded in polyethylene enclosed fruit. Irrespective of storage conditions and packaging material pH, TSS, titratable acidity (%) and ascorbic acid (mg100 ml⁻¹) decreased while electrical conductivity (S/m) increased during storage. Limitations: In future study storage duration should be extended by adding more removals to get clear difference in fruit quality and shelf-life under various treatments. Originality/Value: In conclusion ZECC can be used for short term storage of strawberries.

Keywords: /Evaporative cool chamber/ /Mass loss/ /Perforated polyethylene/ /Postharvest life/ /Strawberry/

Pott, D. M., Lima, F. D., Soria, C., Willmitzer, L., Fernie, A. R., Nikoloski, Z., . . . Vallarino, J. G. (2020). Metabolic reconfiguration of strawberry physiology in response to postharvest practices. *Food Chemistry*, 321, 126747. doi:10.1016/j.foodchem.2020.126747

Abstract

The strawberry fruit is perishable due to its high water content and soft texture, yet exhibits pleasant organoleptic and nutritional profile. Here we conducted a metabolomics-driven analysis followed by linear modelling to dissect the molecular processes in strawberry postharvest. Fruits from five cultivars were harvested and refrigerated during a ten-day period under three different atmospheres: ambient, CO₂-enriched and O₃-enriched. These analyses revealed that metabolites involved in, (i) organoleptic and nutritional properties; (ii) stress tolerance displayed duration and postharvest treatment-dependent levels. Ozone-enriched atmosphere appears to counteract postharvest negative effects, with fruits exhibiting lower levels of fermentative metabolites when compared to fruits kept in an ambient atmosphere. Furthermore, metabolic reconfiguration towards the synthesis of protective metabolites of those fruits can possibly confer enhanced tolerance to postharvest abiotic stresses. Finally, results from the linear modelling identified metabolites which could be used as biomarkers to assess strawberry quality during its postharvest shelf life.

Keywords: /Strawberry/ /Postharvest/ /Quality/ /Metabolites/

SUGAR APPLE

Ren, Y.-Y., Sun, P.-P., Wang, X.-X., & Zhu, Z.-Y. (2020). Degradation of cell wall polysaccharides and change of related enzyme activities with fruit softening in *Annona squamosa* during storage. *Postharvest Biology and Technology*, 166, 111203. doi: 10.1016/j.postharvbio.2020.111203

Abstract

To investigate cell-wall carbohydrate metabolism and fruit softening of postharvest *Annona squamosa*, several indicators including firmness, moisture distribution, cell-wall polysaccharides compositions, activities of enzymes related with fruit softening during storage were studied. Results indicated that

firmness exhibited a significant decline from 1 d to 3 d. Free and semi-bound moisture in pericarp was removed gradually and moisture migrated from high to low freedom degree during storage. Molecular weight distribution and monosaccharide composition of cell-wall polysaccharides changed greatly during storage, especially the degradation of pectin polysaccharide. Besides, related enzymes including PG, PME and Cx were all involved in fruit softening of postharvest *Annona squamosa*. This would provide a theoretical basis to help solve fruit quality decline of *Annona squamosa* during storage in further research.

Keywords: /*Annona squamosa*/ /Fruit softening/ /Cell wall polysaccharide/ /Enzymes/ /Gene expression/

SUMMER SAVORY

Moradinezhad, F., Hajizadegan, S., Sayyari, M. H., & Khayyat, M. (2020). Physiological , chemical and growth responses of summer savory (*Satureja hortensis* L .) to boron under greenhouse conditions. *Journal of Horticulture and Postharvest Research*, 3, 43–52. doi: 10.22077/jhpr.2019.2464.1057

Abstract

Purpose: Boron toxicity is an important factor, which reduces crop productivity, quality and medicinal characteristics around the world. Research method: This research was conducted to investigate the effect of different boron (B) concentrations on growth, chemical and physiological characteristics of *Satureja hortensis* plants under greenhouse conditions in 2016. The experiment was conducted in a glasshouse with 25±3 °C and 15±3 °C (day-night) temperatures, 60% relative humidity and 340 ppm CO₂ concentration. Treatments were different B concentrations as H₃BO₃ that used via irrigation water including 0, 5, 10, 25 and 50 mg L⁻¹. Main findings: Results indicated that total nitrogen, Fm, Fv, Fv/Fm, chlorophyll a, b and total, leaf number, relative water content (RWC), specific leaf weight (SLW), areal fresh and dry weights significantly decreased by B increase. On the other hand, increased B concentration in the leaf led to an increase of F₀, ΦN₀, proline, total carbohydrate and phenolics, specific leaf area and leaf electrolyte leakage. Limitations: No significant limitation to report. Originality/Value: It is concluded that summer savory can tolerate B concentrations up to 10 mg L⁻¹, and leaf boron accumulation significantly inhibited, however, increased with more B concentration of root medium, which affected all physiological aspects mentioned above.

Keywords: /Boron toxicity/ /Chlorophyll fluorescence/ /Phenolic/ /Savory/ /Secondary metabolites/

TOMATO

Ahmad, M., Mohammed Abubakar, M., & Sale, S. (2020). Enhancing the shelf life of tomato fruits using plant material during storage. *Journal of Horticulture and Postharvest Research*, 3(2), 347–354. doi: 10.22077/jhpr.2020.2946.1109

Abstract

Purpose: Postharvest losses of fruits and vegetables are major problem for countries that agriculture is one of the source economy and that losses in tomato have reported from 20 to 50%. It is one of the very perishable fruit and it changes continuously after harvesting. The aim was to evaluate the effect of guava (*Psidium guajava*) and physic nut (*Jatropha curcas*) leaf extract on fresh ripe tomato fruits. Research method: Two tomato varieties obtained (UTC and Tandilo) from Gombe Main Market and were then treated with aqueous and ethanolic extract of *Psidium guajava* and *Jatropha curcas* leaves to extend their shelf life and maintain the quality of tomato fruits during storage. The experiment was laid out using completely randomized block design, (CRBD). Number of days to deterioration was recorded on visual eating quality. The recorded data were analyzed using analysis of variance. Findings: Ethanolic extracts

of *P. guajava* and *J. curcas* was highly effective on UTC variety. The postharvest decay that was the main quality factor in this experiment significantly reduced in Tandilo and UTC tomato fruits after using 2.5g/1000ml ethanol *J. curcas* leaves extract by 24 and 25 days respectively; and 22 and 23 days after using 2.5g/1000ml ethanol *P. guajava* leaves extract. Limitations: No limitations were founded. Originality/Value: These findings indicate that application of leaves extracts proved to be effective in extending the shelf life of test tomato fruits.

Keywords: /Deterioration/ /Plant extracts/ /Postharvest/ /Shelf life/ /Tomato/

Alavi, S. L., & Abbaspour, N. (2020). Evaluation of salt (NaCl) tolerance in tomato (*Lycopersicon esculentum*) cultivars. *Journal of Horticulture and Postharvest Research*, 3, 53–66. doi: 10.22077/JHPR.2020.2738.1084

Abstract

Purpose: Soil salinity is a prevalent abiotic stress that adversely affects crop productivity worldwide. Salinity is an environmental stress that limits growth and development in fruits and vegetables due to increasing osmotic pressure, imbalancing of nutrients and toxicity of some special ions. Tomato (*Lycopersicon esculentum*) is one of the most important fruits and vegetables. Research method: In this study, the effect of salt stress (NaCl) on eight cultivars of tomato (king stone, Caligen, Super Strain B, Primo Early, Early Urbana VF, Early Urbana 111, Cal-j-N3 and Peto Early CH) were investigated. Plants were cultured in hydroponic conditions with five treatments of NaCl including 0, 30, 60, 90 and 120 mM. Each test has repeated three times. The growth indices, Ions, chlorophyll, soluble sugar and proline contents, were measured in roots, stems, petioles and leaves. Main findings: The results showed that sodium and chloride contents increased in all parts of the cultivars with increasing NaCl concentration. However nitrate and potassium contents decreased. Proline and soluble sugars contents increased in leaves under salt stress too. In Primo-Early, Early Urbana 111, Cal-j-N3 and Peto early CH, soluble sugar content increased with increasing NaCl concentration up to 90 mM. In all varieties, high salinity reduced chlorophyll a and b, total chlorophyll, carotenoids contents and growth indices. As far as the measured factors are concerned, it seems that Early Urbana VF and Super Strain B showed a high capacity to tolerate salinity stress. Limitations: No limitations were founded. Originality/Value: This is an opportunity to identify salinity-tolerant tomato cultivars that play an important role in the cultivation and production of quality crops.

Keywords: /Salinity/ /Sensitive/ /Stress/ /Tolerance/

Gamrasni, D., Erova, M., Saar, L., Raz, A., Glikman, M., Sonawane, P. D., ... Goldway, M. (2020). The isocitrate dehydrogenase 1 gene is associated with the climacteric response in tomato fruit ripening. *Postharvest Biology and Technology*, 166, 111219. doi: 10.1016/j.postharvbio.2020.111219

Abstract

Climacteric ripening is related to a respiratory climax accompanied by an exponential increase in ethylene production. This association is not fully understood. Tomato fruit were exposed to the ethylene antagonist 1-methylcyclopropene (1-MCP) at different ripening stages and their transcriptome was monitored. *ISOCITRATE DEHYDROGENASE 1* (ICDH, Solyc01g005560.2.1) was the only respiratory process related gene that was down regulated at all ripening stages including the mature green. Silencing *SIICDH1* using VIGS (virus induced gene silencing), to about 50 % of its native expression, in Micro-Tom tomatoes, reduced both respiration and ethylene production of the harvested fruit. Silenced *SIICDH1* tomatoes also exhibited prolonged ripening and reduced susceptibility to the pathogen *Botrytis cinerea*. In addition, ethylene response factors binding sites were identified in the promotor and in the first intron of

SIICDH1. These results suggest that regulation of *SIICDH1* is a key step in the initiation of the climacteric rise of respiration via ethylene regulation.

Keywords: /Isocitrate dehydrogenase/ /Climacteric fruit ripening/ /Tomato/ /SIICDH1/

ZUCCHINI

Bokhary, S. U. F., Wang, L., Zheng, Y., & Jin, P. (2020). Pre-storage hot water treatment enhances chilling tolerance of zucchini (*Cucurbita pepo* L.) squash by regulating arginine metabolism. *Postharvest Biology and Technology*, 166, 111229. doi: 10.1016/j.postharvbio.2020.111229

Abstract

The effect of hot water (HW) treatment on chilling injury (CI), arginine metabolism, enzymes activity and related gene expressions of zucchini squashes were investigated during cold storage. Immature zucchini fruit were treated with hot water at 45 ± 1 °C for 15 min and then stored at 4 ± 1 °C and above 90 % relative humidity for 15 d. Another batch immersed in distilled water at 25 °C for 15 min served as control. The results revealed that HW treatment significantly reduced the development of CI during storage. The activity of arginase, arginine decarboxylase (ADC) and ornithine decarboxylase (ODC) enzymes were increased leading to higher accumulation of polyamines. Similarly, the proline contents were also increased due to increased activity of Δ 1-pyrroline-5-carboxylate synthetase (P5CS) and ornithine d-aminotransferase (OAT) enzymes. The expression of genes under study also responded accordingly with relatively higher expression level compared with control. Moreover, the activity and gene expression of proline dehydrogenase (PDH) enzyme was lower in tissues of HW treated zucchini fruit. Thus, HW treatment induced the arginine metabolism, resulting in accumulation of polyamines and proline, which subsequently increased the chilling tolerance.

Keywords: /Zucchini squash/ /Chilling injury/ /Arginine/ /Proline/ /Polyamines/ /Hot water treatment/