

SELECTIVE DISSEMINATION OF INFORMATION
As of January 2020

ANTHURIUM

Aliniaefard, S., Falahi, Z., Dianati, Sh., Arab, M., Khoramtabrizi, M. and Woltering, E.J. (2019). Effects of different light spectra on postharvest water relations of *Anthurium* under chilling conditions. Acta Hortic. 1263, 431-438 DOI: 10.17660/ActaHortic.2019.1263.56 <https://doi.org/10.17660/ActaHortic.2019.1263.56>

Abstract

Anthurium (*Anthurium andraeanum* L.) is a cold-sensitive species originating from the tropical region of the world. This plant is widely cultivated all around the globe for the beauty of its ornamental spathes. Here, the effect of light quality on water loss of cut anthurium flowers was tested under chilling conditions. Cut flowers of two anthurium cultivars, Calore (red spathe) and Angel (white spathe), were exposed to a cold temperature (4°C) under different light spectra, including darkness (D), red (R), blue (B), 7:3 ratio of red:blue (RB), and white (W). The results showed that Angel flowers under the B light spectrum had the lowest relative water content (RWC) and specific surface area. It also showed the lowest spathe water content on a dry weight basis. The lowest vase life was obtained for Angel under the B light spectrum, while the longest vase life was obtained under the R light, for both studied cultivars. Under the B light treatment, more open stomata were observed. Accordingly, the highest water loss was observed in all treatments with the B light, and the lowest percentage of water loss was observed in the D and R light, especially in Angel flowers. In conclusion, the B light spectrum negatively influences vase life of cut anthurium flowers, through its effect on water relations of the spathes.

Keywords: /Anthurium/ /Chilling Stress/ /Light Spectrum/ /Stomata/ /Transpiration Rate/

APPLE

Nock, J.F., Doerflinger, F.C., Sutanto, G., Al Shoffe, Y., Gunes, N., Zhang, Y., Wright, A.H., DeLong, J. and Watkins, C.B. (2019). Managing stem-end flesh browning, a physiological disorder of 'Gala' apples. Acta Hortic. 1256, 163-168 DOI: 10.17660/ActaHortic.2019.1256.23 <https://doi.org/10.17660/ActaHortic.2019.1256.23>

Abstract

A physiological disorder known as 'stem-end flesh browning' has recently been found in 'Gala' apples in the USA, Canada, and Brazil. The browning originates at the stem end but can extend throughout the fruit with increasing severity. The effects of harvest date, plant growth regulators (PGRs) (aminoethoxyvinylglycine (AVG) (ReTain) and 1-methylcyclopropene (1-MCP) (Harvista)), postharvest 1-MCP (SmartFresh), storage temperature (0.5 and 3°C), and storage method (standard controlled atmosphere (CA) and dynamic controlled atmosphere NDASH chlorophyll fluorescence (DCA-CF)) have been investigated. A Harvista spray was more effective at reducing disorder incidence than a ReTain or SmartFresh treatment. DCA-CF also delayed disorder development, but did not prevent it. Disorder incidence was slightly lower at 3°C than 0.5°C, indicating an advantage to using a slightly warmer storage temperature. The occurrence of stem-end flesh browning can be reduced by pre- and postharvest management through the use of Harvista and DCA-CF, respectively, while also using a storage temperature of 3°C.

Keywords: /Plant Growth Regulators/ /ReTain (aminoethoxyvinylglycine, AVG)/ /Harvista/ /SmartFresh (1-methylcyclopropene, 1-MCP)/ /Controlled Atmosphere (CA)/ /Dynamic Controlled

Toivonen, P.M.A. (2019). Relation between preharvest conditions, harvest maturity and postharvest performance of apples. Acta Hortic. 1256, 469-480 DOI: 10.17660/ActaHortic.2019.1256.67 <https://doi.org/10.17660/ActaHortic.2019.1256.67>

Abstract

Recent advances in non-destructive instrumentation have enabled a more critical analysis of environmental influences on fruit development and apparent maturation and subsequent impacts for quality outcomes in storage. The paradigm has shifted from the stance that maturation and ripening in climacteric fruit is a series of biochemical and physiological changes coordinated by ethylene to an understanding that components in this series of changes can be differentially coordinated by ethylene. The situation is further complicated because these changes are also influenced by environmental or production factors in the orchard. Two factors that have been shown to influence apparent maturation in apples are; 1) temperature profiles in the orchard during the fruit development stage, and 2) nitrogen content of the fruit. Extreme occurrences for both of these factors have recently been found to accelerate starch clearing (a principal measure used to assess maturity stage in apples) and examples of these effects are presented. The potential issues resulting from reliance on starch clearing for maturity indexing to predict postharvest performance are discussed. Another production factor such as irrigation can determine whether ripening stage is associated with development of a disorder and an example with soft scald in 'Ambrosia' apple is presented. A conceptual framework is proposed that will integrate effects of preharvest conditions to interpret harvest maturity indices such as starch clearing in apples. Photonic approaches to measure maturity are proposed as being less influenced by preharvest factors and thus providing a reliable prediction of postharvest performance and this proposal is supported by recent research findings.

Keywords: /Maturity/ /Preharvest Factors/ /Postharvest Performance/ /vis-NIR spectrometry/ /Storage Disorders/

Díaz, A., Pérez, M., Redondo, D. and Val, J. (2019). Low oxygen treatment prior to cold storage to maintain the quality of apples at industrial scale. Acta Hortic. 1256, 609-614 DOI: 10.17660/ActaHortic.2019.1256.87 <https://doi.org/10.17660/ActaHortic.2019.1256.87>

Abstract

A great proportion of losses in apple production can be attributed to fruit physiological disorders, usually revealed during cold storage. These losses are commonly associated with metabolic processes in which calcium is involved. After years of study and experimentation in an attempt to reduce the incidence of Ca-related disorders by exogenous calcium treatments, a study published by Edna Pesis in 2007 opened another research route in this regard. This study, in 'Granny Smith', revealed that applying a treatment of low oxygen at room temperature, a considerable reduction of scald was achieved and pointed to a possible effect on alleviating bitter pit. It was hypothesized that low oxygen treatments may delay the metabolic activity of fruits and also delay ripening, softening and withering. Since 2008, we have continued to deepen into the development of alternative methods of low environmental impact which avoid the use of chemicals. Strategies have been developed for the application of LOT (low oxygen treatment) treatments at room temperature in various apple cultivars, obtaining promising results at the lab and at the semi-industrial scale. In this paper, LOT technology has been validated, this time, on an industrial scale. An Ilerfred system, with monitoring and control of CO₂ and O₂, was used. The LOT followed by conventional cold storage has proved to be very effective for the control of rots in all cultivars, and was able to effectively control lenticel blotch pit in 'Reinette'. The results of the 2016 campaign compared to those of the two previous seasons allow us to conclude that improvement in shelf life of

apples is achieved by combining different LOT conditions with the dynamic controlled atmosphere (DCA) storage technology.

Keywords: /Bitter Pit/ /Fruit Quality/ /Fruit Physiological Disorders/ /Lenticel Blotch Pit/ /Shelf Life/

Wei, K., Ma, C., Sun, K., Liu, Q., Zhao, N., Sun, Y., ... Pan, L. (2020). Relationship between optical properties and soluble sugar contents of apple flesh during storage. *Postharvest Biology and Technology*, 159, 111021. doi: 10.1016/j.postharvbio.2019.111021

Abstract

Soluble solids (SS) in fruit are mainly composed of soluble sugars. This research aims to further the understanding of the detection mechanism of soluble solid content (SSC) based on optical technology by exploring the relationship between optical properties and soluble sugar contents. The total reflectance and total transmittance at 400–1050 nm of Fuji apple flesh stored at 25 °C for 50 d and 0 °C for 150 d were collected by an automatic integrating sphere system. The absorption coefficient (μa) and reduced scattering coefficient ($\mu's$) were obtained by iteratively solving the radiative transfer equation using the inverse adding doubling algorithm. The relationship of μa and $\mu's$ with the contents of SS, total soluble sugars, fructose, glucose and sucrose were quantitatively analyzed at different wavelengths, and prediction models were established by partial least squares regression (PLSR). The results showed that the changes in μa , $\mu's$, SSC and soluble sugar content presented similar trends during storage at the two test temperatures. As the storage time increased, the decreases in μa and $\mu's$ were accompanied by declines in SSC and soluble sugar content. In addition, μa and $\mu's$ at 550–1050 nm were both positively correlated with SSC and soluble sugar content, with correlation coefficients (r) of 0.834-0.992 and 0.737-0.981, respectively. Compared with the correlations at 550–780 nm, the correlations at 780–1050 nm between μa and SSC and soluble sugar content were enhanced, while the corresponding correlations with $\mu's$ were gradually weakened. In addition, SS was most strongly correlated with sucrose among the three types of soluble sugars. SS and sucrose had closer relationship with μa and $\mu's$ than fructose and glucose with μa and $\mu's$. Moreover, their prediction models also performed better than the models for fructose and glucose, with $Rp2$ values of 0.731-0.804. Thus, the prediction of SSC based on Vis-NIR optical technology may be related to the high correlations between the absorption and scattering properties and the sucrose content.

Keywords: /Apple flesh/ /Integrating sphere/ /Soluble solids/ /Sugar/ /Optical property/ /Correlation/

Mohebbi, S., Babalar, M., Zamani, Z., & Askari, M. A. (2020). Influence of early season boron spraying and postharvest calcium dip treatment on cell-wall degrading enzymes and fruit firmness in 'Starking Delicious' apple during storage. *Scientia Horticulturae*, 259, 108822. doi: 10.1016/j.scienta.2019.108822

Abstract

In this experiment, the effects of early season boron sprays (300 mgL⁻¹, two times at the stage of full bloom and petal fall) and postharvest calcium dip treatment (4% w/v) alone or combined were investigated on the cell wall composition and cell wall modifying enzymes and their contribution to fruit ripening and softening behavior of 'Starking Delicious' apple at harvest and after 6 months storage (0 ± 1 °C and 95% RH) plus shelf life at room temperature. Ca alone and Ca plus B was effective in delaying fruit softening apparently owing to suppressed pectin solubilisation, pectate lyase (PL), β -galactosidase (β -Gal) and α -L-arabinofuranosidase (AFase) activities were negatively correlated to firmness, thus positively affecting fruit storability. B application did not affect fruit Ca content and the activity of cell wall modifying enzymes, but caused small changes in flesh firmness and ethylene production which was less efficient than Ca dip treatment.

Keywords: / α -L-arabinofuranosidase/ / β -galactosidase/ /Enzyme activity/ /Fruit softening/ /Pectate lyase/ /Postharvest/ /Ripening/

APRICOTS

Kafkaletou, M., Karantzi, A., Christopoulos, M.V. and Tsantili, E. (2019). Changes in carotenoid compounds and quality traits during storage of 'Farbaly' apricots (*Prunus armeniaca* L.) at 1°C in air. *Acta Hort.* 1256, 267-274 DOI: 10.17660/ActaHortic.2019.1256.37 <https://doi.org/10.17660/ActaHortic.2019.1256.37>

Abstract

The present research aimed to evaluate changes in quality attributes of a new late ripening cultivar during cold storage. Fruit from 'Farbaly' (Carmingo®) were harvested at commercial maturity stage and stored in air at 1°C with 95% RH. Weight loss, respiration (O₂ uptake and CO₂ production) and ethylene production rates, peel colour, fruit firmness, concentration of total phenolics, flavonoids and carotenoids, total antioxidant capacity, β -carotene, β -cryptoxanthin, γ -carotene and of the acids ascorbic, malic and citric were determined at 20°C after 0, 13 and 19 d storage. Total soluble solids, titratable acidity and pH were determined only at harvest, while sensory evaluation was carried out on day 19. Results showed that weight loss reached 8% at the end of the experiment. During storage, increases in ethylene production and decreases in firmness were the major changes observed. Respiration rates, β -carotene concentration and *h_o* colour parameter decreased, with *h_o* changes indicating a slight blushing development, total flavonoids increased slightly, while minor and non-consistent changes in total carotenoids occurred. Neither decay nor disorders were observed. Panelists rated the fruit as apricots of large size, firm and with good colour and taste. Conclusively, 'Farbaly' is a promising apricot cultivar with good quality traits and high storability potential.

Keywords: /Carotenoids/ /Colour/ /Ethylene/ /Respiration/ /Firmness/ /Organic acids/

ASPARAGUS

Anastasiadi, M., Collings, E. R., Shivembe, A., Qian, B., & Terry, L. A. (2020). Seasonal and temporal changes during storage affect quality attributes of green asparagus. *Postharvest Biology and Technology*, 159, 111017. doi: 10.1016/j.postharvbio.2019.111017

Abstract

Asparagus is a perennial crop with a short UK harvest season. Methods to extend the storage life of asparagus have proven difficult. To gain insight into the physiological (*viz.* colour, respiration rate, cutting energy, and stiffness measured using laser Doppler vibrometry), and biochemical (*viz.* sugars, ascorbic acid, and abscisic acid and its catabolites) changes throughout the UK season, two cultivars were harvested weekly and stored under shelf life conditions (7 °C). Results were compared to spears (plus one additional cultivar) cold stored (1 °C) for three weeks followed by one week of shelf life. Concentrations of sugar, abscisic acid (ABA) and catabolites at harvest were subject to seasonal variation, directly affecting storage potential. A generalised linear model with stepwise feature selection was applied to select the most important parameters for the prediction of total sugars and phaseic acid (PA). More favourable growing conditions at harvest increased sugars and lowered ABA content and catabolites, which coincided with better maintenance of spear quality during storage; including maintaining textural characteristics. Storage time had a negative impact on spear texture and sugar content, with cutting energy increasing and stiffness decreasing both during cold storage and subsequent shelf life. A partial shift in sugar biosynthesis occurred during shelf life increasing sucrose concentrations.

Results suggest that the temporal flux in ABA and catabolites, and individual sugars could be used to model storage potential of asparagus spears.

Keywords: /Sugars/ /Cultivar/ /Storage/ /Abscisic acid (ABA)/

BANANA

Vilaplana, R., Cifuentes, C., Vaca, L., Cevallos-Cevallos, J. M., & Valencia-Chamorro, S. (2020). Curative activity of possible biocontrol agents in the postharvest of yellow pitahaya and organic banana. *Postharvest Biology and Technology*, 159, 111030. doi: 10.1016/j.postharvbio.2019.111030

Abstract

Biological control is one of the best strategies to reduce the use of chemical products during the postharvest period. The isolation and identification of potential biocontrol agents from fruit surfaces is the first step in obtaining an effective biological product against pathogens. In this study several yeast strains were isolated from Ecuadorian fruit and were identified. The curative activity of two selected yeasts, *Candida inconspicua* (CPN3) and *Pichia kluyveri* (B1), was analyzed to establish their antagonism against *Alternaria alternata* on yellow pitahaya and against *Colletotrichum musae* on organic banana. CPN3 yeast showed better effectiveness ($p < 0.01$) than B1 in controlling black rot on yellow pitahaya; whereas on organic banana B1 demonstrated better efficacy ($p < 0.05$) in reducing anthracnose than CPN3. This fact was related to the population dynamics of both yeasts during cold storage of yellow pitahaya and organic banana. No negative effects were observed on physicochemical quality of fruit treated with the potential biocontrol agents. Although curative activity was observed when using CPN3 and B1, studies about their preventive action are needed to establish the antagonistic potential of both yeasts.

Keywords: /*Selenicereus megalanthus*/ /*Musa acuminata*/ /*Alternaria alternata*/ /*Colletotrichum musae*/ /Antagonism/ /Biological control/ /Postharvest/

BLACKBERRY

Horvitz, S., Chanaguano, D. and Dugarte, N.Y. (2019). Postharvest quality of a thorny Andean blackberry (*Rubus glaucus* Benth) cultivar. *Acta Hort.* 1256, 47-52 DOI: 10.17660/ActaHortic.2019.1256.7 <https://doi.org/10.17660/ActaHortic.2019.1256.7>

Abstract

Andean blackberries (*Rubus glaucus* Benth) are highly perishable due to their susceptibility to water loss, softening, mechanical injuries, and postharvest diseases. They are considered non-climacteric, and thus, sold at an advanced maturity stage when the fruit is more sensitive to mechanical damage and spoilage. Harvesting at the proper maturity stage and temperature control are two critical factors in reducing postharvest losses, maintaining quality and extending shelf-life of fruit and vegetables. In this study, the effects of harvest maturity and storage temperature on physicochemical quality of Andean blackberries were evaluated. Blackberries were harvested at maturity stages 3 (light red) and 5 (dark purple), packed in polyethylene terephthalate (PET) clamshells (200±10 g) and stored under room temperature (18±2°C) and cold storage (8±1°C) until visual symptoms of decay were detected. Weight loss was determined daily. Fruit diameter, length and weight were determined on day 1 and colour (L and °hue), firmness, total soluble solids (TSS), pH titratable acidity (TA) and maturity index (TSS/TA) were evaluated on day 1 and every 3 d during storage. The more immature fruit were classified as small and presented lower pH, TSS and maturity index together with higher TA, luminosity, °hue and firmness than the blackberries harvested at maturity stage 5, both at harvest and during storage. Weight loss gradually increased during the storage period in the fruit of both maturity stages with around 9 and 5% after 10 d under refrigeration and

4 d at room temperature, respectively. Refrigeration was effective in maintaining fruit quality and delaying softening and weight loss, with a shelf-life of 3 d at 18°C and up to 8 d in cold storage. The main limiting factors were microbial growth and softening and weight loss at 18 and 8°C, respectively.

Keywords: /Harvest/ /Maturity Index/ /Mora de Castilla/ /Refrigeration/ /Physicochemical Attributes/

BLUEBERRY

Edgley, M., Close, D.C. and Measham, P.F. (2019). Flesh temperature during impact injury and subsequent storage conditions affect the severity of colour change caused by red drupelet reversion in blackberries. Acta Hort. 1265, 129-134 DOI: 10.17660/ActaHortic.2019.1265.18 <https://doi.org/10.17660/ActaHortic.2019.1265.18>

Abstract

Red drupelet reversion (RDR) is a physiological occurrence in blackberries where drupelets revert from black at harvest to red postharvest. The objectives of this trial were to assess the effects of temperature during mechanical injury and temperature changes following injury of blackberries on the subsequent development of RDR. Individual fruit were subjected to mechanical injury from a steel ball dropped from a height of 25 cm at initial temperatures of 15, 25, and 35°C. Following injury, fruit were cooled to 2°C rapidly in a -24°C cooler or slowly in a 2°C cooler. Colour of the impact site and of undamaged control fruit were measured 24 h and 7 days after the initial impact injury using a colourimeter. Impact injury caused a significant colour difference (ΔE) compared to control in 95% of fruit. There were significant interactions between initial temperatures and cooling rates on the colour of the impact site 24 h and 7 days after treatment. Higher fruit temperatures at the time of mechanical injury and a faster cooling rate post-injury were associated with increased lightness and chroma. The results confirm that mechanical injury to blackberry fruit leads to RDR, and that temperature of fruit at the time of injury and subsequently can influence the severity of RDR.

Keywords: /Bruising/ /Impact Injury/ /Reversion/ /CIELAB/ /Storage/

Rivera, S.A., Sofkova-Bobcheva, S., East, A., Hutchins, D. and Kerckhoffs, H. (2019). The effect of foliar calcium application on key (post) harvest quality attributes in Rabbit-eye blueberry (*Vaccinium ashei*). Acta Hort. 1265, 135-144 DOI: 10.17660/ActaHortic.2019.1265.19 <https://doi.org/10.17660/ActaHortic.2019.1265.19>

Abstract

Fruit firmness is considered a key fruit quality trait in blueberries. A fresh berry with an adequate firmness is required for keeping the rise of blueberries consumption worldwide. The amount of calcium associated to the cell-wall could positively affect the physical characteristics of the berry. Previously reported results associating foliar calcium treatment to blueberry firmness are not conclusive. Most studies on blueberry fruit do not account for the interaction between soil applied calcium, foliar applied calcium and harvest time. The aim of this study is to determine the interaction between calcium soil nutrition and pre-harvest foliar CaCl₂ treatments on key (post) harvest quality attributes of Rahi blueberries harvested at different times. Five year old Rahi blueberries (*Vaccinium ashei*) were transplanted at bloom stage, and treated with two nutritional programs (low and high calcium). During the season, the plants were kept under glass-house conditions and foliar CaCl₂ (16.9% Ca, Stopit, YaraVita, Norway) adjusted to pH 5.5 was applied at six times at Ca amount of 0 (control) and 250 mg plant⁻¹. Five harvest times were evaluated during the season. Low or null effect of calcium on key (post) harvest quality attributes were obtained. No interactions ($p > 0.05$) between the nutritional program and foliar CaCl₂ treatments were observed on TSS/TA ratio, weight loss and fruit texture parameters. However harvest time influenced fruit quality more

than calcium treatments in this study. Further investigation of water relation variables such as water vapor permeance and cell turgor pressure evolution during storage, and/or anatomical and morphological attributes, could help to elucidate the effect of harvest time on postharvest fruit quality parameters such as weight loss and texture.

Keywords: /Berry Fruit/ /Calcium Nutritional Program/ /Foliar CaCl₂/ /Texture Profile Analysis (TPA)/ /Harvest Time/

Rodríguez-Nieto, J., Jarquín-Enríquez, L., Vázquez-Celestino, D., Rivera-Pastrana, D., Mercado-Silva, E. and Dufoo-Hurtado, D. (2019). Effect of the application of an edible coating on the quality of blueberry (*Vaccinium corymbosum*) during postharvest storage. Acta Hort. 1265, 241-246 DOI: 10.17660/ActaHortic.2019.1265.34 <https://doi.org/10.17660/ActaHortic.2019.1265.34>

Abstract

Blueberry crop area in Mexico has increased up to 60% per year due to climate, adequate areas for production, which has made it profitable for its producers and exporters. The commercial value of this fruit is affected by a poor postharvest handling system weight loss, wilting and softening. A weight loss of 3 to 5% causes wrinkling in the fruit. The use of edible films or coatings represents an alternative to preserve the quality of fruits due to its ability to reduce water loss, the respiration and transpiration rates, to maintain firmness and delay the senescence. The aim of this study was to evaluate the use of edible coating based on CMC and different content of beeswax (0, 30, 40 60% DM) to preserve the quality of blueberry fruit Biloxi stored at 21 days at 10°C. All edible coatings altered the characteristic appearance (Bloom) of blueberry fruit, however after 14 days of storage, the blueberries coating with 60% of beeswax showed low weight loss (4.03%) and high firmness (1.75 N), in comparison to control fruit (7.42% and 1.29 N, respectively), as well as the respiration rate was lower (1.2 mL CO₂ kg⁻¹ h) than the control fruit (4.96 mL CO₂ kg⁻¹ h). Our results show the potential use of the coatings based on CMC and beeswax to maintain the blueberry quality.

Keywords: /Blueberry/ /Edible Coatings/ /Weight Loss/ /Firmness/ /Beeswax/ /Carboxymethylcellulose/

Pols, S., Williams, E., Botes, A. and Vries, F. (2019). Development of novel postharvest techniques for the preservation of blueberry fruit. Acta Hort. 1256, 575-582 DOI: 10.17660/ActaHortic.2019.1256.82 <https://doi.org/10.17660/ActaHortic.2019.1256.82>

Abstract

Over the past decade, the blueberry industry both in South Africa and around the world has shown extensive growth. Blueberry fruit have become a valuable agricultural commodity, due to its high levels of anti-oxidants and other health benefits. The average storage life of blueberries is estimated to be between 35 and 40 days, where postharvest fungal infections are the greatest limiting factor for longer storage. Blueberry fruit are susceptible to various pathogen infections, both pre- and postharvest, with grey mould (*Botrytis cinerea*) being the most common. Sulphur dioxide (SO₂) generating pads are a popular postharvest treatment preventing fungal development in table grapes and may have potential for enhancing blueberry storage as well. The aim of this study was to determine whether the SO₂ generating pads could effectively prevent postharvest decay development in blueberries. The study was conducted during the 2016 South African blueberry season, investigating the use of SO₂ generating pads in isolation, as well as the use of the pads in combination with controlled atmosphere (CA). A variety of cultivars were treated with SO₂ and stored under CA, after which they were assessed specifically for postharvest fungal development. Less decay was observed when berries were treated with SO₂ generating pad in combination with CA storage conditions. For this treatment, no bleaching or loss in fruit quality was observed. In addition to these results, PCR quantification of *B. cinerea* DNA levels showed a

three times reduction in DNA level when inoculated blueberries were treated with a SO₂ generating pad. This trend is seen for both berries that were artificially inoculated with *B. cinerea*, and berries with a natural inoculum.

Keywords: /Postharvest Treatment/ /Blueberry/ /*Botrytis cinerea*/ /*Rhizopus stolonifer*/ /Sulphur dioxide/ /PCR/

Brassica rapa

Al Ubeed, H.M.S., Wills, R.B.H., Bowyer, M.C., Vuong, Q.V. and Golding, J.B. (2019). Effects of hydrogen sulphide, nitric oxide and ethylene on postharvest deterioration of pak choy. Acta Hortic. 1256, 115-120 DOI: 10.17660/ActaHortic.2019.1256.16 <https://doi.org/10.17660/ActaHortic.2019.1256.16>

Abstract

Ethylene, hydrogen sulphide (H₂S) and nitric oxide (NO) are signaling molecules that affect plant metabolism. Postharvest fumigations with these gases have been shown to interfere with a range of factors associated with postharvest senescence. This study reports on postharvest studies with pak choy (*Brassica rapa* subsp. *chinensis*) that examined the effect of fumigation with hydrogen sulphide and nitric oxide and subsequent storage at 10°C in air with and without the addition of 0.1 µL L⁻¹ ethylene. The results showed that treatment with nitric oxide increased the shelf life and decreased respiration rates for the pak choy heads during the storage. However, fumigation with H₂S alone or in combination with NO resulted in greater inhibition of respiration rate and extension in market life, and this effect was more pronounced in the presence of 0.1 µL L⁻¹ ethylene.

Keywords: /Fumigation/ /H₂S/ /NO/ /*Brassica rapa*/ /Respiration/ /Senescence/ /Leafy Vegetable/

BROCCOLI

Ekman, J.H., Goldwater, A., Marques, J.R., Winley, E., Holford, P. and James, H. (2019). Preserving broccoli quality from harvest to retail: use of 1-MCP. Acta Hortic. 1256, 23-30 DOI: 10.17660/ActaHortic.2019.1256.4 <https://doi.org/10.17660/ActaHortic.2019.1256.4>

Abstract

Despite broccoli's image as a healthy, nutritious and flavoursome vegetable, sales in the Australian market have been constrained by poor quality at retail and disappointing shelf life. In a series of experiments across three broccoli growing regions, we tested the potential of SmartFresh InBox, a new delivery system for the ethylene inhibitor 1-methylcyclopropene (1-MCP), to enhance broccoli retail quality. We added 2, 4, or 8 InBox sachets to broccoli packed in either standard perforated low-density polyethylene (LDPE) liner or the broccoli specific Ripelock liner. Compared to untreated controls (i.e., liners alone), applying 2-4 InBox sachets, especially when combined with the RipeLock liner, improved the retention of green colour and overall visual quality of broccoli, thus increasing marketability by 5-7 days when heads were transported and held at 5-7°C for up to 3 weeks. In addition, the percentage of marketable heads increased from 0 to 72-100% during simulated retail display at 7°C for up to 2 weeks. There were more modest treatment differences in rots development and no differences on broccoli weight loss. Delaying application of 1-MCP by 24 h after harvest had little impact on its effectiveness. The InBox/RipeLock system generally provided broccoli with equal or better protection from fluctuating cold chain temperatures than the standard industry practice of top icing in polystyrene. Results suggest the InBox/RipeLock system can potentially replace top-icing, especially in situations of long transport/storage and/or under temperatures higher than optimal. An additional benefit is that the effects of InBox are

retained once broccoli is transferred to warmer temperatures, as typically occurs during retail and consumer handling.

Keywords: /Postharvest/ /1-methylcyclopropene/ /SmartFresh/ /InBox/ /Modified Atmosphere Packaging/ /Storage/ /Hydrocooling/

CABBAGE

Koide, S., Kumada, R., Hayakawa, K., Kawakami, I., Orikasa, T., Katahira, M. and Uemura, M. (2019). Survival of cut cabbage subjected to subzero temperatures. Acta Hort. 1256, 329-334 DOI: 10.17660/ActaHortic.2019.1256.46 <https://doi.org/10.17660/ActaHortic.2019.1256.46>

Abstract

The use of supercooling during preservation has the potential to increase the shelf life of vegetables at subzero temperatures without freezing occurring, and would be a new preservation method for living vegetables. In this study, we measured the survival ratio of cut cabbage (*Brassica oleracea* var. *capitata*) subjected to subzero temperatures (-5 or -10°C) by use of ethanol brine for 12 h. Cole-Cole plots of the supercooled samples, including fresh as well as dead samples (stored at -80°C for 12 h), were generated using electrical impedance spectroscopy. Cell viability was quantitatively determined by the triphenyl tetrazolium chloride method (physiological index for evaluation of freezing injury in plant tissue). The results of the fresh samples showed that the Cole-Cole plot described a circular arc, and high values for cell viability were maintained. With regard to the dead samples, no circular arc was found in the Cole-Cole plot, and little cell viability was obtained. Thus it can be said that electrical impedance spectroscopy is a rapid and effective method for evaluating survival after supercooling. Our test indicated that the survival percentages of supercooled samples were 100% and over 30%, for -5 and -10°C. Furthermore, samples that were dehydrated before supercooling were used for the preservation test at -10°C. The survival percentage of 30% (w/w) dehydrated samples was higher compared with supercooled samples, although the difference was not statistically significant.

Keywords: /Supercooling/ /Survival Ratio/ /Electrical Impedance/ /TTC Method/ /Cell Viability/

Chalupowicz, D., Osher, Y., Maurer, D., Ovadia-Sadeh, A., Lurie, S. and Kenigsbuch, D. (2019). Characterizing the genetic potential of cabbage for summer storage. Acta Hort. 1256, 463-466 DOI: 10.17660/ActaHortic.2019.1256.80 <https://doi.org/10.17660/ActaHortic.2019.1256.80>

Abstract

Cabbage production is problematic in hot climates, since it grows best in a temperature range of 16 to 18°C. In Israel the best production time is fall and winter, but to allow for year round supply cultivation and storage is necessary in the spring and summer months. Eight red and ten white cabbage cultivars were grown in net houses during the spring and their growth characteristics were examined. After harvest in June, two red and seven white cultivars were stored for 127 days at 1°C in regular air and in controlled atmosphere (3% O₂, 6% CO₂). Regular air storage for an extended period was not suitable because all the cultivars developed unacceptable weight loss, external leaf browning, decay and black spot. Controlled atmosphere enabled storage for this period of time, but some cultivars stored better than others. The red cultivars, Kojak and Kosero showed good storage potential. Three white cultivars, Cheers, Proctor and Proctor-Cems stored better than the other white cultivars.

Keywords: /*Brassica oleracea*/ /Controlled Atmosphere/ /Decay/ /Black Spot/

CAMPANULA

Hansen, H.B., Favero, B.T. and Lütken, H. (2019). Postharvest quality of novel *Campanula* lines – assessment of indoor longevity and quality. Acta Hort. 1263, 421-430 DOI: 10.17660/ActaHortic.2019.1263.55 <https://doi.org/10.17660/ActaHortic.2019.1263.55>

Abstract

The production of ornamental plants has a yearly turnover in billions of euros with Europe as the major producer. It is important to assess the postharvest quality of potted plants to provide tools to reduce the losses during transport and/or handling. The producers examine postharvest quality e.g., by assessment of the plants' tolerance to different temperatures and light conditions. In the current study, two potted *Campanula* lines, i.e., 1 and 2, were evaluated in terms of postharvest performance, longevity and plant quality. Plants were kept under three different temperatures (i.e., 5, 23 or 28°C) and low light intensity (50 $\mu\text{mol m}^{-2} \text{s}^{-1}$), mimicking transport/storage and indoor conditions. Control plants were kept in the greenhouse. The plants were evaluated every week by measurements of height, diameter, number of flowers and leaf colour. Additionally, photos of flowers and whole plants were taken. The experimental data showed that both lines did not tolerate the high temperatures. Plants kept at 23°C senesced after 3 weeks, and plants kept at 28°C completely senesced after 2 weeks, due to wilting and fungal infections. Plants kept at 5°C did not notably increase in size over the 3 weeks, and their flower number did not increase compared to the other treatments. Both *Campanula* lines tolerated being kept at low temperatures, thus exhibiting a potential to be stored and transported under cold environment before sale, thereby reducing postharvest losses. Line 1 kept in the greenhouse produced more flowers than plants kept in any other treatment, while line 2 displayed flowers only when kept in the greenhouse. This could indicate that the two *Campanula* lines need a higher light intensity to initiate anthesis. Collectively, it was found that none of the *Campanula* lines tolerated warm temperatures and low light intensity. However, the plants coped with low temperatures and only developed slowly.

Keywords: /Colour/ /Flowers/ /Ornamental Plants/ /Potted Plants/ /Senescence/ /Temperature/

CARROT

Lokoglu, N. and Yanmaz, R. (2019). The effects of storage temperature and packaging methods on quality of roots and seed yield in purple carrot (*Daucus carota* L.). Acta Hort. 1251, 109-112 DOI: 10.17660/ActaHortic.2019.1251.14 <https://doi.org/10.17660/ActaHortic.2019.1251.14>

Abstract

This research was carried out to determine the effects of storage conditions of roots on seed yield and quality in purple carrots. For this purpose, purple carrot roots for seed were stored in refrigerated (+4°C) and non-refrigerated stores in soil + sawdust, soil free + sawdust and perforated PE bags for 16 weeks between 2015 and 2016. During the storage period, sprouting, rooting, shriveling and decay rate were determined. After storage, seed yield characteristics were determined from roots planted on field. As a result of the research, the increase of the storage period caused an increase in the rate of rooting, sprouting and decay. The rate of sprouting and rooting increased with the PE bag in refrigerated storage (+4°C) 56.67%, with the soil free + sawdust 72.50% and the soil + sawdust 90.84% in non-refrigerated storage. Seed yields of roots taken from refrigerated and non-refrigerated storage were between 36.74 and 21.02 g plant⁻¹, respectively. In terms of packaging types, better results were obtained for both storage conditions, in the soil free + sawdust (22.20 and 60.12 g plant⁻¹).

Keywords: /Carrot/ /Seed Yield/ /Storage/ /Packaging/

Chaves, D.V., Zanatta, F.L., Karsten, J. and Finger, F.L. (2019). Physical and physiological

characteristics during storage at cold and ambient temperature of carrot and cenourete® cultivars. Acta Hortic. 1251, 164-172 DOI: 10.17660/ActaHortic.2019.1251.24 <https://doi.org/10.17660/ActaHortic.2019.1251.24>

Abstract

The mechanical damage caused by the cut stimulates surface discoloration, dehydration and the accumulation of secondary metabolites in the carrot root, being proportional to the intensity of the cut. The objective was to characterize physical and physiological changes in three cultivars 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 cenourete®. In each of the groups, half received application of ethylene (10 ppm for 24 h) and the other half control. Afterwards, carrots were conditioned in plastic bags and stored at 8 and 25°C for 6 days. Samples were taken at every three days for analyses of the relative fresh weight loss, whitening index and total phenolic compounds. It was observed that the application of ethylene had no marked effect on all analyzes, regardless of the storage temperature. The roots stored at room temperature lost more weight, and the loss was higher in baby carrot. Regardless of the processing or not, all the carrots exceeded the maximum fresh weight loss (8%). The baby carrot has greatly increased the values of whitening index between 0 and 3 days, independent of treatment. There was an increase in total phenolic compounds during storage, in the three cultivars and for all treatments. Application of ethylene, the concentration used did not change the physical and physiological characteristics of carrots; there were differences between storage temperatures, cenourete® and carrots; and there were differences between cultivars during storage.

Keywords: *Daucus carota*/ /Minimally Processed/ /Relative Fresh Weight Loss/ /Whitening Index/ /Phenolic Compounds/

CHERRY

Gimeno, D., Gracia, A.P., Campo, E., Venturini, M.E. and Oria, R. (2019). Influence of MAP technology on the aroma composition of cherries during shelf life period. Acta Hortic. 1256, 589-594 DOI: 10.17660/ActaHortic.2019.1256.84 <https://doi.org/10.17660/ActaHortic.2019.1256.84>

Abstract

Modified atmosphere packaging (MAP) is known to slow down and prevent spoilage of fruits and vegetables. We investigated whether MAP technology may also be suitable to guarantee the characteristic aroma of stored products. As a case study, we selected cherries from Rainier and Lapins cultivars grown in Aragon. Since both represent an important segment in world-wide exportation, increasing the shelf life of these products represents a major issue for producers and distributors. The main objective of this work is monitoring the impact of Lifepack semipermeable bags on the odour profile and therefore aromatic potential of cherries during the commercial shelf-life period, that was established in 20 days. For this purpose, the odour volatiles from Lapins and Rainier cherries were extracted by solid-phase microextraction (SPME) and analysed by gas chromatography-olfactometry (GC-O). A total of 20 odour zones were detected in both cultivars, with a score above 25% (established as noise threshold). From these, 18 could be satisfactory identified, belonging to the aldehyde, ethyl ester and ketone families. Hexanal, E-3-hexanal and E-2-hexanal are compounds with a powerful grass aroma that were identified at three ripening stages, which indicates that they are key-members of cherry aroma. Knowledge of the influence of packing films on the odour profile of specific cherry cultivars is valuable information for producers and distributors, in order to find the optimal storage conditions that allow preserving the aroma potential of fresh cherries during commercial shelf life.

Keywords: /Cherry/ /Aroma Profile/ /Olfactometry/ /Preservation/ /MAP Technology/ /GC-O/

CHRYSANTHEMUM

Christiaens, A., Van Huylenbroeck, J., Gobin, B. and Van Labeke, M.C. (2019). Postharvest quality of ornamental cuttings evaluated by chlorophyll fluorescence. Acta Hort. 1263, 413-420 DOI: 10.17660/ActaHortic.2019.1263.54 <https://doi.org/10.17660/ActaHortic.2019.1263.54>

Abstract

Globalization of the ornamental industry leads to an increased import and export of young plants and cuttings. In the Belgian ornamental industry, there is an increasing trend of producing high quality cuttings in favourable climatic regions worldwide. Transport of these cuttings to the Belgian nurseries and worldwide can affect their quality. To assess postharvest quality after transport or storage, chlorophyll fluorescence was evaluated as a non-destructive method. Therefore, cuttings from two pot chrysanthemum (*Chrysanthemum morifolium*) cultivars, Conaco and Jasoda, were stored in dark conditions at $3.1\pm 0.3^{\circ}\text{C}$ for 35 days. After 0, 5, 10, 15, 21, 28, and 35 days, cuttings were removed from the cold room and were rooted. Chlorophyll fluorescence was measured during the first days of rooting. Results show optimal levels of Fq/Fm already 24 h after sticking for Conaco for all storage treatments. Jasoda showed suboptimal levels of Fq/Fm 24 h after sticking for cuttings that were stored for at least 21 days. Two days after sticking, a suboptimal level of Fq/Fm was still monitored for cuttings stored for 35 days. This was also reflected by visual leaf damage. It is concluded that below a certain threshold value for Fq/Fm, measured 24 h after sticking, the quality of rooted cuttings will be poor.

Keywords: /Chlorophyll Fluorescence/ /*Chrysanthemum morifolium*/ /Storage/ /PSII Operating Efficiency/

CITRUS

Tian, Z., Chen, C., Chen, K., Liu, P., Fan, Q., Zhao, J., & Long, C.-A. (2020). Biocontrol and the mechanisms of *Bacillus* sp. w176 against postharvest green mold in citrus. *Postharvest Biology and Technology*, 159, 111022. doi: 10.1016/j.postharvbio.2019.111022

Abstract

Green mold caused by *Penicillium digitatum* is a serious postharvest disease of citrus. In this study, we obtained a new strain with potent biocontrol activity to control green mold of citrus, and it was characterized as *Bacillus* sp. w176 by physiological, biochemical, and 16S rDNA analyses. Cell-free supernatant (CFS) of strain w176 in PDB culture was analyzed by Liquid Chromatography Tandem Mass Spectrometry (LC—MS/MS). There were more than four different groups of possible metabolites including macrolactin, bacillaene, mycosubtilin, and surfactin. Additionally, both *Bacillus* sp. w176 and its CFS could effectively reduce disease incidence and lesion diameter of green mold of citrus *in vivo*. *Bacillus* sp. w176 and its CFS reduced green mold by round percentage of 89.3% and 54.46%, respectively. Moreover, both *Bacillus* sp. w176 and its CFS could similarly inhibit the expansion of green mold on citrus with similar effect compared to the fungicide prochloraz after three months of storage. Transmission Electron Microscope (TEM) examination showed that subcellular structure of *P. digitatum* was changed involving vacuolation, when it was incubated with CFS. Gene expression analysis indicated a change in redox and ribosome biogenesis stress-related genes transcript levels, when *P. digitatum* were treated with CFS. These results suggested that both *Bacillus* sp. w176 and its CFS might be valuable for disease control purpose. Our study may provide a novel biological agent to control the citrus green mold and improve our understanding of the possible biocontrol mechanisms of strain w176.

Keywords: /*Penicillium digitatum*/ /Citrus/ /*Bacillus* sp. w176/ /Biocontrol/ /Antifungal effect/

COWPEA

Bempi, S., Makrogianni, D., Tsekouras, A., Ntatsi, G., Savvas, D. and Karapanos, I. (2019). Postharvest behaviour and quality changes of green pods of cowpea (*Vigna unguiculata* ssp. *unguiculata*) in relation to storage temperature and plastic packaging. Acta Hort. 1256, 601-608 DOI: 10.17660/ActaHortic.2019.1256.86 <https://doi.org/10.17660/ActaHortic.2019.1256.86>

Abstract

Although cowpea green pods have been traditionally used in folk diets in tropical and sub-tropical regions, very little is known about their behaviour and physicochemical changes after harvest. For this reason, we studied the effect of storage temperature (2, 5 and 10°C) and plastic packaging (using perforated polyethylene, flexible vinyl and polyvinylchloride films) on the visual quality and some physicochemical characteristics of cowpea pods of two genotypes, stored for 7 days and kept in the packages for 2 days at 20°C, in order to study the shelf life period. During cold storage the lower the temperature, the better was the appearance of the pods. However, after shelf life, pods became in most cases non-marketable due to chilling injury at 2 and 5°C or weight loss (up to 25%), shriveling and decay at 10°C. Only pods enclosed in flexible vinyl and stored at 10°C could still be marketable after 2 days at 20°C. Weight loss was higher in the perforated and flexible vinyl than in the polyvinylchloride film, which, due to its low permeability to water vapour was unsuitable, causing water condensation and decay to pods during shelf life. Cold storage did not significantly affect pods content in total soluble solids, except a reduction in the polyvinylchloride film after shelf life. It had no effect on chlorophyll content, which increased during shelf life, except in the PVC film. Firmness of pods either did not change or increased during storage, irrespective of the postharvest handling. Cowpea pods are highly perishable and susceptible to chilling; therefore, they may be stored successfully for 7 or more days at low temperatures provided they are enclosed in plastic packages of proper permeability and will not be exposed at ambient temperatures during the shelf life period.

Keywords: /Chilling Injury/ /Legumes/ /Storability/ /Fresh Pods/ /Shelf Life Period/ /MAP Storage/

CUTFLOWERS

Ahmad, I., Naseem, T., Dole, J.M. and Basra, S.M.A. (2019). Moringa leaf extract pulse extends longevity of selected cut flowers. Acta Hort. 1263, 487-496 DOI: 10.17660/ActaHortic.2019.1263.63 <https://doi.org/10.17660/ActaHortic.2019.1263.63>

Abstract

Pakistan cut flower industry is dominated by roses, gladioli and tuberose, which are only marketed locally due to a poor postharvest handling chain and unavailability of commercial preservatives. A study was conducted to evaluate the effect of *Moringa oleifera* leaf extract (MLE) on the postharvest performance of cut White Prosperity *Gladiolus* hybrids, Angelique, Gold Medal and Kardinal *Rosa* hybrids, and Single *Polianthes tuberosa* stems. MLE was applied at 0, 1, 5, 10, 20 or 30 mL L⁻¹ as a pulsing solution for 24 h followed by placement in distilled water or continuous vase application of 0, 1, 2, 5, or 10 mL L⁻¹ MLE until termination of vase life. Pulsing of cut stems with 10 mL L⁻¹ MLE for 24 h extended the vase life by 3.0 d for gladiolus, 2.7, 1.1 or 1.1 d for Angelique, Gold Medal or Kardinal roses, respectively, and by 2.5 d for tuberose stems, as compared with stems kept in water (control). Pulsing with MLE at 10 mL L⁻¹ also maintained higher water uptake of gladiolus, Gold Medal rose, and tuberose, and the dry weight of the cut stems, and reduced the electrolyte leakage of cut stems of all tested species and cultivars. Vase application of 2 mL L⁻¹ MLE extended the vase life by ≈1 d over control, maintained water uptake and dry weight of cut stems, and reduced the electrolyte leakage of all species/cultivars. In summary, MLE can be used at 10 mL L⁻¹ as a 24-h pulse or at 2 mL L⁻¹ as a vase solution to extend the vase life and maintain the quality of cut gladiolus, rose and tuberose flowers. However, pulsing had a

greater effect on longevity compared to a continuous vase application.

Keywords: /Plant Growth Hormones/ /Preservatives/ /*Gladiolus* L. Hybrids/ /Organic Preservatives/ /*Rosa* L. Hybrids/ /*Polianthes tuberosa*/ /Vase Life/

DAHLIA

Casey, M., Tansey, K.E., Andrews, R., Marchbank, A., Rogers, H.J. and Stead, A.D. (2019). Flower senescence in composite flowers, can understanding how dahlia florets senesce help to increase dahlia vase life?. *Acta Hort.* 1263, 383-390 DOI: 10.17660/ActaHortic.2019.1263.50 <https://doi.org/10.17660/ActaHortic.2019.1263.50>

Abstract

The dahlia is popular as an ornamental garden plant in the UK, however, its value as a cut flower has been undermined by its short vase life. The vase life of dahlias is often no more than 5 days, whereas 10-14 days are required by the cut flower industry due to the supply chain involved in transporting cut flowers from growers to retailers, sufficient time in store, and still guaranteeing 5 days vase life to a consumer. The current study has considered ethylene sensitivity and how phytohormones interact with one another during the senescence process. In conjunction with these traditional methods, RNA sequencing and de novo assembly of the dahlia transcriptome in the cultivar 'Sylvia' has been carried out, resulting in an assembly of over 20,000 genes, many of which change in expression during floret senescence.

Keywords: /Flower Senescence/ /Ethylene/ /Cytokinins/ /Transcriptome/

EGGPLANT

Tsouvaltzis, P., Babellahi, F., Amodio, M. L., & Colelli, G. (2020). Early detection of eggplant fruit stored at chilling temperature using different non-destructive optical techniques and supervised classification algorithms. *Postharvest Biology and Technology*, 159, 111001. doi: 10.1016/j.postharvbio.2019.111001

Abstract

Eggplant fruit is a chilling injury sensitive vegetable and should not be stored at lower than 12 °C postharvest, although fruit are often placed in temperatures as low as 0–5 °C. For this reason, a rapid early detection of eggplants previously stored at chilling temperatures would allow early removal of those fruit from the market. Eggplant fruit (cv. Fantasy) were stored either at 2 °C (chilling injurious temperature) or at 12 °C (safe storage temperature) for 10 days. Every 2 days, fruit from each group were sampled and left at room temperature, for one additional day. Color measurements in the CIE L*a*b* mode and reflectance data in the wavelength range 360–740 nm, Fourier Transform (FT)-NIR spectra (800–2777 nm) and hyperspectral images at the visible (400–1000 nm) and near infrared (900–1700 nm) part of the electromagnetic spectrum were also acquired on each fruit. Three supervised algorithms; partial least square (PLS), supervised vector machine (SVM) and k-nearest neighbor (kNN) were applied to classify fruit according to the storage temperature. Chilling injury (CI) was subjectively evaluated, according to the presence of black seeds or of brown discolored flesh area. According to the results, although chilling injury symptoms started being evident only after the 4th day of storage at 2 °C, it was possible to discriminate fruit earlier, since day 2, by processing the FT-NIR spectral data with the SVM classifier (100 and 92% non-error-rate (NER)) in calibration and cross validation, respectively) in the whole period data set. Color or FT-NIR spectral data classified with PLS-DA permitted relatively good classification of fruit (>83% accuracy) since the 4th day of storage, while L, C, H° color measurements or

Vis-NIR hyperspectral imaging data combined with PLS-DA generate trustworthy models only after the 6th day of storage. On the other hand, NIR hyperspectral imaging technique and kNN classification algorithm were incapable to separate the fruit either accurately or consistently. These results indicate a good potential of adapting selected protocols, in terms of technique, processing of the raw data and supervised classification algorithm, in order to minimize postharvest losses induced by the improper temperature management of chilling sensitive fruit, such as the eggplants.

Keywords: /Chilling injury/ /Supervised classification/ /Non-Error-Rate (NER)/ /FT-NIR/ /Hyperspectral image/

EUSTOMA

Zhao, Ya and Lien, Cheng Hsiang (2019). Postharvest handling of cut *Eustoma* flowers in Taiwan: a review. Acta Hortic. 1263, 503-506 DOI: 10.17660/ActaHortic.2019.1263.65 <https://doi.org/10.17660/ActaHortic.2019.1263.65>

Abstract

In recent years there is a dramatic increase in the amount of cut *Eustoma* flowers exported to Japan from Taiwan. A major reason for this increase is the improvement of postharvest techniques by the cooperation among local growers, exporters and researchers. The present review will illustrate the factors influencing the postharvest life of cut *Eustoma* flowers. The best quality of cut *Eustoma* flowers are grown in Taiwan and the key aspects are related to the extension of vase life and improvement of overall quality. Apart from the establishment of the standard operating procedures (SOP) for exporting to Japan from Taiwan, e.g., harvesting, grading, packing, precooling, etc., much emphasis is made on the development of effective pretreatment solutions by combination of various chemicals, namely, carbohydrates and ethylene inhibitors.

Keywords: /Postharvest Handling/ /*Eustoma*/ /Ethylene Inhibitors/ /Sugar/ /Standard Operating Procedures (SOP)/

FEIJOA

Oseko, J., East, A.R. and Heyes, J.A. (2019). Reassessing temperature and humidity storage conditions for maintaining quality of 'Kakariki' feijoa. Acta Hortic. 1256, 157-162 DOI: 10.17660/ActaHortic.2019.1256.22 <https://doi.org/10.17660/ActaHortic.2019.1256.22>

Abstract

Feijoa (*Acca sellowiana*) is a fruit with significant market potential due to its aroma, nutritional content, and flavour. In New Zealand the fruit is traded mostly in the local market due to its short storage life, however potential for export exists. Recommendations for extending feijoa storage life suggest cool storage at 4°C. Nevertheless, this recommendation has not been assessed for newly released cultivars and does not give guidance on humidity control. In this study storage conditions for a commonly-planted cultivar, 'Kakariki', were assessed. Cool storage conditions were set at 1°C, 85% RH or 4°C, 88% RH (resulting in equal water vapour pressure deficits at both temperatures). Relative humidity effects on feijoa quality during storage were assessed by the use of a polyethylene polyliner in each tray for half of the treatments. Despite good retention of some attributes indicating quality (firmness and skin colour) for up to 8 weeks at 1°C, many fruit developed chilling injury (internal browning) making it unsaleable and therefore causing huge losses. At both 4 and 1°C the use of a polyliner resulted in reduced water loss, suggesting polyliners may be beneficial for feijoa storage. Given the chilling injury results, it is imperative to consider treatments that may reduce chilling injury and yet maintain fruit quality. One such treatment

could be the use of low temperature conditioning which may acclimatise fruit to increase chilling tolerance.

Keywords: /*Acca sellowiana*/ /Polyliner/ /Chilling Injury/ /Cool Storage/

GRAPE

Moreira, L., Underhill, A. and Clark, M. (2019). Postharvest evaluation of cold-hardy table-grape breeding lines. Acta Hort. 1248, 101-108 DOI: 10.17660/ActaHortic.2019.1248.15 <https://doi.org/10.17660/ActaHortic.2019.1248.15>

Abstract

The University of Minnesota grape breeding program has evaluated a small number of cold-hardy cultivars and advanced selections for postharvest storage traits. This is the first experiment for comparing advanced selections to table-grape cultivars for these traits. Nine genotypes were evaluated for cluster weight and fruit chemistry at harvest. Three clusters per genotype were packed in ventilated polyethylene bags and arranged in carton boxes. Paper pads and SO₂ pads were placed on top of the bunches in each carton. The cartons were stored at 2.2°C for 2, 4, 6, and 8 weeks. Clusters were destructively sampled at each storage time point and evaluated for change in fruit weight, berry splitting, berry decay, juice chemistry, and an overall rating of acceptability. An advanced selection, MN1296, was the top-performing seedless cultivar for overall acceptability for postharvest traits, but has berries that tend to shatter. Louise Swenson, Swenson Red, and MN1296 were rated as the best-performing lines for stem dehydration, in descending order. Swenson Red is the largest-fruited Elmer Swenson/UMN cultivar, but has limited commercial planting because of its seeded berries; Swenson Red also had no shattering after storage. Berry splitting was worst in Louise Swenson, a seeded white grape with multiple uses including wine. Jupiter had severe rachis browning after 8 weeks, but little at 2, 4, or 6 weeks, whereas Vanessa and MN1369 both suffered from decay. Jupiter and Vanessa had the largest clusters, but can be grown in Minnesota with only marginal success using the J-vine training system. Additional research on bud survival and consumer preference will be needed to determine whether any of the advanced selections are suitable for cultivar release.

Keywords: /Table Grape/ /Postharvest/ /Cold-hardy/ /Rachis Browning/ /Visual Quality/

Maoz, I., De Rosso, M., Kaplunov, T., Chalupowicz, D., Dalla Vedova, A., Lewinsohn, E., Flamini, R. and Lichter, A. (2019). Effect of controlled atmosphere on metabolites associated with quality of 'Sable Seedless®' grapes. Acta Hort. 1256, 549-554 DOI: 10.17660/ActaHortic.2019.1256.78 <https://doi.org/10.17660/ActaHortic.2019.1256.78>

Abstract

Controlled atmosphere (CA) has not been implemented so far for storage of grapes, partly because the threshold for prevention of decay can overlap the accumulation of off-flavors. 'Sable Seedless®' was stored under ambient atmosphere or under CA conditions of 5 kPa O₂ and 5, 10 and 15 kPa of CO₂. The level of decay in the experiment was low, in part because the fruit were sanitized with ethanol before storage. Off-flavors developed in grapes stored at the high CO₂ level and the berries were sampled for volatile and non-volatile metabolites. Volatile compounds associated with off-flavor were mainly pyruvate degradation products which accumulated in the high CO₂ atmosphere. Analysis of phenylpropanoid metabolites suggested that flavonols and anthocyanins were lower in fruit stored in the high CO₂ CA conditions. Of the stilbenes, *trans*-resveratrol and piceatannol were higher in the control compared to the high CO₂ CA conditions. These results point on potential markers for negative effects of CA in table grapes and that extreme CA conditions can modulate the phenylpropanoid pathway

Keywords: /GC/MS/ /Postharvest/ /Volatile Compounds/ /Controlled Atmosphere/ /Table Grapes/

Mucalo, A., Zdunić, G. and Maletić, E. (2019). Prolonged ripening on the vine affects the polyphenolic profile of grapes and wine of 'Plavac Mali' (*Vitis vinifera* L.). *Acta Hort.* 1248, 417-424 DOI: 10.17660/ActaHortic.2019.1248.59 <https://doi.org/10.17660/ActaHortic.2019.1248.59>

Abstract

Compositional differences in the polyphenolic profile and physicochemical parameters of grapes and corresponding wines of 'Plavac Mali' at five different harvest dates were evaluated by standard chemical analysis and high-performance liquid chromatography. Prolonged ripening enhanced the anthocyanin and flavonol concentration in skin tissue, with the exception of 3-*O*-glucosides of delphinidin, petunidin and quercetin, and 3-*O*-rutinoside of quercetin. Various trends in skin low-molecular-weight phenolic compounds were detected: increases in (+)-galocatechin and (-)-epicatechin, and decreases in the others including (+)-catechin, (-)-epigallocatechin, and proanthocyanidins (B1, B2, B3, B4). Grape seeds reached stable concentration of low-molecular-weight phenolic compounds at the third harvest date, while prolonged ripening had a significant influence on (-)-epicatechin and (-)-epigallocatechin. In contrast, in the corresponding wines, the concentrations of anthocyanins had two peaks NDASH one at the third harvest date and one at the fifth harvest date NDASH with no significant difference between the two, except in peonidin-3-*O*-glucoside. Prolonged ripening caused a production of wines with high concentration of (+)-galocatechin and (-)-epicatechin, and the lowest concentration of (-)-epigallocatechin. The results indicate the potential of 'Plavac Mali' for prolonged grape ripening, but negative aspects of the prolonged ripening practice should also be considered.

Keywords: /Flavonoids/ /Anthocyanins/ /Proanthocyanidins/ /(+)-catechin/ /Postharvest Over-Ripening/ /Mediterranean Climate/

Tyagi, K., Maoz, I., Vinokur, Y., Rodov, V., Lewinsohn, E., & Lichter, A. (2020). Enhancement of table grape flavor by postharvest application of monoterpenes in modified atmosphere. *Postharvest Biology and Technology*, 159, 111018. doi: 10.1016/j.postharvbio.2019.111018

Abstract

Consumers expect ready-to-eat grapes to have excellent quality and flavor. In practice, most table grape cultivars have a neutral flavor relying mainly on the combination of sugar and acidity due to limited levels of volatiles that impart the unique aromas. This study investigated the possibility of improving grape flavor by incubating the berries in monoterpene-enriched modified atmosphere. The berries were sanitized by dipping in ethanol and packaged in trays sealed with plastic films of different perforation levels. The optimal conditions selected for further study were one micro-perforation per package containing 250 g berries and storage at 5 °C for 2 weeks. To test the possibility of improving grape flavor during storage, berries of the cultivars Flame Seedless, Adominique, 4111 and Crimson Seedless were stored in the presence of the monoterpenes linalool or geraniol. After two weeks of storage in the presence of linalool, it accumulated in the berries to levels of 551, 704 and 3273 µg kg⁻¹ in Adominique, 4111 and Crimson Seedless, respectively. Application of linalool or geraniol resulted in appearance of many other monoterpenes, probably by the action of endogenous enzymes. Organoleptic preference assays indicated that berries of Adominique and 4111 stored in the presence of linalool were favored over the control berries. Overall, the results demonstrate the feasibility of using monoterpenes to enhance berry flavor during storage.

Keywords: /Table grapes/ /*Vitis vinifera*/ /Postharvest/ /Ready-To-Eat/ /Volatile compounds/ /Flavor/

GOLDEN TORCH

Shokalu, A.O., Akintoye, H.A., Olatunji, M.T., Adebayo, A.G. and James, I.E. (2019). Use of organic and inorganic solutions for extending the vase life of cut *Heliconia* 'Golden Torch' flowers. *Acta Hortic.* 1263, 497-502 DOI: 10.17660/ActaHortic.2019.1263.64 <https://doi.org/10.17660/ActaHortic.2019.1263.64>

Abstract

The use of organic solutions as floral preservatives for extending the vase life of cut flowers has been found to be a cheaper and eco-friendly alternative as compared to inorganic solutions. This study was carried out to investigate the use of *Aloe vera* (*Aloe vera barbadensis*) and moringa (*Moringa oleifera* Lam.) solutions, compared with calcium chloride and salicylic acid solutions, for improving the postharvest longevity of cut *Heliconia* 'Golden Torch' flowers. The experiment was carried out in the plant physiology laboratory, at the National Horticultural Research Institute (NIHORT), Ibadan, Nigeria. The treatments, applied as preservative solutions, included: control (CON); moringa solutions at 2.5, 5.0, and 7.5% (ML 1-3); *Aloe vera* solutions at 2.5, 5.0, and 7.5% (AL 1-3); moringa solutions at 2.5, 5.0, and 7.5% + 4% sucrose (MLS 1-3); *Aloe vera* solutions of 2.5, 5.0, and 7.5% + 4% sucrose (AS 1-3); calcium chloride solution 350 μ L L⁻¹ (CA); calcium chloride solution 350 μ L L⁻¹+ 4% sucrose (CAS); and calcium chloride solution 200 μ L L⁻¹ + salicylic acid 150 μ L L⁻¹ + 4% sucrose (CSS). All treatments improved the vase life of cut *Heliconia* flowers compared to the control, except of the moringa solutions, which resulted in the highest wilted bracts at day 10. Flowers treated with solutions of *Aloe vera* at 5.0% combined with 4% sucrose showed the best water uptake, percentage of maximum increase in open bracts (67.4%), and the highest relative water content (RWC) (78.9%). The quality and vase life of cut *Heliconia* 'Golden Torch' flowers was extended significantly beyond 14 days with *Aloe vera* gel solutions, followed by calcium chloride/salicylic acid solutions compared to control.

Keywords: /Sucrose/ /*Aloe vera*/ /Moringa/ /Calcium/ /Salicylic acid/ /Longevity/

GUAVA

Oliveira, J.G., Oliveira, A.V., Santana, D.B., Silva, G.M.C., Oliveira, T.F., Oliveira, A.A. and Morles, L.M.M. (2019). Effect of chitosan film on C₂H₄ emission and respiratory and antioxidant activities during 'Cortibel' guava ripening. *Acta Hortic.* 1256, 127-134 DOI: 10.17660/ActaHortic.2019.1256.18 <https://doi.org/10.17660/ActaHortic.2019.1256.18>

Abstract

The aim of this work was to investigate how chitosan-based biodegradable coating interferes in the respiration process, ethylene (C₂H₄) emission, and reactive oxygen species (ROS) homeostasis during guava ripening. 'Cortibel' guava fruit in two ripening stages (green and ripe) were used. Fruit coated with chitosan at 1.5% (w/v) were compared with uncoated fruit (control). The ethylene emission and respiratory rates of intact fruit by CO₂ emission were evaluated by gas chromatography. The total respiration and oxidase pathway (AOX and COX) contributions, hydrogen peroxide, and peroxidase (POD) and superoxide dismutase (SOD) were also assessed in mitochondria isolated from fruit pulp. CO₂ emissions increased during ripening, both in control and in coated fruits, with lower CO₂ emission in fruit coated with chitosan. The same results were observed for ethylene emission. The application of chitosan on fruit decreased the total respiration rate in mitochondria isolated from green fruit, but no such effects were observed in ripe fruit. The effect of chitosan coating on the total respiration rate occurred due to a decrease in O₂ uptake by the COX pathway, with no difference verified in the AOX pathway. Both POD and SOD activities were lower in green fruit when compared with the ripe ones. On the other hand, while the chitosan coating decreased the POD and SOD activities in ripe fruit, SOD activity was higher in green

fruit; furthermore, no effect of chitosan on POD activity was registered in green fruit. In conclusion, the chitosan coating decreased the respiratory activity and the ethylene emission by fruit, probably due to the lower O₂ tension induced by the film coating. The COX pathway was more sensitive to the reduced O₂ tension than the AOX pathway and, consequently, there was an increase in ROS production. The results indicate the fruit shelf life was enhanced and fruit quality was prolonged by the application of the chitosan coating.

Keyword: /Biodegradable Coating/ /Mitochondria Isolated/ /Oxidase Pathway/ /*Psidium guajava* L./ /Reactive Oxygen Species/

Galli, J.A., Palharini, M.C. de A., Torres, E.M.J., Michelotto, M.D., Fischer, I.H., Bertani, R.M. de A. and Martins, A.L.M. (2019). Multivariate analysis of guava fruits stored under different temperatures and modified atmosphere. Acta Hortic. 1256, 583-588 DOI: 10.17660/ActaHortic.2019.1256.83 <https://doi.org/10.17660/ActaHortic.2019.1256.83>

Abstract

Brazil is the largest producer of guavas, but the exported volume is small because of their short shelf life. This research aims to optimize the storage conditions to preserve the physical-chemical characteristics from the freshly harvested fruit. Seven treatments were applied after harvest of guava fruits genotype L5P10 cultivated in organic system: fruits covered with biofilm of manioc starch and stored at 25°C for 2 days (MS2d25°C) or at 10°C for 4 days (MS4d10°C), fruits packed in PVC film and stored at 25°C for 2 days (PVC2d25°C) or at 10°C for 4 days (PVC4d10°C), uncoated fruits stored at 25°C for 2 days (UF2d25°C) or at 10°C for 4 days (UF4d10°C), and fruits stored at room temperature (28-30°C) for 24 h (control). The fruits were evaluated for: skin colour, pulp colour, firmness, soluble solids, titratable acidity, ratio SS-TA, pH, ascorbic acid content and percentage of mass loss. The data were submitted to multivariate analysis using hierarchical cluster analysis techniques by UPGMA and principal component analysis (PCA). The UPGMA analysis showed the formation of three groups, the treatment PVC4d10°C being the most similar to the control (Euclidean distance 2.54), and the treatment UF2d25°C, the more divergent (6.43) from the control. In PCA, 80.01% of the variation in the original data was explained by the first two principal components. This analysis showed that the treatments PVC4d10°C and control were similar and showed higher values of SC, SS, and lower value of %LM. The Biplot graphic illustrated the divergence of the treatment UF2d 25°C compared to the others and to the control. The multivariate analyses were useful for discriminating the storage conditions, and suggest that fruits packed with PVC film and stored for four days at 10°C maintained its features closer to freshly harvested fruits, mainly regarding the skin colour and the soluble solids content.

Keywords: /*Psidium guajava*/ /Fruit Quality/ /Hierarchical Cluster Analysis/ /Principal Component Analysis/

Heliconia

Malakar, M., Acharyya, P. and Biswas, S. (2019). Consequences of divergent vase solutions on postharvest durability and quality of *Heliconia* inflorescences. Acta Hortic. 1256, 77-94 DOI: 10.17660/ActaHortic.2019.1256.12 <https://doi.org/10.17660/ActaHortic.2019.1256.12>

Abstract

Heliconia the most flourishing cut flower in the tropics owing to its charismatic form and alluringly blended hues of its bracts. To label postharvest complications and also to protract vase life for a substantial span the present experiment was designed using antithetical vase solutions of various concentrations and fresh, mature, cut spikes of nine different *Heliconia* species and cultivars. T5 and T6 treatment combinations contain AgNO₃ at 1500 ppm and CaCl₂ at 750 mg L⁻¹ along with 8-HQC at 500 mg L⁻¹

and sucrose 2% outstandingly elevated solution uptake and flower opening inside bracts principally in all species and cultivars, respectively. Untreated spikes of *Heliconia psittacorum* Lady di, *Heliconia wagneriana*, *Heliconia stricta*, *Heliconia humilis* Dwarf and *Heliconia metallica* exhibited noteworthy fresh weight retention on the 8th day exceptionally while in contrast T4, T5, T7 and T3 evinced themselves unrivalled for rest of the genotypes for the same duration. To preserve bract and flowers carotene, anthocyanin and chlorophyll pigments all treatments impact were truly species specific apparently. T7 and T9 hold GA3 at 80 ppm and citric acid at 200 mg L⁻¹ along with germicide and sucrose, respectively, besides T5 and T6 also yield utmost vase life being impeded senescence in all inflorescences. These identical treatments amplified the levels of catalase, peroxidase enzymatic activities and collaterally declined the lipid peroxidation on 7 days in the bract. Therefore, the present study concludes that AgNO₃, CaCl₂, GA3 and citric acid at mentioned concentration renders magnificent beneficial effects on vase life attributes being subsisted with oxidative stress of *Heliconia* inflorescences.

Keywords: /*Heliconia*/ /Vase Life/ /Catalase/ /Peroxidase/ /Lipid Peroxidation/ /Senescence/

HYDRANGEA

Terfa, M.T. and Torre, S. (2019). Impact of lighting conditions during forcing on flowering time, morphology and postharvest transpiration of *Hydrangea macrophylla*. Acta Hort. 1263, 405-412 DOI: 10.17660/ActaHortic.2019.1263.53 <https://doi.org/10.17660/ActaHortic.2019.1263.53>

Abstract

In this study, the main objective was to evaluate the impact of lighting conditions and to test effects of continuous lighting and light quality on morphology, number of flowering shoots, flowering time and postharvest transpiration. *Hydrangea macrophylla* 'Clarissa' was forced in controlled climate chambers. Extending the photoperiod from 16 to 24 h with high pressure sodium lamps (HPS) did not affect forcing time or morphology, but postharvest transpiration was more than 50% higher when the plants were forced at 24 h compared to 16 h lighting. Additional blue light (30% BL, 400-500 nm) in combination with HPS (HPS + BL) did not change the postharvest transpiration compared to HPS but resulted in more compact plants and one week earlier flowering. White light emitting diodes (LEDs) with 20% BL induced more compact plants, compared to HPS, but the flowering was delayed by one week, and postharvest transpiration increased compared to HPS.

Keywords: /Blue Light/ /Flowering Time/ /Photomorphogenesis/ /*Hydrangea (Hydrangea macrophylla)*/ /Transpiration/

JUJUBE

Oh, Sung-II, Lee, Sugwang, Kim, Chul-Woo and Lee, Uk (2019). Enhanced shelf life of jujube (*Ziziphus jujuba* Mill.) using aqueous chlorine dioxide. Acta Hort. 1256, 343-348 DOI: 10.17660/ActaHortic.2019.1256.48 <https://doi.org/10.17660/ActaHortic.2019.1256.48>

Abstract

In this study, we aimed to determine the appropriate conditions for storage of jujube (*Ziziphus jujuba* Mill.). Jujube was treated with aqueous chlorine dioxide (10, 25, and 50 mg L⁻¹ for 1, 5, and 10 min) and was stored at 0±0.3°C (optimal storage temperature) and 90±5% relative humidity for six weeks. The weight loss rate of all samples increased during storage, but it was not significantly different among treatments. The percent of weight loss after six weeks of storage ranged from 0.4 to 1.4%. The colour change (ΔE) values, soluble solid content, and firmness of jujube were not significantly different among treatments. However, the sensory evaluation index was higher for chlorine dioxide-treated samples than

untreated samples with regard to palatability, texture, and off-odor. The decay rate of all samples increased during storage, and after storage for six weeks it was the highest in the 10 mg L⁻¹ - 1 min treatment group (50.0%) and was the lowest in the 50 mg L⁻¹ - 5 min treatment group (23.0%). After six weeks of storage, the order of the treatments according to the number of yeasts and moulds present in the samples was: control (6.77 log CFU g⁻¹) > 50 mg L⁻¹ - 1 min (6.73 log CFU g⁻¹) > 10 mg L⁻¹ - 1 min (6.53 log CFU g⁻¹) > 25 mg L⁻¹ - 1 min (6.37 log CFU g⁻¹) > 10 mg L⁻¹ - 5 min (6.33 log CFU g⁻¹) > 25 mg L⁻¹ - 5 min (6.00 log CFU g⁻¹) > 25 mg L⁻¹ - 10 min (5.90 log CFU g⁻¹) > 10 mg L⁻¹ - 10 min (5.70 log CFU g⁻¹) > 50 mg L⁻¹ - 5 min (4.80 log CFU g⁻¹) > 50 mg L⁻¹ - 10 min (4.63 log CFU g⁻¹). These results suggest that aqueous chlorine dioxide treatment (particularly treatment at 50 mg L⁻¹ for 5 min) improved microbiological characteristics and preserved the quality of jujube during storage.

Keywords: /Chlorine dioxide/ /Jujube/ /Postharvest Treatment/ /Storage Technique/ /Quality/

KIWI

Gong, H., Fullerton, C., Billing, D., & Burdon, J. (2020). Retardation of 'Hayward' kiwifruit tissue zone softening during storage by 1-methylcyclopropene. *Scientia Horticulturae*, 259, 108791. doi: 10.1016/j.scienta.2019.108791

Abstract

The use of the ethylene action inhibitor 1-methylcyclopropene (1-MCP) is becoming more common in the global kiwifruit industry as a tool for firmness management after harvest. The overall fruit firmness measured by penetrometer or compression is dependent on the relative changes in texture of the three main tissue zones: the outer pericarp, inner pericarp and core. This research has investigated the way in which 1-MCP affects the firmness of individual tissue zones during storage, and the changing response of 1-MCP treated fruit to ethylene. 1-MCP retarded fruit softening as measured by whole fruit compression or penetrometer. However, there was a long period in storage where the compression test did not show the same degree of softening as was detected by the penetrometer measurement. In addition, it was shown that 1-MCP retarded the softening of the three tissue zones investigated. The exposure of 1-MCP treated fruit to ethylene at intervals throughout storage demonstrated the long term nature of the anti-ethylene effect of a 1-MCP treatment at the start of storage; an effect that persisted in all three tissue zones. It is concluded that 1-MCP retards the overall softening of 'Hayward' kiwifruit, whether measured by compression or penetrometer. More specifically, the treatment affects the softening of the outer pericarp, inner pericarp and core tissues to a similar extent. The protective effect of a 1-MCP treatment at the start of storage against exogenous ethylene persists to some degree throughout storage.

Keywords: /Actinidia/ /Storage/ /1-MCP/ /Firmness/ /Pericarp/ /Core/ /Efficacy/

Kai, K., Bi, W., Sui, Y., Hua, C., Liu, Y., & Zhang, D. (2020). Curcumin inhibits *Diaporthe phaseolorum* and reduces postharvest decay in kiwifruit. *Scientia Horticulturae*, 259, 108860. doi: 10.1016/j.scienta.2019.108860

Abstract

Curcumin is a promising antifungal agent because of its wide range of antifungal activities. In the present study, the effect of curcumin on postharvest decay of kiwifruit, caused by *Diaporthe phaseolorum*, was evaluated. We found that spore germination, germ tube elongation, and mycelial growth of *D. phaseolorum* were all significantly inhibited by curcumin. Cell viability and ATP content were also reduced by the addition of curcumin. Curcumin induced the production of reactive oxygen species in *D. phaseolorum* hyphae, resulting in apoptosis and accelerated rate of cell death. The activities of antioxidant enzymes, including catalase, peroxidase, superoxide dismutase and glutathione peroxidase, increased upon curcumin treatment. Mycelia exposed to curcumin exhibited a greater sensitivity to

osmotic and oxidative stresses than untreated mycelia, and they lost their ability to penetrate plant cell walls. Application of curcumin effectively inhibited disease development in kiwifruit in a dose dependent manner. Collectively, the results indicated that curcumin can effectively inhibit postharvest decay of kiwifruit caused by *D. phaseolorum* by inhibiting the vegetative growth and cell viability, promoting apoptosis and cell death, and decreasing pathogenicity of the pathogen.

Keywords: /Curcumin/ /Postharvest disease/ /*Diaporthe phaseolorum*/ /Vegetative growth/ /Pathogenicity/ /Reactive oxygen species/

LEAFY VEGETABLES

Retta, M.A., Verlinden, B., Verboven, P. and Nicolai, B. (2019). Texture-microstructure relationship of leafy vegetables during postharvest storage. Acta Hort. 1256, 169-178 DOI: 10.17660/ActaHortic.2019.1256.24 <https://doi.org/10.17660/ActaHortic.2019.1256.24>

Abstract

Leafy vegetables such as lettuce (*Lactuca sativa* L.) and spinach (*Spinacia oleracea* L.) are consumer favourites. As leafy vegetables are highly perishable, they need to be refrigerated immediately after harvest to retard the biochemical processes that lead to senescence. The main aim of this study is to test the hypothesis that changes in the three-dimensional (3-D) leaf microstructure during postharvest storage contribute significantly to loss of texture. Leaves from spinach and lamb's lettuce at commercial maturity were stored in dark at 13°C with the relative humidity maintained at 99.5±7.4 and 76.5±5.8%. The 3-D leaf anatomy was then imaged at day 0, 2, 4, 6 and 8 using X-ray micro computed tomography (X-ray μ CT). In addition, mechanical properties were assessed by a punch test using a texture analyzer. The leaf anatomy showed drastic changes congruent with the observed water loss and tissue softening. Structural parameters were calculated from the X-ray μ CT images. The 3-D leaf thickness correlated well with strength and displacement before fracture while tissue specific surface and pore specific surface correlated well with toughness. The implication of such correlations on crispiness and crunchiness is discussed.

Keywords: /Storage Disorder/ /Food Quality/ /Shelf-life/ /Imaging/ /3-D Microstructure/ /Tomography/ /Lettuce/ /Spinach/

Cantwell, M.I., Albornoz, K. and Hong, G. (2019). Ammonia accumulation is a useful indicator of the postharvest freshness and quality of spinach and kale. Acta Hort. 1256, 303-310 DOI: 10.17660/ActaHortic.2019.1256.42 <https://doi.org/10.17660/ActaHortic.2019.1256.42>

Abstract

Freshness is a very desirable attribute for all fresh produce, but especially leafy greens. Loss of freshness may occur due to postharvest factors such as time, temperature abuse, and mechanical injury. Ammonia, a product of protein catabolism associated with senescence of leafy greens, is toxic to plant cells and accumulates during postharvest handling. The time-course of ammonia accumulation (spectrophotometric determination) and marketable quality attributes (overall visual quality, decay, yellowing) was studied in relation to storage temperature and leaf maturity in fresh-cut kale, and in relation to storage temperature and mechanical damage in baby leaf spinach. Ammonia increased more rapidly in mature than immature kale leaves at 0, 5 or 7.5°C. Kale storage at 0°C clearly minimized quality loss as well as ammonia accumulation. At 7.5°C, differences in ammonia occurred before there were visible differences in kale quality attributes. At 0 and 5°C, measurable changes in ammonia coincided with visible quality changes. Young spinach leaves with greater mechanical damage had earlier increases in decay, off-odors and ammonia concentrations when stored at 2.5 or 7.5°C compared to leaves with minimal mechanical damage. Baby leaf spinach stored in perforated bags at 0, 5 or 10°C had ammonia increases coincident

with or before changes in visual quality, decay and off-odors. Accumulation of ammonia in leafy green tissues should be associated with an increase in volatile ammonia when the product is in a package. This was effectively demonstrated in one spinach storage experiment using sensitive experimental volatile ammonia sensors. Spinach held for 6 days at 0°C had very little tissue or volatile ammonia accumulation compared to spinach samples held at 10°C for 6 days or 20°C for 2 days. Although there is probably no single measurement of freshness, there is evidence that for leafy vegetables, ammonia accumulation could be a useful freshness indicator. Ammonia can be determined in the leafy tissues or as a volatile in the packaged product.

Keywords: /Damage/ /Leaf Maturity/ /Temperature/ /Visual Quality/ /Decay/ /Off-odors/

Nicole, C.C.S., Mooren, J., Pereira Terra, A.T., Larsen, D.H., Woltering, E.J., Marcelis, L.F.M., Verdonk, J., Schouten, R. and Troost, F. (2019). Effects of LED lighting recipes on postharvest quality of leafy vegetables grown in a vertical farm. *Acta Hort.* 1256, 481-488 DOI: 10.17660/ActaHortic.2019.1256.68 <https://doi.org/10.17660/ActaHortic.2019.1256.68>

Abstract

Vertical farming is a technology that controls climate, water, nutrients and light to grow food in a closed environment. This allows vegetables to grow pesticide free and without other contaminants. We investigated how to influence the postharvest quality by controlling the preharvest growth conditions while keeping a high production rate. Several standard LED lighting recipes (red/blue or red/white either with or without far red) are in use in commercial farms. For this research we used lettuce, baby leaf spinach, rocket and basil from various cultivars all grown in a vertical farm research facility. We used the standard red white LED light recipe as control, while we changed the spectrum with higher blue and/or higher far-red or apply few days of continuous light stimulation just before the harvest (preharvest). Quality at harvest and quality loss during postharvest storage was monitored. We observed that light quality affects shelf life of baby leaf spinach and rocket by several days. The best light recipe for shelf life had a high blue content (35%) while the worst was with a high far red (25%). In addition, contents of vitamin C, K, nitrate, chlorophyll and flavonols were different under various light quality. Nitrate (in lettuce, rocket and spinach) and vitamin C in rocket were strongly affected by preharvest continuous light, offering a way to reduce the nitrate and improve the antioxidant level. In addition, taste was also found to change as a function of light quality but magnitude of this change is shown to be strongly cultivar dependent.

Keywords: /Vertical Farming/ /Shelf Life/ /LED Lighting/ /Nitrate/ /Vitamin C/ /Vitamin K/ /Taste/

LETTUCE

Hunter, P.J., Pink, D., Hand, P., Heath, J., Barker, G., Hambidge, A., Lignou, S., Oruna-Concha, M.-J., Radha, B., Wagstaff, C. and Monaghan, J.M. (2019). A genetic approach to improving postharvest quality in lettuce. *Acta Hort.* 1256, 295-302 DOI: 10.17660/ActaHortic.2019.1256.41 <https://doi.org/10.17660/ActaHortic.2019.1256.41>

Abstract

Ready to eat salad products have considerable added value. However, such products have increased perishability resulting in high wastage. Many leafy vegetables and fruits are susceptible to discolouration, and breeding crop varieties with reduced propensity to discolour offers a cost effective solution as growing them has no added costs. This project facilitates a genetic approach to controlling postharvest discolouration by developing an understanding of the genetics and biochemistry of discolouration and providing underpinning knowledge to allow exploitation of quantitative natural variation in the development of discolouration whilst maintaining other traits (e.g., disease resistance, taste, etc.) at acceptable levels.

We have observed that a lettuce (*Lactuca sativa*) recombinant inbred population from 'Saladin' × 'Iceberg' segregates into two Iceberg and Cos head morphotypes. Levels of phenolics in the leaves are associated with morphotype and processed and bagged leaves from the population show a general negative association between pinking and browning symptoms. Discolouration traits exhibit genotypic variation allowing the identification of breeding material to develop lines with improved postharvest quality. A better understanding of the biochemical variation has the potential to lead to specific treatments that could be applied during processing to reduce discolouration development and increase shelf life.

Keywords: Lettuce/ /Postharvest/ /Pinking/ /Browning/ /Polyphenols/

LENTEN ROSE

Abdulla, M.F. and Çelikel, F.G. (2019). Postharvest quality and extending vase life of *Helleborus orientalis* flowers by sucrose pulsing. Acta Hortic. 1263, 449-454 DOI: 10.17660/ActaHortic.2019.1263.58 <https://doi.org/10.17660/ActaHortic.2019.1263.58>

Abstract

Helleborus orientalis Lam. (*Ranunculaceae*) flowers have long stems bearing many greenish-white florets and nice leathery leaves. There is no published postharvest study of these beautiful native flowers. We investigated the postharvest physiology and the possibility of extending the vase life of *H. orientalis* cut flowers naturally grown in the Black Sea region of Turkey. Flowers were harvested in March from a native forest located in the campus of Ondokuz Mayıs University in Samsun. Changes in water uptake (WU) and relative fresh weight (RFW) were determined daily in a standard vase life evaluation room maintained at 20±2°C. The vase life was defined as the time to wilting of 50% of the florets in each stem. Pulsing the flower stems overnight with 20% sucrose delayed their wilting by increasing their WU and maintaining their RFW at high values. Consequently, the flowers in the vases reached a longevity of more than two weeks. These results suggest that *Helleborus orientalis* Lam. flowers have a commercial potential and a high market value as cut flowers.

Keywords: /Vase Life/ /Cut Flower/ /Relative Fresh Weight/ /Water Uptake/ /Sucrose/ /*Helleborus orientalis* Lam/

LITCHI

Lai, D., Shao, X., Xiao, W., Fan, C., Liu, C., He, H., ... Kuang, S. (2020). Suppression of fruit decay and maintenance of storage quality of litchi by *Photorhabdus luminescens* Hb1029 treatment. *Scientia Horticulturae*, 259, 108836. doi: 10.1016/j.scienta.2019.108836

Abstract

Photorhabdus luminescens Hb1029, a nematode symbiotic bacteria, has been found to control litchi fungus disease in vitro, but very limited information is available about fruit postharvest. Litchi fruits cv. Guiwei were treated with 108 CFU mL⁻¹ *P. luminescens* suspension or sterile water as the control and stored at 25±1 °C with 40%–50% relative humidity. The changes in fruit decay, quality maintenance, defense-related enzyme activities and those involved in reactive oxygen species (ROS) were monitored. The results showed that *P. luminescens* effectively repressed fruit decay, mainly expressed as a significant reduction in browning index and weight loss. Meanwhile, litchi treated with *P. luminescens* maintained higher total soluble solids, titratable acidity, total soluble sugars and vitamin C compared to the control. Moreover, *P. luminescens* treatment enhanced the defense enzyme activities (peroxidase, superoxide dismutase and catalase) and induced a significant increase in trehalose content in fruit pulp while a significant decrease in malondialdehyde (MDA), hydrogen peroxide (H₂O₂) accumulations in

pericarp. These findings indicated that, the application of *P. luminescens* enhanced the defense-related mechanism and non-enzymatic antioxidant system (trehalose, MDA, ROS and H₂O₂) of litchi against fruit decay.

Keywords: *Litchi chinensis*/ *Photorhabdus luminescens*/ Storage quality/ Defense enzymes/ Trehalose/

LOTUS

Buanong, M., Wongs-Aree, C., Meir, S. and Philosoph-Hadas, S. (2019). Delaying petal blackening of cut sacred lotus flowers by packaging conditions during storage. Acta Hort. 1263, 367-374 DOI: 10.17660/ActaHortic.2019.1263.48 <https://doi.org/10.17660/ActaHortic.2019.1263.48>

Abstract

The demand for cut flowers of sacred lotus (*Nelumbo nucifera* Gaertn.), is progressively increasing both in the local and export markets. However, flower marketability is limited mainly due to the rapid blackening of the outer petals after harvest, resulting in a very short vase life of only 2-3 days. The objective of this study was to develop optimal packaging conditions during transport for sacred lotus flowers. Cut lotus flowers were packed in the following conditions: no bags (paper wrap), perforated bags and modified atmosphere packaging (MAP) - sealed bags in which MA was created. All bags were of 30 μ thickness. The packed flowers were stored at 13°C for two days and subsequently transferred to 25°C for additional 4-8 days (market simulation). The results showed that during the storage period under MAP, CO₂ and ethylene accumulated to high levels, while O₂ levels decreased. These treatments reduced the petal blackening after 3-day storage, compared to control bags. However, MAP at 13°C for two days delayed petal blackening by only one day compared to the other packaging treatments. Therefore, we further studied the effect of MAP with bags varying in their thickness (30 and 50 μ) during storage at 25°C. The results show that in the thick MAP bags, the gas levels ranged between 6 and 10% CO₂ and 8-32 μ L L⁻¹ ethylene, while O₂ continuously decreased up to 5% throughout the storage period. Consequently, the petal blackening was delayed for 10 days, while in the other bags it was delayed for only six days. It seems, therefore, that packaging cut lotus flowers under MAP in sealed 50 μ -thick bags was the best method for delaying their petal blackening. This suggests a protective role for high CO₂ and low O₂ in preventing petal blackening.

Keywords: *Nelumbo nucifera* Gaertn. 'Sattabut'/ MAP/ Polyethylene Bags/ Oxygen/ Carbon dioxide/ Ethylene/ Senescence/

MACADAMIA NUTS

Bai, S.H., Trueman, S.J., Gama, T., Jones, K., Walton, D.A., Randall, B. and Wallace, H.M. (2019). Shelf life of macadamia kernels of different origin. Acta Hort. 1256, 375-378 DOI: 10.17660/ActaHortic.2019.1256.53 <https://doi.org/10.17660/ActaHortic.2019.1256.53>

Abstract

Postharvest factors affect the shelf life of edible kernels. However, it is uncertain to what extent the origin of nuts can influence the shelf life of kernels. We established an accelerated ageing experiment for macadamia cultivar 'A16' kernels sourced from two geographically-distant plantations at Bundaberg and Clunes, Australia. We also purchased macadamia kernels of unknown cultivar and origin from a retail outlet. The samples were incubated at 45°C for 24 days. Headspace gas (40 mL) was collected at 1, 10 and 24 days following incubation and analysed for hexanal content using e-nose (OdourScan®) as an indicator of oxidative stability. Hexanal content increased significantly throughout the incubation period in kernels of all different origins. However, hexanal content did not differ significantly between the different

kernel origins. Our results suggest that kernel origin does not affect the shelf life of kernels that commence storage at similar levels of oxidative activity.

Keywords: /Oxidative Stability/ /Hexanal Concentrations/ /Headspace Gas/ /Accelerated Ageing/

MANGO

Gabriels, S.H.E.J., Brouwer, B., de Villiers, H., Westra, E. and Woltering, E.J. (2019). Near infrared spectroscopy to predict internal quality of mangoes. Acta Hortic. 1256, 289-294 DOI: 10.17660/ActaHortic.2019.1256.40 <https://doi.org/10.17660/ActaHortic.2019.1256.40>

Abstract

Consumers have high demands regarding the quality of mangoes. Fruits with internal defects lead to disappointment after sale and a decrease in purchases. The aim of this study is to predict internal quality of mangoes using non-destructive near infrared (NIR) measurements. The internal browning was measured from 3000 mangoes grown and harvested in Brazil, transported to the Netherlands and ripened. The results show a good correlation between the occurrence of internal defects and the loss of fruit firmness and increase in fruit flesh colour. NIR measurements allow sorting of mangoes for internal defects in a non-destructive manner, to ensure only mangoes without internal defects reach the consumers. This not only prevents consumer disappointment but also contributes to less waste and a more sustainable mango chain.

Keywords: /NIR/ /Mango/ /Browning/ /Internal Defects/ /Postharvest/ /Physiology/ /Non-destructive Measurements/

Santos, O.S., Oliveira, C.G., Pinto, M.A.B., Xavier, G.T., Pinheiro, J.M.S. and Santos, J.S. (2019). Postharvest losses of vegetables in fruit markets: a case study in the semi-arid region of Bahia, Brazil. Acta Hortic. 1256, 311-314 DOI: 10.17660/ActaHortic.2019.1256.43 <https://doi.org/10.17660/ActaHortic.2019.1256.43>

Abstract

Brazil is among the ten largest mango producers in the world, and the state of Bahia accounts for more than 40% of national production. In the municipality of Guanambi/BA, mango farming is one of the main sources of income for producers from the Farmers' Co-op of the Irrigated Perimeter in Ceraíma. Within the stages of production, it is important to identify the failures in the processes that involve the harvest and postharvest activities of mangoes in order to ensure a good quality product. This study aims to identify the processes that occur during the harvest and postharvest operations of mangoes in the Irrigated Perimeter of Ceraíma, Guanambi, Bahia, Brazil. Harvest and postharvest activities were monitored on eight farms by means of direct observation and interviews. Based on this research, a flow chart of the work processes was designed and the relationship between failure and risk was established. The harvest took place in periods of high temperatures and insolation in 50% of the properties. In regards to fruit selection, excessive and neglectful management practices, as well as lack of knowledge, were identified in seven of the eight properties evaluated. Fruit was placed in dirty boxes and stored in unfavourable hygienic conditions on most of the properties. On all properties, the boxes of mangoes were transported in dirty vehicles without any protection from the sun, wind or rain. Increased awareness and attention from farmers during the work processes could reduce losses and consequently improve farmers' profitability.

Keywords: /*Mangifera indica* L./ /Fruit Quality/ /Damages/ /Selection/ /Transport/

Assefa, M.K., Gruyters, W., Rogge, S., Vanmaercke, S., Ramon, H., Demessie, B.A., Shimelis, E.A., Verboven, P. and Nicolaï, B. (2019). CFD modeling of packaging of mango fruit during forced evaporative cooling. *Acta Hort.* 1256, 321-328 DOI: 10.17660/ActaHortic.2019.1256.45 <https://doi.org/10.17660/ActaHortic.2019.1256.45>

Abstract

Small-scale evaporative cooling systems are in use in developing countries to improve quality and reduce postharvest loss of mango fruits. However, unless packaging is designed properly, it is not possible to achieve fast and uniform cooling despite the cost of energy for pumping water and air circulation inside the cooler. Three currently used packaging boxes (of carton, plastic and wood construction, respectively) and two fruit-stacking patterns inside the box (random and regular) were evaluated numerically using computational fluid dynamics (CFD). Mango fruit geometries were selected randomly from 100 representative shapes of the 'Kent' cultivar, which were generated by a validated 3D fruit shape model generator. Discrete element modeling (DEM) was used to generate a random stacking pattern by using the principle of Newton second law to obtain the position of the bodies inside the packages. Storage experiments at different temperatures were conducted to identify the firmness model parameters. The result of the simulation was then compared with experimental results obtained in a small scale cooling set-up. Fast cooling was observed for the carton, followed by plastic and wood packages. The improvement observed between the carton and plastic packaging was found to be significant compared to plastic and wood packaging.

Keywords: /CFD/ /Pre-cooling/ /DEM/ /Quality/ /Cooling Rate/ /Temperature/ /Airflow/

Penchaiya, P., Tijksens, L. M., Uthairatanakij, A., Srilaong, V., Tansakul, A., & Kanlayanarat, S. (2020). Modelling quality and maturity of 'Namdokmai Sithong' mango and their variation during storage. *Postharvest Biology and Technology*, 159, 111000. doi: 10.1016/j.postharvbio.2019.111000

Abstract

'Namdokmai Sithong' mangoes, grown in carbon paper bags, are harvested at commercial maturity. As chlorophyll is virtually absent, they have a yellow skin colour changing only slightly during fruit ripening. This special characteristic, i.e., the absence of chlorophyll, conceals the variation within the batch in maturity stage and as well as in quality. Quality variables were assessed during storage by destructive (traditional penetration test F_{pff} , flesh colour $L^*a^*b^*$, total soluble solids TSS and titratable acidity TA) or non-destructive techniques (limited distance compression F_{comp} , skin colour $L^*a^*b^*$). Three batches of mango in export quality grown at different cultivation locations were stored at four constant temperatures (kinetic experiment) and at 13 °C for 14 d then at 25–28 °C (dynamic experiment). Huge variation was observed in all quality variables in both systems mainly due to differences in maturity of individual fruit. Kinetic models are presented to describe behaviour of quality variables including the biological variation expressed as biological shift factor. A logistic model (logis) was used for all variables, except flesh colour b^* value and TSS in the dynamic experiment, where a first order production model (FOP) was applied to analyse the data. Destructively measured data were first grouped based on rank at every measuring time (probelation). Rank number and fruit number were used as an index in non-linear regression. High explained parts (R^2_{adj} above 90%) were obtained for firmness and skin colour (a^* and b^*) for all temperatures of the kinetic experiment separately as well as combined. The (lower) asymptote values for limited compression firmness (F_{comp}) were somewhat different at different temperatures, which is again an indication of large difference in maturity. In absence of chlorophyll, a strong relation was found between the biological shift factors of F_{comp} and all colour values. During first storage period at 13 °C of the dynamic experiment, most obtained explained part (R^2_{adj}) but not all were well over 90%. When both

temperature schemes (13 °C and ambient temperature) were analysed together, the rate constant after the temperature switch for firmness and colour was higher indicating a faster fruit ripening. The two cultivation locations generated a substantial difference in colouration, but not so much in terms of firmness. A strong correlation between *Fcomp*, TSS and TA was revealed. All these results indicate that observed variation in any of the quality variables are all linked directly to variation in maturity. In fruit industry, the biological variation is ignored completely which results in a heterogeneity in the final product at the consumers. Modelling techniques have studied can take care of this variation and could help to improve quality management in the production line in order to assure a constant level of the fruit quality.

Keywords: /Namdokmai mango/ /Firmness/ /Modelling/ /Fruit quality/ /Storage/ /Postharvest/

MANDARIN

Haider, S.-A., Ahmad, S., Khan, A. S., Anjum, M. A., Nasir, M., & Naz, S. (2020). Effects of salicylic acid on postharvest fruit quality of “Kinnow” mandarin under cold storage. *Scientia Horticulturae*, 259, 108843. doi: 10.1016/j.scienta.2019.108843

Abstract

The present study was conducted to investigate the effects of postharvest SA application on the fruit quality of mandarin during storage. Different concentrations of SA (4, 8 or 12 mM) were applied in the first year while, 2, 4 or 6 mM during the second year. The fruits were stored at 5 ± 1 °C and $90 \pm 5\%$ RH for 90 days and data were collected regarding different fruit quality parameters. Results revealed that maximum antioxidant activity, total phenolic contents, activities of peroxidases (POD) and superoxide dismutase (SOD) enzymes were found in the fruit treated with 4 mM SA. All SA levels had significant effects to prevent fungal attack in comparison to untreated control fruit during 90 days storage. Therefore; pre-storage application of 4 mM SA can be used safely to minimize the decay % and to maintain the highest level of bioactive compounds in ‘Kinnow’ mandarin fruit for three months under cold storage.

Keywords: /Antioxidant activity/ /Citrus/ /Catalase/ /Enzyme activity/ /Total phenolic contents/

MUSHROOM

Agoreyo, B.O. and Oseghale, E.I. (2019). Effect of postharvest storage at ambient temperature on the micronutrients, phytochemicals and phenolic profile of the sclerotia of king tuber mushroom (*Pleurotus tuber-regium*). *Acta Hort.* 1256, 251-260 DOI: 10.17660/ActaHortic.2019.1256.35 <https://doi.org/10.17660/ActaHortic.2019.1256.35>

Abstract

King tuber mushroom (*Pleurotus tuber-regium* (Fr.) Sing.) is found in various continents of the world such as Africa, Asia and Australia, where it grows naturally on decaying wood in the forest. The king tuber mushroom is a macro-fungus with edible sclerotia that are used as food, herbal medicine and food additives such as bulking and flavoring agents. Its unique flavor and health benefits can be attributed to the presence of micronutrients and phytochemicals such as phenolics. The mushroom provides a good source of income to local farmers and traders, who usually store them for long duration under ambient temperature after harvest. This study examined the effect of postharvest storage at ambient temperature on the micronutrients and phytochemicals that are present in the king tuber mushroom. Micronutrients such as iron, zinc magnesium and calcium were high in the freshly harvested mushroom, but showed decline in concentrations during the postharvest storage period of 16 weeks. Phytochemicals such as tannins, phenols, alkaloids, flavonoids and saponins showed marked increase in concentrations within the

postharvest storage period except for phenols, in which decrease was observed. The phenolic profile of the mushroom showed the presence of 41 constituents, which included catechin with antioxidant activity, carvacrol with antimicrobial and antioxidant activities, salicylic acid, vanillic acid, ferulic acid, kaempferol, gallic acid and quercetin. These phenolics showed decrease in concentrations with postharvest storage. The freshly harvested mushroom is very rich in micronutrients and phytochemicals and can be used as food, food additive and herbal medicine, however, some of the micronutrients and phenolics decreased with long postharvest storage period.

Keywords: /Postharvest/ /Storage/ /*Pleurotus tuber-regium*/ /Micronutrients/ /Polyphenols/ /GC-FID/

Sun, B., Chen, X., Xin, G., Qin, S., Chen, M., & Jiang, F. (2020). Effect of 1-methylcyclopropene (1-MCP) on quality of button mushrooms (*Agaricus bisporus*) packaged in different packaging materials. *Postharvest Biology and Technology*, 159, 111023. doi: 10.1016/j.postharvbio.2019.111023

Abstract

The effects of 1-MCP treatment on the quality of *Agaricus bisporus* mushrooms packed in three different packaging films, i.e., low permeable packaging (LPP), medium permeable packaging (MPP) and high permeable packaging (HPP), were evaluated. Quality factors included weight loss, color, texture, and sensory. Results show that 1-MCP can slow down the respiration rate of mushrooms. In LPP and MPP, where O₂ supply was limited, the respiration rate of mushrooms can be reduced by around 25%, while in HPP where there was constant O₂ supply, the respiration rate reduced by around 2%. The best effectiveness was obtained from the combination of 1-MCP and MPP, which created headspace composition of less than 0.1% of O₂, and 5–10% CO₂, providing more than 15 d of shelf life. This combination provided several benefits for mushroom quality including maintaining sensory quality, weight, and firmness, as well as altering the formation of flavor nucleotides process which has the potential to improve umami taste.

Keywords: /*Agaricus bisporus*/ /1-Methylcyclopropene/ /Modified atmosphere packaging/ /Shelf life/

NARCISSUS

Çelikel, F.G. and Demir, S. (2019). Effects of ethephon spray on plant quality and growth parameters of potted *Narcissus tazetta*. *Acta Hort.* 1263, 439-448 DOI: 10.17660/ActaHortic.2019.1263.57 <https://doi.org/10.17660/ActaHortic.2019.1263.57>

Abstract

The effects of ethephon treatment applied as a foliar spray on plant height, flowering time, flower quality and growth parameters of native narcissus (*Narcissus tazetta* L.) grown in pots were investigated. When plants were 7-10 cm tall, ethephon at 0, 1000 and 2000 µL L⁻¹ was applied as a foliar spray. The effects of ethephon treatment on plant height, leaf length, the time of flowering, number of flowers and the flower longevity were determined. In addition, the effects of ethephon spray on growth parameters, including leaf area ratio (LAR), specific leaf area (SLA), leaf thickness (LT), leaf weight ratio (LWR) and stem weight ratio (SWR) were examined and analysed in native narcissus. When narcissus grown in pots in the greenhouse reached the sale stage, plants were transferred to the laboratory at 20°C to evaluate their postproduction longevity and quality. The narcissus plants treated with 2000 µL L⁻¹ ethephon were 41% (7.5 cm) shorter than untreated control plants (12.7 cm), while the treatment with 1000 µL L⁻¹ ethephon shortened the plant height by 35% (8.3 cm). These effects of treatments on plant height were maintained under laboratory (home-office) conditions after production. Ethephon treatment significantly decreased the LAR and SLA values, but slightly not significantly increased the LT, LWR and SWR. Therefore, the

ethephon treatment provides more compact and shorter plants with smaller LAR and SLA values.

Keywords: /*Narcissus tazetta*/ /Plant Height/ /Postproduction/ /Ethephon/ /Growth Parameter/

Abdulla, M.F. and Çelikel, F.G. (2019). Postharvest quality and extending vase life of *Narcissus tazetta* flowers by sucrose. Acta Hort. 1263, 455-460 DOI: 10.17660/ActaHortic.2019.1263.59 <https://doi.org/10.17660/ActaHortic.2019.1263.59>

Abstract

Narcissus tazetta L., which belongs to the *Amaryllidaceae* family, has many nice and fragrant flowers appearing as bunch on a leafless peduncle. They grow naturally in the Black Sea region of Turkey, and are used as local cut flowers. However, there is no detailed postharvest study on these beautiful delicate flowers. Therefore, we investigated the postharvest physiology and the possibility of extending the vase life longevity of this natural species. The bulbs obtained from Ordu were grown in a greenhouse at Ondokuz Mayıs University in Samsun. Flowers were harvested in February and March. Vase life, relative fresh weight (RFW) and water uptake (WU) during vase life were determined daily in a standard vase life evaluation room. The vase life was determined as the time to wilting of all open florets. Our results show that a vase solution composed of 2% sucrose and 300 µL L⁻¹ hydroxyquinoline citrate (8-HQC) significantly increased the WU and maintained the RFW of the flowers at high values compared to control flowers kept in 8-HQC or in NaOCl. Consequently, this vase solution extended the vase life of cut *Narcissus tazetta* L. flowers from six to nine days. These results suggest that bunch flowered *Narcissus tazetta* L. have a commercial potential as cut flowers.

Keywords: /Vase Life/ /Cut Flower/ /Water Uptake/ /Sucrose/ /8-HQC/ /*Narcissus tazetta*/

Zeybekoğlu, E., Salman, A., Alp, Ş. and Özzambak, M.E. (2019). Effects of different storage methods and periods on vase life of cut narcissus (*Narcissus tazetta* L. 'Karaburun'). Acta Hort. 1263, 461-468 DOI: 10.17660/ActaHortic.2019.1263.60 <https://doi.org/10.17660/ActaHortic.2019.1263.60>

Abstract

Improving storage performance of cut flowers is particularly useful for flowers that are short-lived, and whose display period in the field is brief. Here we report on factors affecting postharvest performance of *Narcissus tazetta* L. 'Karaburun', which is a field-grown narcissus in Turkey. A factorial experiment was performed, in which the cut narcissi were held dry in modified atmosphere packaging (MAP) or wrapped paper at 0±0.5°C for 1, 2, 3, 4, 5 or 6 weeks, and were pulsed with 0.25 mM silver thiosulfate (STS) or distilled water (control) either before or after storage. Vase life of 7 days was reduced with increasing storage duration. The degree of the decrease in vase life depended on the type of storage treatment imposed. At 5 weeks of storage, wrapped paper was as good as MAP for maintaining vase life (4.7-5.6 days), when a pre-storage pulsing treatment was applied. However, at 6 weeks of storage, the MAP-stored flowers had a better vase life (5.3 days) than those stored in paper (4 days). The vase life of the 6-week paper-stored flowers was even less (2.1 days), when the pulsing treatment was applied after storage. By contrast, at 6 weeks of storage, the vase life of the MAP-stored flowers was the same (4.9-5 days), regardless of the time of application of the pulsing treatment pre- or post-storage. In conclusion, the best treatment for *N. tazetta* L. 'Karaburun' was MAP storage, combined with STS pulsing, applied either pre- or post-storage.

Keywords: /Silver thiosulphate/ /Pulsing/ /Cold Storage/ /Modified Atmosphere Packaging/

NECTARINE

Ceccarelli, A., Farneti, B., Khomenko, I., Cellini, A., Donati, I., Aprea, E., ... Spinelli, F. (2020). Nectarine volatilome response to fresh-cutting and storage. *Postharvest Biology and Technology*, 159, 111020. doi: 10.1016/j.postharvbio.2019.111020

Abstract

The offer of fresh-cut peaches and nectarines represents a valid alternative for stone fruit commercialization and matches the increasing market demand of ready-to-eat (RTE) products. In this study we explored the effect of fruit processing and storage on the volatilome of RTE fresh-cut nectarine. Fruit of three cultivars were sliced and packed in an industrial line and stored for 5 d at 5 °C. Volatile organic compound (VOC) evolution was assessed daily in both intact and processed fruit by an exhaustive untargeted analysis, performed by proton transfer reaction-time of flight-mass spectrometry (PTR-ToF-MS) and solid phase microextraction- gas chromatography-mass spectrometry (SPME/GC-MS). Fresh-cut processing induced a major variation in nectarine volatilome depending on genetic differences and storage. This volatilome amelioration may be considered as an applicable strategy to enhance peach and nectarine perceived quality. Moreover, results of this study allowed the detection of a set of possible biomarkers enabling the selection of the best nectarine genotypes for processing and the prediction of the product shelf life based on the release of flavours and off-flavours.

Keywords: /VOCs/ /*Prunus persica*/ /Minimal processing/ /Cold storage/ /PTR-ToF-MS/ /SPME/GC-MS/

OKRA

Shyr, Jeng-Jung, Hong, Wei-Tzuo and Zheng, Yi-Ling (2019). Effects of modified atmosphere package and 1-MCP treatment on the DPPH (1,1-diphenyl-2-picrylhydrazyl) radical scavenging activity of okra (*Abelmoschus esculentus*) during storage. *Acta Hort.* 1256, 631-638 DOI: 10.17660/ActaHortic.2019.1256.90 <https://doi.org/10.17660/ActaHortic.2019.1256.90>

Abstract

Okra (*Abelmoschus esculentus*) is widely spread in tropical and subtropical areas. It has been favoured as a food for the health-conscious. Okra pods possess significant antioxidant activity and phenolics as well as flavonoids are active constituents. Fresh okra deteriorates quickly during storage due to tenderness and a high respiration rate. Modified atmosphere package and 1-MCP treatment were developed to extend the storage limit successfully. However, the antioxidant activity of okra during storage was not clarified. The objective of the study was to determine the total flavonoid and phenolic contents as well as total antioxidant activity of okra during storage by using modified atmosphere package and 1-MCP treatment. Fresh okra pods were sealed into 25×35-cm bags comprised of 0.03 and 0.1-mm-thick low density polyester (LDPE) film or 0.01-mm-thick high density polyester (HDPE) film and stored at 12°C. Okra pods were treated by 1-MCP (0.5, 10, and 20 mg L⁻¹) for 16 h at 6°C before storage. Total flavonoid and phenolic contents as well as DPPH radical scavenging activity were checked every week during storage. Results showed that okra pods packaged in low density polyester bags of 0.03 mm thickness showed the highest total flavonoid and phenolic contents as well as DPPH radical scavenging activity during storage at 12°C. 1-MCP pretreatment minimized the decrease of total flavonoid and phenolic contents as well as DPPH radical scavenging activity at 12°C. Good correlations were found between DPPH radical scavenging activity and contents of total flavonoid and phenolic in okra pods stored at 12°C for 4 weeks.

Keywords: /Okra/ /1-MCP/ /MAP/ /DPPH/

ORANGE

Morales, J., Navarro, P., Besada, C., Bermejo, A. and Salvador, A. (2019). Effect of cold storage on fruit quality of blood oranges. *Acta Hort.* 1256, 203-210 DOI: 10.17660/ActaHortic.2019.1256.28 <https://doi.org/10.17660/ActaHortic.2019.1256.28>

Abstract

Traditionally the production of blood oranges has been destined to the juice industry. However, in the last years the demand for this citrus fruit for fresh consumption is considerably increasing. Nowadays there is not enough information about the optimum storage conditions of Sanguinelli and Tarocco Rosso, the most important cultivars in the Spanish Mediterranean area. In this study the effect of cold storage at different temperatures on fruit quality was evaluated in both cultivars. In two different seasons, after harvest, the fruit was stored up to 45 days at 1, 5, or 9°C. Periodically a sample of fruit was transferred to 20°C during 6 days simulating shelf-life conditions. The following quality parameters were evaluated: maturity index, external colour, firmness, ethanol concentration and physiological disorders. Although there were slight differences between seasons, Sanguinelli showed higher sensitiveness to low temperatures than Tarocco Rosso, which manifested chilling injury symptoms after 30 days of cold storage at the three studied temperatures. The lower temperature storage the higher disorders incidence was observed. During storage the acidity slightly decreased and total soluble solids remains constant in both cultivars. The increase in the external colour was affected by the storage temperature; fruit stored at 5 and 9°C exhibited the highest colour index. The increase of ethanol concentration throughout the storage period was not associated with a sensory quality loss.

Keywords: /Blood Orange/ /Physiological Disorders/ /Postharvest/ /Cold Storage/

Youssef, K., & Hussien, A. (2020). Electrolysed water and salt solutions can reduce green and blue molds while maintain the quality properties of 'Valencia' late oranges. *Postharvest Biology and Technology*, 159, 111025. doi: 10.1016/j.postharvbio.2019.111025

Abstract

The effect of four salt solutions; sodium metabisulfite (SM), potassium sorbate (PS), potassium carbonate (PC) and sodium chloride (SC) as electrolyte to generate alkaline (aEW) and acidic (acEW) electrolysed water was assessed *in vitro* and *ex vivo* under artificial and natural infection against *Penicillium digitatum* and *P. italicum*, the causal agents of green and blue molds, respectively. Generally, both components of the electrolysed water have exhibited decontaminating activity against the two tested *Penicillium* species, with clear stronger effect for the acidic component. The effect of aEW and acEW on physical and chemical properties of 'Valencia' sweet orange quality, including mass loss, total soluble solids (TSS), citric acid, pH, ascorbic acid and fruit color index was investigated. The results suggest that neither aEW nor acEW may have any negative impact in term of orange quality as compared to control treatments. aEW produced by PS and PC have increased citric acid content of orange fruits. The inhibitory effect of aEW and acEW against naturally occurring microbial population of filamentous fungi in the fruit washing tank was recorded. The direct effect of aEW and acEW on radial growth, conidial germination, germ tube elongation and the morphological changes of both pathogens by scanning electron microscopy (SEM) was examined. Results have shown that treatments have caused abnormal mycelia growth, irregular branching of hyphae in the apical part and loss of linearity in the tested fungal structures. Some salts, as electrolytes, have shown potential to produce robust electrolysed water that may represent valuable ecofriendly tool in controlling citrus postharvest decay.

Keywords: /*Penicillium digitatum*/ /*Penicillium italicum*/ /Orange quality/ /Alkaline electrolysed water (aEW)/ /Acidic electrolysed water (acEW)/ /scanning electron microscopy (SEM)/

ORCHIDS

Pungam, K. and Atthirawong, W. (2019). A supply chain management quality management and competitive advantage framework for Thai orchid exporters. Acta Hortic. 1262, 23-30 DOI: 10.17660/ActaHortic.2019.1262.4 <https://doi.org/10.17660/ActaHortic.2019.1262.4>

Abstract

This study aims to develop a conceptual framework of supply chain management (SCM), quality management (QM), and competitive advantage (CA) for agricultural business, specifically, the Thai orchid industry. Papers relating to elements of SCM, QM, and CA adopted by different organisations in the small-to-medium size enterprises (SMEs) sector were reviewed. The conceptual framework comprises three elements: first, SCM, which includes strategic supplier partnerships, customer relationships, and information sharing; second, quality management, which includes top management commitment, customer focus, employee involvement, and continuous improvement, and finally, competitive advantage, including price and cost-based, product-based, and service-based advantages. The literature review reveals SCM and QM have the strongest influence on CA. Thus, we propose conceptual frameworks of the relationship between SCM, QM, and CA. After developing the conceptual framework, we aim to create questionnaire as a research instrument. This will be sent to Thai orchid exporters and the responses will be analysed using the structural equation modelling (SEM) approach.

Keywords: /Supply Chain Management/ /Quality Management And Competitive Advantage/

Chanprame, S., Sornchai, P., Reanboon, S., Kongkuna, W. and Imsabai, W. (2019). The transgenic *Dendrobium* 'Sonia' BOM 17 containing an antisense ACO gene demonstrated normal growth with prolonged vase life. Acta Hortic. 1262, 125-132 DOI: 10.17660/ActaHortic.2019.1262.17 <https://doi.org/10.17660/ActaHortic.2019.1262.17>

Abstract

The growth of four transgenic *Dendrobium* Sonia 'BOM 17' lines possessing antisense ACC oxidase gene, were evaluated using two-year-old transgenic orchid lines grown in a biosafety greenhouse. The parameters investigated, in relation to ACO included, 1-aminocyclopropane-1-carboxylic acid (ACC) enzyme activity, ACC oxidase (ACO) and ethylene production in the leaves and inflorescence, and the vase life of the inflorescence. The results revealed that the leaves of the transgenic orchid contained 0.15 pmol g⁻¹ FW of ACC while the 4 transgenic lines had ACC levels ranging from 0.1 to 0.15 pmol g⁻¹ FW. The ACO enzyme activity in the leaves of the transgenic orchids was found to be in the range of 0.004 to 0.0065 pL C₂H₄ mg⁻¹ protein h⁻¹, which was lower than those of the non-transgenic lines (0.008), a reduction of 18.75-50%. The transgenic lines produced 0.036 to 0.08 nL C₂H₄ g⁻¹ h⁻¹ of ethylene, which was lower than that of the control line at 0.104 nL C₂H₄ g⁻¹ h⁻¹, a reduction of 23.08-68.36%. Similar patterns were also observed in the inflorescence. When compared to the non-transgenic line, the ACO activity was reduced to 34.48-53.45% of the control and the ethylene production was not only decreased in the transgenic lines but its production was delayed. The transgenic lines had a 29-57% longer vase life than did the non-transgenic lines.

Keywords: /Orchid/ /Transgenic/ /ACO/ /Antisense/ /Flower Senescence/

Chuchoisuan, P., Sukpitak, C., Jongsri, P., Obsuwan, K. and Seraypheap, K. (2019). Effects of 1-methylcyclopropene on ascorbate-glutathione cycle enzyme activities of postharvest *Dendrobium* 'Khao Sanan'. Acta Hortic. 1262, 219-224 DOI: 10.17660/ActaHortic.2019.1262.29 <https://doi.org/10.17660/ActaHortic.2019.1262.29>

Abstract

White orchids, especially *Dendrobium* 'Khao Sanan', are amongst the most important cut flowers in Thailand. However, owing to the effects of ethylene, such orchids experience rapid flower senescence. This presents a serious problem with regard to the exportability of quality flowers in the cut orchid industry. Following harvesting, 1-methylcyclopropene (1-MCP) is used to inhibit ethylene; thus, the aim of the present study was to determine the effects of 1-MCP on ascorbate-glutathione cycle enzyme activities in *Dendrobium* 'Khao Sanan'. We treated the inflorescences of white orchids with 0.5 $\mu\text{L L}^{-1}$ 1-MCP for 3 h and/or 0.4 $\mu\text{L L}^{-1}$ ethylene for 24 h. The ascorbate-glutathione cycle underwent a significant increase in the activities of dehydroascorbate reductase (DHAR) and glutathione reductase (GR) in the 1-MCP-treated flowers. These results suggest that 1-MCP has the ability to stimulate certain antioxidant enzymes via the ascorbate-glutathione cycle in *Dendrobium* 'Khao Sanan', and may be used to retard senescence in this cultivar.

Keywords: /Flower Senescence/ /Vase Life/ /Antioxidant Enzyme/ /Hydrogen peroxide/ /Ethylene/

Khunmuang, S., Kanlayanarat, S., Wongs-Aree, C., Meir, S., Philosoph-Hadas, S. and Buanong, M. (2019). Variability in the response to ethylene of cut flowers of three *Vanda* orchid cultivars. *Acta Hortic.* 1262, 241-249 DOI: 10.17660/ActaHortic.2019.1262.32 <https://doi.org/10.17660/ActaHortic.2019.1262.32>

Abstract

Ethylene plays an important role in the senescence of most cut flowers including members of the family *Orchidaceae* but sensitivity to ethylene varies among species and cultivars. Therefore, we compared ethylene sensitivity in cut flowers of three *Vanda* orchid cultivars: Pure Wax, Pachara Delight, and Sansai Blue. The flowers were exposed to air (control), 10 $\mu\text{L L}^{-1}$ ethylene for 24 h, or 0.2 $\mu\text{L L}^{-1}$ 1-methylcyclopropene (1-MCP; an ethylene inhibitor) for 6 h. Ethylene reduced the vase lives of all three cultivars by approximately 50%, and 1-MCP extended their vase lives, but each cultivar had a different response to ethylene regarding pigmentation. The anthocyanin content of Pure Wax was almost unaffected by ethylene, except at the bud stage, whereas in Pachara Delight it was partially reduced after 2 days, mainly in the full bloom stage. The anthocyanin content of Sansai Blue was completely reduced during this period after exposure to only 1 $\mu\text{L L}^{-1}$ ethylene. The ethylene-treated Pure Wax and Pachara Delight flowers exhibited increased wilting and sleepiness compared to the control flowers. In contrast, the ethylene-treated Sansai Blue flowers immediately discoloured, and the faded flowers did not wilt during the subsequent 7 days. Anthocyanin breakdown in Sansai Blue was related to its comparatively high sensitivity to ethylene. Examination of changes in other quality parameters of the Sansai Blue flowers over 2 days following ethylene treatment revealed that ethylene significantly reduced their fresh weight, but not their water uptake rate, ion leakage, and amino acid and protein contents. However, as expected, the rates of ethylene evolution and respiration increased slightly in response to ethylene treatment. All three cultivars are sensitive to exogenous ethylene, but their ethylene-induced colour-fading responses differ. In cut Sansai Blue flowers, ethylene first promotes petal anthocyanin degradation, then other typical senescence-related processes.

Keywords: /Sensitivity/ /Senescence/ /Vase Life/ /Anthocyanin/ /Pigmentation/

PAPAYA

Supapvanich, S., Boonyaritthongchai, P. and Wongs-Aree, C. (2019). Physicochemical changes in 'Holland' papaya fruit treated with quarantine hot water incorporated with salicylic acid dip during cold storage. *Acta Hortic.* 1256, 223-230 DOI: 10.17660/ActaHortic.2019.1256.31

<https://doi.org/10.17660/ActaHortic.2019.1256.31>

Abstract

The aim of this study was to determine the effects of quarantine hot water dip at 42°C for 40 min followed with 49°C for 20 min (H) incorporated with 2.0 mM salicylic acid (SA) on physicochemical changes in 'Holland' papaya fruit during storage. Firmness, total soluble solids content, electrolyte leakage (EL), malondialdehyde (MDA) content, pectin substances, antioxidant capacity, ascorbic acid and total phenols content of the fruit held at 8±1°C for 21 days followed by 1 day at room temperature (31±2°C) were monitored. The firmness of the fruit dipped in hot water incorporated with 2.0 mM SA (2.0 mM SA+H) dip was higher than that of the fruit dipped in H, 2.0 mM SA and control. All treatments had no effect on TSS content. 2.0 mM SA+H dip retarded the increase in EL, MDA and EDTA-soluble pectin content and decrease in Na₂CO₃-soluble pectin content better than other treatments. Moreover, bioactive compounds content such as antioxidant capacity, ascorbic acid and total phenols content were maintained by 2 mM SA+H dip. These suggest that the use of 2.0 mM SA+H is an effective alternative maintaining postharvest quality of papaya fruit during cold storage.

Keywords: /Papaya Fruit/ /Salicylic acid/ /Hot Water Dip/ /Firmness/ /Bioactive Compounds/

Tabassum, N., & Khan, M. A. (2020). Modified atmosphere packaging of fresh-cut papaya using alginate based edible coating: Quality evaluation and shelf life study. *Scientia Horticulturae*, 259, 108853. doi: 10.1016/j.scienta.2019.108853

Abstract

Fresh-cut fruits have been observed to deteriorate more rapidly than the intact ones leading to increased surface browning, textural breakdown and development of off-flavor. These changes can be minimized by the application of a modified atmosphere in the form of an edible coating at low temperature which not only increases shelf life of food products but also is environment friendly. Edible coatings have been reported to provide a semi-permeable barrier to gases and water vapor and also improve mechanical properties, thus delaying the natural senescence, minimizing water loss and keeping the structural integrity of coated product intact. The purpose of this study was to evaluate the quality and shelf life of fresh-cut papaya cubes treated with alginate based edible coatings containing thyme and oregano essential oils in various concentrations (0.5 ml, 1.0 ml, and 2.0 ml) as the lipid component of the coating while the alginate concentration (2% w/v) was kept constant. Papaya cubes were packed in low density polypropylene trays which further prevented loss of water and firmness and stored at 4 °C. The samples were analyzed for physico-chemical changes, gas exchange, microbial stability and sensory quality for 12 days of storage period. Control samples showed greatest water loss and lowest sensory scores. Increasing the concentration of essential oil increased the shelf life as well as the moisture retention capacity but showed negative responses from the sensory panel due to the strong odor of essential oils. Sample containing thyme essential oil (2.0 ml) was unacceptable to the panel due its strong and penetrating odor.

Keywords: /Papaya/ /Fresh-cut/ /Edible coating/ /Alginate/ /Essential oil/

PEACH

Brizzolara, S. and Tonutti, P. (2019). The effect of cold storage on volatile organic compounds (VOCs) emitted from intact peach fruit. *Acta Hortic.* 1256, 151-156 DOI: 10.17660/ActaHortic.2019.1256.21 <https://doi.org/10.17660/ActaHortic.2019.1256.21>

Abstract

Postharvest peach fruit aroma profile is heavily affected by several factors including storage temperature that, together with storage period, plays a key role in determining the organoleptic properties and the overall quality perceived by consumers. The effect of three storage temperatures (0.5, 5.5 and 20°C) applied during storage up to one month on peaches from three cultivars (Flaminia, FL, Regina di Londa, RL, and Red Haven, RH) was evaluated in terms of volatile organic compound (VOC) emission from intact fruit. In addition, the ripening behaviour of the fruit has been monitored during post-cold storage (3 d of shelf-life at 20°C). Aroma profile was analysed via SPME (solid phase micro extraction) fibre technique by GC-MS. PLS-DA (partial least squares discriminant analysis) of the whole data set showed that samples belonging to different cultivars resulted well-separated, indicating that marked differences in terms of VOCs concentration between cultivars are present. FL samples appeared to be the poorest in terms of evolved aroma compounds in general. A more detailed analysis revealed that intact peaches, sampled immediately after cold storage, are characterized by a pronounced different aroma profile when compared with fruit kept for three additional days under shelf-life at 20°C and with control samples. After 0.5°C storage fruit maintain higher firmness and lower soluble solids content (SSC) than control, indicating that this temperature is effective in delaying the normal ripening also during shelf-life, as also demonstrated by the profile of aroma compounds emitted by the intact fruit. On the other hand, after storage at 5.5°C peaches have higher SSC and VOCs levels, indicating that these conditions induce an acceleration of the ripening syndrome as observed in other fruit species.

Keywords: /Postharvest/ /Low Temperature/ /SPME-GC-MS/ /Aroma Profile/ /*Prunus persica*/

Redondo, D., Díaz, A. and Val, J. (2019). Low oxygen treatment prior to cold storage to maintain the quality of peaches. Acta Hort. 1256, 567-574 DOI: 10.17660/ActaHortic.2019.1256.8 <https://doi.org/10.17660/ActaHortic.2019.1256.8>

Abstract

High value late season peach cultivars from the region of Aragón (NE, Spain) are appreciated for their delicate flavor, external uniform golden appearance, yellow pulp and chiefly to be free of chemicals as they are bagged from their last three months of growth until harvest. However, their shelf life under storage is very short due to several problems such as loss of firmness, appearance of chilling injuries, incidence of physiological alterations called vitrescent dark spot (VDS) or corky spot (CS) and fungal rots. The research team from Zaragoza has worked for years in the fight against calcium-related physiological disorders in apples by preharvest strategies of foliar calcium treatments. More recently, postharvest treatments with low oxygen at room temperature (LOT) have been successfully applied. However, no reports of these kinds of treatments have been previously reported in late season peaches. Therefore, immediately after harvest, 'Chato' peaches were stored for 2 days at 20°C under low O₂ (1-2%) in Palliflex bags. Thereafter, fruits were cold-stored (0-2°C) without bag for 40 days and changes were monitored in terms of fruit quality, chilling injuries, incidence of physiological alterations and respiration rates. After 40 days of cold storage, the firmness of treated fruits was the same as at the harvest day, about 41.9 N, meanwhile fruits untreated, decreased to 35.0 N. On the other hand, LOT treatment decreased both the incidence of VDS from 37.9 to 4.0% and chilling injury severity from 59.3 to 20.0%. Respiration rates were similar between treatments. Only statistical differences on ethanol production were found: higher in the treated fruits, probably due to the storage temperature the very first 2 days, although no odd flavors were found. In conclusion, the application of LOT treatments prior to cold storage may be a promising strategy to preserve fruit quality of late season peach cultivars and deserves further investigation.

Keywords: /*Prunus persica*/ /Fruit Firmness/ /Vitrescent Dark Spot/ /Palliflex©/ /Chilling Injury/

Gracia, A.P., Gimeno, D., Lasierra, B., Oria, R. and Venturini, M.E. (2019). Controlled atmosphere pallets to extend the shelf-life of Calanda peaches. Acta Hortic. 1256, 623-630 DOI: 10.17660/ActaHortic.2019.1256.89 <https://doi.org/10.17660/ActaHortic.2019.1256.89>

Abstract

Calanda peaches have achieved great prestige in European markets because of their size, firmness and sweetness. However, apart from maintaining current markets by offering a high-quality product, further research is needed to improve their shelf-life in order to reach more distant markets. Thus, the effects of controlled atmosphere (CA) pallets at O₂:CO₂ concentrations of, 10:10, 5:10 and 2:10%, on the quality and shelf-life of Calanda 'Calante' peaches were studied. Physico-chemical parameters, ethanol and acetaldehyde production, decay percentage, chilling injury development and sensory evaluation were determined four times every 2 weeks of cold storage and shelf-life. Also, gas chromatography-olfactometry was conducted to detect off-flavours. Peaches stored at ambient atmosphere at 1°C promptly developed symptoms of chilling injury that became severe on day 28. All the CA conditions delayed ripening and prevented chilling injury with the best sensory results obtained for peaches stored at 2% O₂:10% CO₂. Although an increase in the production of ethanol and acetaldehyde was detected from day 14 onwards, this did not affect the quality of the fruit that was excellent after 56 days at 1°C plus a shelf-life period of 1 day at 20°C.

Keywords: /Controlled Atmosphere/ /Storage/ /Shelf-life/ /GC-O/ /Calanda Peach/ /*Prunus persica*/

PERSIMMON

Salvador, A., Fathi, A., Gil, R., Navarro, P. and Besada, C. (2019). Effect of storage conditions on quality of persimmon produced under organic conditions. Acta Hortic. 1256, 195-202 DOI: 10.17660/ActaHortic.2019.1256.27 <https://doi.org/10.17660/ActaHortic.2019.1256.27>

Abstract

Cold storage of persimmon required a pretreatment with 1-MCP in order to delay chilling injury manifestation. However, the use of this ethylene inhibitor is not allowed in the case of persimmon produced under organic conditions. Thus, it is necessary to optimize the storage conditions, taking into account not only temperature and storage duration but also factors such as maturity stage at harvest and the application of the deastringency treatment. In this study, organically produced persimmons were harvested at different maturity stages throughout the season, and they were stored at low (0°C) and moderate temperature (15°C) for up to four weeks. Two different moments of application of the deastringency treatment with high CO₂ concentrations were assayed (immediately after harvest or after the storage periods). Our results showed that the storage of fruit harvested with firmness values lower than 30 N was not possible due to the important softening that took place after harvest. Fruit harvested with higher firmness (30-45 N) maintained an acceptable quality for two or three weeks depending of the storage conditions. Both the storage temperature and the moment of application of CO₂-deastringency treatment were observed to be decisive factors in the final quality of the fruit. Here we discuss the optimum conditions to store organic persimmons depending on the maturity stage.

Keywords: /Chilling Injury/ /Softening/ /Flesh Gelling/ /CO₂-treatment/ /Astringency/

Besada, C., Gil, R., Fathi, A., Navarro, P. and Salvador, A. (2019). Effect of transport temperature on persimmon fruit quality. Acta Hortic. 1256, 355-360 DOI: 10.17660/ActaHortic.2019.1256.50 <https://doi.org/10.17660/ActaHortic.2019.1256.50>

Abstract

Persimmon fruit often shows quality loss and internal disorders when it arrives at overseas markets. This study was carried out to evaluate the effect of temperature during the sea freight transport in refrigerated containers and later transport in refrigerated trailers on the quality of the persimmon fruit. 'Triumph' persimmon fruits harvested at mid- and final season and fruit stored at 1°C for 1 month were submitted to sea freight transport simulation during 25 days at 1 or 3°C followed by a later transport in trailer at 1, 3 or 9°C. Afterwards, all fruits were transferred at 20°C for 5 days simulating shelf-life. Mid-season fruit shipped in container at 1°C and highway-transported in trailer at 1 or 3°C showed excellent quality without internal disorders; transport at 9°C caused more loss of quality. Fruit harvested at the end of the season, with less firmness, showed significant softening and severe incidence of flesh gelling in different conditions of transportation. Fruit previously cold-stored for 30 days also exhibited important firmness loss after being transported in container; after shelf-life period only the fruit sent in container at 1°C and later transported at 1 or 3°C in trailer did not show symptoms of flesh gelling. The results obtained indicate that temperature of container and trailer during transport is critical in order to deliver persimmon fruit with high quality. Also the physiological stage of the fruit is critical at the moment of sending it to long-distance shipment for reaching to final consumers with high quality.

Keywords: /'Triumph'/ /Firmness/ /Chilling Injury/ /Flesh Gelling/ /Overseas Transportation/

PITAHAYA

Vilaplana, R., Cifuentes, C., Vaca, L., Cevallos-Cevallos, J. M., & Valencia-Chamorro, S. (2020). Curative activity of possible biocontrol agents in the postharvest of yellow pitahaya and organic banana. *Postharvest Biology and Technology*, 159, 111030. doi: 10.1016/j.postharvbio.2019.111030

Abstract

Biological control is one of the best strategies to reduce the use of chemical products during the postharvest period. The isolation and identification of potential biocontrol agents from fruit surfaces is the first step in obtaining an effective biological product against pathogens. In this study several yeast strains were isolated from Ecuadorian fruit and were identified. The curative activity of two selected yeasts, *Candida inconspicua* (CPN3) and *Pichia kluyveri* (B1), was analyzed to establish their antagonism against *Alternaria alternata* on yellow pitahaya and against *Colletotrichum musae* on organic banana. CPN3 yeast showed better effectiveness ($p < 0.01$) than B1 in controlling black rot on yellow pitahaya; whereas on organic banana B1 demonstrated better efficacy ($p < 0.05$) in reducing anthracnose than CPN3. This fact was related to the population dynamics of both yeasts during cold storage of yellow pitahaya and organic banana. No negative effects were observed on physicochemical quality of fruit treated with the potential biocontrol agents. Although curative activity was observed when using CPN3 and B1, studies about their preventive action are needed to establish the antagonistic potential of both yeasts.

Keywords: /*Selenicereus megalanthus*/ /*Musa acuminata*/ /*Alternaria alternata*/ /*Colletotrichum musae*/ /Antagonism/ /Biological control/ /Postharvest/

POMEGRANATE

Khemnar, A.S., Pujari, K.H., Relekar, P.P. and Bhattacharya, T. (2019). Effect of CPPU (Forchlorofenuron) with GA3 (Gibberellic acid) on fruit set and post-harvest quality of 'Bhagwa' pomegranate (*Punica granatum*). *Acta Hort.* 1254, 179-184 DOI: 10.17660/ActaHortic.2019.1254.27 <https://doi.org/10.17660/ActaHortic.2019.1254.27>

Abstract

An Investigation was undertaken to study the effect foliar application of different concentrations of CPPU with GA3 on fruit set, fruit drop, yield and physico-chemical parameters of pomegranate. Significantly higher fruitset, fruit drop, yield, TSS as well as organoleptic evaluation of 'Bhagwa' pomegranate was observed in CPPU treated plants over control plants. However there was no significant difference was noticed in terms of acidity, reducing sugar and total sugars in CPPU treated plants over control plants. The treatment T3 i.e., T1 (10 ppm CPPU at flowering) + (30 ppm CPPU with 10 ppm GA3) was significantly superior to all other treatment in terms of fruit set, fruit drop, yield, fruit weight, TSS and cost.

Keywords: /Pomegranate/ /CPPU/ /GA3/ /Fruit Se/ /Postharvest Quality/

Palou, L. and Vicent, A. (2019). Fungal pathogens causing postharvest decay of pomegranate fruit in Spain. Acta Hortic. 1254, 243-252 DOI: 10.17660/ActaHortic.2019.1254.36 <https://doi.org/10.17660/ActaHortic.2019.1254.36>

Abstract

Spain is the largest European Union exporter of entire pomegranates (*Punica granatum* L.) for fresh consumption. The most important cultivar in the country is Mollar de Elche (syn.: Mollar), an autochthonous cultivar of yellowish rind and excellent sensory properties cultivated mainly in Alacant province (València region, eastern Spain). However, foreign intense red cultivars such as Wonderful, Acco or Smith are increasingly being planted in northern areas in the region (València and Castelló provinces) due to their good adaptability and good acceptance in EU markets, especially for the industries of juices and minimally processed arils. Research work has been conducted and is still in progress to identify and characterize fungal pathogens causing fruit postharvest disease in local environmental conditions. Mollar de Elche pomegranates from different orchards were used in different seasons to assess both latent and wound fungal pathogens causing decay after harvest. In addition, disease was also assessed on fruit packed and stored in commercial conditions. In red cultivars, postharvest symptoms consisting of internal black rot of arils and membranes were increasingly observed in the last seasons. Affected fruit with light to moderate internal lesions are very difficult to sort at harvest and during packaging, which is very detrimental for consolidation of export markets. In all cases, fungi from symptomatic fruit were isolated, purified and identified by means of macroscopic and microscopic observation and molecular techniques. Pathogenicity (Kochs postulates) and disease development at ambient and low temperatures were tested with pomegranates artificially inoculated with the fungi. Main fungi causing latent and wound infections on Mollar de Elche pomegranates were *Botrytis cinerea* (gray mold) and *Penicillium* spp. (blue/green mold), respectively. These pathogens were also the most frequently found on symptomatic cold-stored pomegranates. Other relatively frequent pathogens on fruit stored at 20 and 5°C were *Aspergillus niger* (black rot) and *Pilidiella granati* (syn.: *Coniella granati*; dry rot), respectively. In red cultivars, heart rot was caused by *Alternaria alternata*. This disease was not observed on Mollar de Elche pomegranates.

Keywords: /*Punica granatum* L./ /Postharvest Disease/ /Etiology/ /Latent Infection/ /Wound Infection/ /Cold Storage/

Villamón, D., Palou, L., Bartual, J., Taberner, V., de la Fuente, B. and Pérez-Gago, M.B. (2019). Fruit quality attributes of a new Spanish pomegranate cultivar at harvest and during cold storage. Acta Hortic. 1254, 275-282 DOI: 10.17660/ActaHortic.2019.1254.41 <https://doi.org/10.17660/ActaHortic.2019.1254.41>

Abstract

A new hybrid pomegranate (*Punica granatum* L.) cultivar, named provisionally as H628, was obtained in the Elche Agricultural Experiment Station (Alicante, Spain) by crossbreeding Mollar de Elche and Wonderful cultivars. Physico-chemical, sensory and nutritional quality of these three cultivars were evaluated at harvest and after two storage periods of 8 and 16 weeks at 5°C followed by 1 week at 20°C simulating shelf life. Weight loss increased with storage time and no differences were observed among cultivars. At harvest, the values of soluble solids content (SSC), titratable acidity (TA) and maturity index of the new hybrid were between those of Mollar de Elche and Wonderful. However, no differences were observed between the new hybrid and Mollar de Elche during storage. Sensory quality evaluation by trained panelists showed no significant differences between the new cultivar and Mollar de Elche, which was better evaluated than Wonderful. On the other hand, rind color of H628 pomegranates was similar to that of Wonderful, with higher a* (red) and lower b* (yellow) values than those of Mollar de Elche. Values of L*, a* and b* of the juice of H628 pomegranates were in a range between those of the other two cultivars. Similarly, anthocyanin content, total phenolic content and antioxidant activity were higher in Wonderful than in H628 pomegranates, although total anthocyanin and phenolic contents were five and two times higher, respectively, in the latter than in Mollar de Elche pomegranates. For all cultivars, the most abundant anthocyanin at harvest and during cold storage was cyanidin 3,5-diglucoside. In general, irrespective of the cultivar, a slight decrease was observed at the end of the storage period for total anthocyanin content and antioxidant activity, but not for total phenolic content. Overall, the new hybrid cultivar H628 showed excellent sensory characteristics with intense peel red coloration and high nutritional quality.

Keywords: /'H628', 'Rugalate' /'Mollar de Elche' /'Wonderful' /Hybridization/ /Fruit Color/ /Sensory/ /Nutritional Quality/

García-Pastor, M.E., Guillén, F., Zapata, P.J., Agulló, V., Castillo, S., Serrano, M. and Valero, D. (2019). Melatonin: a new tool to increase yield and quality at harvest and to extend postharvest shelf-life of pomegranate. Acta Hort. 1254, 289-294 DOI: 10.17660/ActaHortic.2019.1254.43 <https://doi.org/10.17660/ActaHortic.2019.1254.43>

Abstract

Pomegranate (*Punica granatum* L.) trees were preharvest treated with melatonin 0.1 mM along the developmental growth cycle. Five treatments were performed (each month after fruit set) and quality was evaluated at harvest and during postharvest storage. At harvest the application of melatonin significantly increased tree productivity with higher yield, number of fruit per tree, and average fruit weight. The content of sugars (glucose and fructose) and organic acids (malic, succinic and ascorbic acid) were higher in treated than in non-treated fruit at time of harvest. During the 60 days of postharvest storage, pomegranates treated with melatonin showed a reduction of weight loss and softening, which was attributed to delay in the postharvest ripening. With respect to bioactive compounds, total phenolics, total anthocyanins and total antioxidant activity (TAA) were significantly higher in melatonin-treated fruits. After 60 days of storage, total anthocyanins and TAA remained higher in treated pomegranates, while total phenolics did not change during storage. These results suggest that melatonin applied at preharvest induced higher pomegranate quality at harvest (increased yield) and a net increase of shelf-life during postharvest storage.

Keywords: /Melatonin/ /Sugars/ /Organic acids/ /Anthocyanins/ /Phenolics/ /Antioxidant Activity /Postharvest/

Proteaceae

Huysamer, A., Hoffman, E.W. and Johnson, S. (2019). Postharvest insect pest control for western

flower thrips, *Frankliniella occidentalis*, in exported cut *Proteaceae* flowers. Acta Hortic. 1263, 507-513 DOI: 10.17660/ActaHortic.2019.1263.66 <https://doi.org/10.17660/ActaHortic.2019.1263.66>

Abstract

A seriously limiting factor to the *Proteaceae* cut flower export industry of South Africa is the presence of entomofauna within export consignments, which leads to rejection of consignments when exporting to strict international markets. This study aimed to assess the efficacy of two potential postharvest pest disinfestation techniques, controlled atmosphere and temperature treatment systems (CATTs) technology, which is a heated controlled atmosphere treatment, and ethyl formate (EF) fumigation treatment. The post-treatment flower quality was evaluated with two *Leucadendron* cultivars, Safari Sunset and Jade Pearl, as well as with the *Chamelaucium* cultivar Ofir. A small and cryptic insect pest, that can be present in high numbers after harvest, is thrips. Both CATTs and EF treatments were assessed for their efficacy against the western flower thrips (WFT), *Frankliniella occidentalis*. In the CATTs treatments the temperature was increased from 23 to 40°C at 30°C h⁻¹ or 35°C h⁻¹, under a controlled atmosphere of 1% O₂, 15% CO₂ in N₂. EF fumigation treatments were carried out at room temperature with EF concentrations of 10 or 20 g m⁻³ for 1 and 2 h. Untreated control and treated flowers were stored at air- and ship-freight simulated conditions, after which flower quality and vase-life were determined. CATTs treatments yielded the best results, as the flower quality and their vase-life matched untreated controls across all commodities and treatments, with no reduction in either of them, following simulated air- or ship-freighting (3 or 21 days, respectively, at 2°C). However, EF treatments resulted in a rapid flower deterioration and unacceptable quality soon after treatment. Both CATTs and EF were highly effective in controlling the WFT mortality, as 100% mortality was achieved across all treatments within 24 h of treatment. The results suggest that for the cultivars tested here, CATTs technology holds a great promise as a postharvest treatment against the WFT, as their flower quality was maintained under treatment conditions that effectively controlled the insect pest.

Keywords: /Controlled Atmosphere Temperature Treatment System Technology/ /CATTs/ /Ethyl formate/ /Cut Flowers/ /*Proteaceae*/ /*Leucadendron*/ /*Chamelaucium*/ /Postharvest/ /Phyto-Sanitary Control/ /Vase Life/

Prunus sp.

Valero, D., Serrano, M., Valverde, J.M., Martínez-Esplá, A., Guillén, F., Corraliza, P., Marín, C. and Martínez-Romero, D. (2019). Effect of rosehip oil as coating on 'Royal Rosa' plum and 'Atenea' nectarine. Acta Hortic. 1256, 349-354 DOI: 10.17660/ActaHortic.2019.1256.49 <https://doi.org/10.17660/ActaHortic.2019.1256.49>

Abstract

In this work the effect of rosehip oil at 2% as an edible coating on 'Royal Rosa' plum and 'Atenea' nectarine stored for 50 and 35 days, respectively, at 1°C plus 1 day at 20°C is analysed. The rosehip oil treatment reduced the ethylene emission in both fruits. However, control fruits exhibited the characteristic climacteric peak at 20-21 storage days. Similarly, the respiration rate of treated fruits was lower than control ones. Both physiological processes reduction allowed maintaining the quality of plum and nectarine during storage time. In this sense, all treated plum and nectarine exhibited the best external appearance (turgidity and coloration) due to the delay of initial losses of coloration and firmness. In addition, rosehip oil controlled the weight loss throughout the storage period. At the end of the experiment, an 18 and 40% reduction of weight losses was obtained in the treated plums and nectarines, respectively. Thus, rosehip oil coating could be a good postharvest alternative to control the physiological and quality changes of plums and nectarines.

Keywords: /Fruit Quality/ /*Prunus salicina* L./ /*Prunus persica* L./ /Ethylene/ /Ripening/ /*Rosa canina* L./

RED CHICORY

Pinto, L., Yaseen, T., Caputo, L., Furiani, C., Carboni, C. and Baruzzi, F. (2019). Application of passive refrigeration and gaseous ozone to reduce postharvest losses on red chicory. Acta Hortic. 1256, 419-426 DOI: 10.17660/ActaHortic.2019.1256.60 <https://doi.org/10.17660/ActaHortic.2019.1256.60>

Abstract

Red chicory is a leafy vegetable, currently used for the preparation of ready-to-eat salads that undergo heavy losses during cold storage mainly due to microbial soft rot development. In this work, chicory was stored at (1°C) in a passive refrigeration chamber with low doses of gaseous ozone (0.1-1 ppm) applied during 21 days in order to reduce postharvest losses. Conventional refrigeration in absence of gaseous ozone was used as the reference storage method. In addition, in order to evaluate the antimicrobial effect a challenge test was performed inoculating sound red chicory heads with a specific spoilage microbiota, accounting approximately 8 log cfu mL⁻¹ bacteria and 7 log cfu mL⁻¹ yeasts and moulds, responsible for soft rot development under cold storage. The results showed that soft rot developed from day 8, especially in the inoculated samples, even though the leaf appearance was unchanged. At the end of cold storage, non-inoculated red chicory heads stored under conventional conditions lost all characteristics related to vegetable fresh appearance; on the contrary, colour brightness and tissue turgidity were retained in samples stored under passive refrigeration. Oxidative discoloration of leaf margins was recorded in red chicory heads stored under 1 ppm ozone. At the day 21, microbial counts of spoiled vegetable regardless the different cold storage conditions did not show any significant difference. Conversely, as expected, evident difference in soft rot severity was recorded between inoculated and non-inoculated samples. Passive refrigeration determined a lower amount of food waste in comparison with conventional refrigeration. Control samples, inoculated or not, showed 100% of losses whereas those under passive refrigeration produced 40.09±4.24 and 90.69±12.03% of food waste for inoculated and non-inoculated samples, respectively. A further reduction of vegetable waste (ranging from 10 to 30%) was registered when passive refrigeration was associated with gaseous ozone treatment at 0.1 ppm. Higher ozone doses caused no significant additional improvements. Passive refrigeration alone was able to reduce significantly weight losses and preserve the quality of chicory up to 21 days. In addition, the combined application of gaseous ozone and passive refrigeration resulted a valid approach to counteract soft rot development on red chicory heads and to reduce the amount of food waste. However, ozone exposure needs to be carefully calibrated to preserve vegetable tissues from oxidative damages caused by this gas.

Keywords: /Ready-to-eat Vegetables/ /Shelf-Life/ /Microbial Spoilage/ /Control Tools/

ROSE

Cocetta, G., Trivellini, A. and Ferrante, A. (2019). Effects of postharvest application of salicylic acid and benzothiadiazole on cut rose (*Rosa hybrida*). Acta Hortic. 1256, 101-106 DOI: 10.17660/ActaHortic.2019.1256.14 <https://doi.org/10.17660/ActaHortic.2019.1256.14>

Abstract

Rose (*Rosa hybrida*) is among the most important species sold as cut flower. Its vase life is quite short and ranges from 6 to 10 days, depending on postharvest conditions. Flower and leaf senescence is the main responsible for quality losses and strongly affects the marketability of this ornamental item. Salicylic acid is a plant hormone playing a key role in flowers senescence acting at different levels. The aim of this work was to evaluate the effects of postharvest treatments on the quality and on the vase life of cut-rose flowers. Cut roses (flowers and leaves) were treated for 24 h with salicylic acid - SA and with a commercial formulation containing benzothiadiazole - BTH, which is a functional analogue of the hormone. During vase life, chlorophyll a fluorescence was monitored non-destructively in leaves. Samples (leaves and petals) were collected at the beginning of the trial (T0) and after 4 (T4) and 7 (T7) days at 20°C and destructive determination of phenolic index was conducted. Results showed that SA treatment was effective in extending the vase life of roses but did not affect the phenolic content. On the other hand, BTH significantly increased the levels of phenols, especially in leaves, but, at the same time, it negatively affected the quality of stems, probably due to an impairment of water uptake.

Keywords: /Chemical Elicitors/ /Senescence/ /Phenolic Compounds/ /Signal Molecules/ /Cut Flowers/

ROSEMARY

De Pasquale, C., La Bella, S., Cammalleri, I., Gennaro, M.C., Licata, M., Leto, C. and Tuttolomondo, T. (2019). Agronomical and postharvest evaluation of the essential oils of Sicilian rosemary (*Rosmarinus officinalis* L.) biotypes. Acta Hortic. 1255, 139-144 DOI: 10.17660/ActaHortic.2019.1255.21 <https://doi.org/10.17660/ActaHortic.2019.1255.21>

Abstract

Rosmarinus officinalis L. is an aromatic shrub commonly found in the Mediterranean area. It is used in cooking both to add aroma and as a preservative in processed foods. Essential oils of rosemary are used in medicine and in the cosmetics industry due to their considerable biological properties. The yield and quality of rosemary essential oils mainly depend upon the chemo type, environmental conditions and cultivation techniques. The aim of this study was to evaluate the qualitative and quantitative characteristics of essential oils of wild *R. officinalis* biotypes found in Sicily using different drying methods. Five types of drying methods were used for the tests: a) shade drying under a roof using natural air ventilation; b) direct sunlight drying; c) oven drying at 30°C; d) oven drying at 40°C; e) oven drying at 50°C. The results highlight qualitative and quantitative differences with regards to the dry methods and essential oils.

Keywords: /Drying Methods/ /Essential Oils/ /*Rosmarinus*/ /Wild Plants/

SOURSOP

Ventura Vázquez Hernández, M., Arévalo-Galarza, L. and Esquivel, G.L. (2019). Single and double applications of 1 methyl-cyclopropene in prolonging the shelf life of soursop (*Annona muricata* L.). Acta Hortic. 1256, 31-38 DOI: 10.17660/ActaHortic.2019.1256.5 <https://doi.org/10.17660/ActaHortic.2019.1256.5>

Abstract

Soursop (*Annona muricata* L.) is a tropical fruit, source of vitamins, dietary fibre and minerals, with a very pleasant taste, aroma and texture. However, its shelf life is very short due to the high rates of respiration and ethylene production, in addition to being highly susceptible to chilling injury. Thus, it is necessary to use postharvest techniques to preserve its organoleptic characteristics and prolong the storage life. The aim of this study was to determine the effect of one or two consecutive applications of 1-methylcyclopropene (1-MCP) on soursop fruits at 20°C. Fruits were harvested at physiological maturity in a commercial orchard in Veracruz, Mexico. After washing, 1-MCP was applied at doses of 0, 400, 800 nL L⁻¹ and two applications of 400 nL L⁻¹ (400×400) (initial and 3 days later). The variables evaluated were weight loss, peel browning, total soluble solids and titratable acidity as well as CO₂ and ethylene production after 1, 3, 6 and 9 days at 20°C. The results showed that the fruits treated with any of the 1-MCP doses maintained firmness better than control fruits ($P \leq 0.05$). Image analysis showed that fruits treated with doses of 400 and 400×400 nL L⁻¹ had 35% of peel browning, whereas control fruits and those treated with 800 nL L⁻¹ had 100% of browning after 9 days of application. The respiration rate was significantly lower after 1 and 6 days in fruits treated with 400 nL L⁻¹ (94.6 and 214.6 mL CO₂ kg⁻¹ h⁻¹) and 400×400 nL L⁻¹ (70.4 and 107.0 mL CO₂ kg⁻¹ h⁻¹), respectively, than the control fruits (160.1 and 341.6 mL CO₂ kg⁻¹ h⁻¹) on the same days. The control fruits could only be kept in good condition for six days, whereas those treated with 1-MCP up to nine days. In conclusion, doses of 400 nL L⁻¹ in one or two applications can be used to maintain the quality and prolong the shelf life in soursop fruits better than 800 nL L⁻¹ in one single application.

Keywords: /Annona/ /Respiration/ /Ethylene/ /Shelf Life/

STRAWBERRY

Vendel, I., Hertog, M.L.A.T.M. and Nicolai, B. (2019). Introducing SIFT-MS to postharvest research, a case study on strawberries (*Fragaria × ananassa*). Acta Hort. 1256, 245-250 DOI: 10.17660/ActaHortic.2019.1256.34 <https://doi.org/10.17660/ActaHortic.2019.1256.34>

Abstract

Aroma is an important quality aspect of fresh produce and plays an important role in postharvest research. Volatile organic compounds (VOCs) can serve as markers for fermentation and disorders occurring during postharvest storage and play an important role in consumer acceptance and liking of fresh produce. This study suggests selected ion flow tube mass spectrometry (SIFT-MS) as a candidate technique for the rapid, non-destructive measurement of VOCs in postharvest quality research. Strawberry was chosen as a model fruit since aroma is one of its main quality traits. SIFT-MS is able to distinguish inter- and intra-cultivar variation in strawberries. A comparison with gas chromatography mass spectrometry (GC-MS) shows both techniques are able to detect similar stages in strawberry ripening, where SIFT-MS is able to detect smaller differences due to its lower limit of detection. Moreover, a clear distinction is seen in the aroma profile of strawberries infected with *Botrytis cinerea*, making SIFT-MS a useful tool in detecting postharvest disorders.

Keywords: /Aroma/ /Volatile Organic Compound/ /SIFT-MS/ /Strawberry/

Giacalone, G. and Chiabrand, V. (2019). Active packaging to improve the shelf-life and nutritional quality of strawberries. Acta Hort. 1256, 379-386 DOI: 10.17660/ActaHortic.2019.1256.54 <https://doi.org/10.17660/ActaHortic.2019.1256.54>

Abstract

Strawberries have a high degree of perishability due to their high respiration rates that lead to the loss of organoleptic traits. High sensory quality and microbiological stability are critical factors in maintaining commercial marketability of fresh products. Active packaging systems in combination with modified atmosphere packaging (MAP) are a technology developed to increase the shelf-life of fresh perishable fruits. In particular, antimicrobial packaging is a promising technology to delay the deterioration process of whole or fresh-cut fruit. In this paper, we discuss the results of the application of an innovative packaging, Life+ systems (ILIP, Italy), on strawberries. The packaging is based on the use of an anti-microbial active absorbent pad (Sirane Group Ltd., UK) associated with an unvented and anti-mist PET punnet, closed with a heat-sealed micro perforated film (Plastopil, Israel). In the study, strawberries were packed with different Life system. Two kinds of pads, with a different concentration of antimicrobials, were associated with a film having high gas permeability. During the refrigerated storage (6°C, 8 days) atmosphere composition of the pack, colour, firmness, nutritional value, overall appearance and microbiological contamination were evaluated. The results indicated that the Life+ system packaging has a positive influence on the visual appearance, the organoleptic traits and the weight loss of strawberries. Finally, active packaging reduced the microbial proliferation and the loss of product.

Keywords: /Berry/ /Postharvest/ /Modified Atmosphere Packaging/ /Life+/ /Micro-Performed Film/

Pols, S., Williams, E. and Vries, F. (2019). Increasing strawberry fruit shelf-life. Acta Hort. 1256, 639-646 DOI: 10.17660/ActaHortic.2019.1256.91 <https://doi.org/10.17660/ActaHortic.2019.1256.91>

Abstract

Strawberry fruit is characterized by a unique flavour and taste. The fruit are harvested at full maturity, causing high susceptibility to mechanical damage, pathological and physiological disorders during postharvest storage, with a maximum shelf-life of 4 days. Due to high levels of postharvest spoilage, increased fungicide resistance and a growing health concern from the consumer, the industry is currently searching for an economically viable, effective and affordable alternative to improve fruit quality and reduce spoilage. Although various postharvest treatments, including a chitosan coating and hot water treatments have been investigated, an effective standard treatment is yet to be identified. The aim of this study was to investigate the efficacy of a dual-release sulphur dioxide (SO₂) generating pad, in combination with modified atmosphere packaging (MAP) to control postharvest fungal development on strawberry fruit. The study specifically focused on preventing postharvest development of *Botrytis cinerea*, commonly referred to as grey mould. Strawberry fruit exposed to SO₂ showed a noticeable decrease in decay development, especially when the SO₂ treatment was combined with MAP. The treatment successfully decreased the *B. cinerea* incidence by more than half, allowing for a longer cold storage period than is currently available with standard industry practices.

Keywords: /Shelf-life/ /*Botrytis cinerea*/ /Modified Atmosphere Packaging/ /Sulphur dioxide pads/

Li, Y., Dong, Q., Chen, J., & Li, L. (2020). Effects of coaxial electrospun eugenol loaded core-sheath PVP/shellac fibrous films on postharvest quality and shelf life of strawberries. *Postharvest Biology and Technology*, 159, 111028. doi: 10.1016/j.postharvbio.2019.111028

Abstract

Strawberries are susceptible to physical injuries and fungal spoilage. To extend the shelf life of strawberries, eugenol (EG) loaded core-sheath fibrous films were fabricated and characterized as novel edible active packaging. With EG as the antifungal active substance, polyvinyl pyrrolidone (PVP) and shellac as the core and sheath matrix, respectively, PVP/Shellac fibrous films were prepared using a coaxial electrospinning technology. The data of fourier transform infrared spectroscopy and thermogravimetric analysis showed that EG was encapsulated into the core-sheath fibers and the fibers had good thermal stability. The diameter of the fibers was in the scale of micron and fibers had a bead-free surface and a clear core-sheath structure. Morphology analysis verified that the core-sheath fibrous films had good moisture resistance. The mechanical properties of fibrous films stored in dry and humid environments were tested. Application studies on the conservation of strawberries showed that EG loaded core-sheath PVP/Shellac fibrous films are able to maintain quality and extend the shelf life of strawberries, indicating that they are potential for the application in fruit preservation.

Keywords: /Coaxial electrospinning/ /Polyvinyl pyrrolidone/ /Shellac/ /Eugenol/ /Active packaging materials/

SWEET CHERRY

Pristijono, P., Bowyer, M.C., Scarlett, C.J., Vuong, Q.V., Stathopoulos, C.E., Vuilleminot, L. and Golding, J.B. (2019). Postharvest UV-C treatment reduces postharvest decay in sweet cherries stored at ambient temperature (20°C). Acta Hortic. 1256, 441-448 DOI: 10.17660/ActaHortic.2019.1256.63 <https://doi.org/10.17660/ActaHortic.2019.1256.63>

Abstract

Postharvest treatment with UV-C (180-280 nm) has been shown to significantly extend the shelf-life of many horticulture crops. In this study, two sweet cherry cultivars ('Sweetheart' and 'Lapin') were exposed to UV-C light at five different intensities (0, 2.1, 9.7, 25.3, 50.8 kJ m⁻²) and stored for up to 9 days at 20°C or 28 days at 1°C. Fruit quality was assessed by stem colour, stem attachment, development of postharvest rots, flesh colour, fruit firmness, total soluble content and titratable acidity. Fruit exposed to UV-C treatment and storage at 20°C experienced significantly lower levels of postharvest rot, but this response to UVC treatment was not dose dependent. In contrast, UV-C treatment was found to have no significant effect on decay development for treated fruit when later stored for up to 28 days at 1°C. UV-C treatment exhibited no significant impact on stem colour, flesh colour, stem detachment, TSS, TA nor TSS/TA ratio for fruit stored at 20°C, although treated 'Lapin' fruits, showed significantly greater firmness retention relative to the control. Results indicated that under certain conditions, postharvest UV-C treatment has the potential to reduce the incidence of decay and maintaining flesh firmness in sweet cherries stored at ambient temperature (20°C), however, there was no significant effect when stored at 1°C.

Keywords: /Storage/ /Rots/ /Quality/ /Stem Colour/ /Firmness/

Larsen, H. and Børve, J. (2019). Shelf life of sweet cherries in different packages after 0 and 3 weeks of CA-storage. Acta Hortic. 1256, 555-562 DOI: 10.17660/ActaHortic.2019.1256.79 <https://doi.org/10.17660/ActaHortic.2019.1256.79>

Abstract

The positive effect of low oxygen and high CO₂ for sweet cherry (*Prunus avium* L.) storability is well-known. In the present experiment, a combination of controlled atmosphere (CA; 2°C, 5% O₂ and 15% CO₂) storage and modified atmosphere in consumer packaging (MAP) were assessed. Fruit of 'Kordia' were packaged directly (0-week CA) or after three weeks in CA storage (3-week CA). The different packages were 1: macro-perforated polyethylene bag (carry bags); 2: trays wrapped in perforated films giving passive modified atmosphere with high CO₂ concentration (MAP-high CO₂); 3: similar as 2, but with low CO₂ concentration (MAP-low CO₂); 4: perforated shaker with lid containing cherries with stem; and 5: similar as 4, but with fruit without stems. The consumer packages were stored at 4°C for 5 days and thereafter for 3 days at 4°C (Chill) or 20°C (Retail) simulating different retail storage conditions. The weight loss was below 1% for fruit in all packages stored at chill conditions. At retail conditions, weight loss for cherries in carry bags varied between 2.2 and 8.4%, whereas MA packages had insignificant weight loss. Fungal fruit decay was below 0.5% for 0-week CA cherries stored at chill conditions for 8 days, and from 7 to 14% for 3-week CA cherries stored at chill conditions for 6 days after packaging. At retail conditions, 25 to 52% decay was detected at the end of storage period after previous storage in 0 and 3 weeks in CA, respectively. Sweet cherries of 'Kordia' did not maintain an acceptable quality in 3 weeks of CA with consecutive simulated distribution conditions during 6 days. Fungal decay was lower in carry bags and MA packaging with high CO₂, and the MA packages had additionally insignificant weight loss in mean of the different temperature regimes and storage times.

Keywords: /Modified Atmosphere Packaging/ /Storage Temperature/ /Weight Loss/ /Fungal Decay/

Suran, P., Zelený, L. and Skřivanová, A. (2019). Impact of storage technologies on length of storage period and fruit quality of sweet cherries. Acta Hort. 1256, 615-622 DOI: 10.17660/ActaHortic.2019.1256.88 <https://doi.org/10.17660/ActaHortic.2019.1256.88>

Abstract

The aim of the trial was to test the possibilities of long-term storage of sweet cherry fruits in cold storage conditions with the use of MAP (modified atmosphere packaging) technology in comparison to ULO conditions and to cold storage without atmosphere regulation. The length of storage, fruit weight loss, fruit firmness, soluble solids content, taste characteristics, pedicel turgidity, shelf-life and occurrence of fungal diseases attack on fruits were observed. Fruits of middle and late ripening sweet cherry cultivars were chosen for the trial in comparison with two standard cultivars. The tested sweet cherry cultivars were Amid, Justyna, Korvik, Tamara, the standard cultivars were Kordia and Regina. Storage temperature was 1°C, ultra-low storage atmosphere (ULO) containing 2% of O₂ and 1% of CO₂. Fruits were stored for 50 days. Weight loss, stem browning, increased soluble solid content and shrivelling of fruits were observed on fruits in cold storage and slightly on fruits in ULO storage. Fruits in MAP kept fresh appearance, green stem and good taste. Weight loss of fruits in MAP was lower compared to fruits stored in cold and ULO store. Storability of sweet cherry cultivars was extended as well. Length of storability of fruits depends on cultivar predisposition as well as fruit quality. For long storage period special treatment management is necessary against brown fruit rot.

Keywords: /Modified Atmosphere Packaging/ /Ultra-Low Oxygen Atmosphere/ /Xtend/ /Fruit Weight/ /Fungal Diseases/

Tokatlı, K., & Demirdöven, A. (2020). Effects of chitosan edible film coatings on the physicochemical and microbiological qualities of sweet cherry (*Prunus avium* L.). *Scientia Horticulturae*, 259, 108656. doi: 10.1016/j.scienta.2019.108656

Abstract

In this study, the effects of chitosan edible film coatings on the physicochemical and microbiological qualities of sweet cherry (*Prunus avium* L.) were investigated. Sweet cherries were coated with 1% chitosan [two of which were produced from shrimp waste originating from the Marmara Sea in Turkey (Chitosan-1, Chitosan-2) and the other two of which were commercially produced (Commercial-1 and Commercial-2)] and stored at 4 °C for 25 days or 20 °C for 15 days. Various physicochemical (weight loss, pH, titratable acidity, total soluble solids, water activity, respiration rate, total carbohydrate content) and microbiological (total mesophilic aerobic bacteria, total psychrophilic aerobic bacteria, total coliform bacteria, yeasts and molds) qualities were measured. After storage, the least weight loss was found to be 8.85% in Chitosan-2 coated sweet cherries at 20 °C and 16.18% in the control group stored at 4 °C. The lowest titratable acidity value was observed in the control group (0.657%) at 4 °C and in the Chitosan-2 coated sweet cherries (0.600%) at 20°C. The water activity value was determined at 0.969-0.974 for all sample groups and storage conditions at the end of each period. The total count of mesophilic aerobic bacteria in the sweet cherry coated with CH-1 and CH-2 was found to be below the detectable amount (<2 logCFU/g) while that for the control group was 2.74 log CFU/g at 4 °C. Coating sweet cherries with CH-1 and CH-2 inhibited yeast and mold growth at 4 °C for 25 days while the highest yeast and mold count was determined as 4.75 log CFU/g in C-2 coated sweet cherries at the end of storage. It has been determined that each tested chitosan coatings have different effects on various quality characteristics at distinct storage temperatures. When microbiological analyses are taken into consideration, it can be concluded that chitosan, especially those produced from shrimp wastes, have high antimicrobial effects and can be used effectively in increasing the shelf life of sweet cherries.

Keywords: /Sweet cherry/ /Chitosan/ /Edible film coating/ /Microbiological quality/ /Shelf life/

TOMATO

Cherono, K. and Workneh, T.S. (2019). Effect of transportation conditions and pre-storage treatments on the quality and shelf-life of fresh tomatoes in selected South African supply chains. Acta Hortic. 1258, 55-62 DOI: 10.17660/ActaHortic.2019.1258.8 <https://doi.org/10.17660/ActaHortic.2019.1258.8>

Abstract

This study investigates the effect of various pre-storage treatments and transport conditions on the quality and shelf life of fresh tomatoes transported along three South African supply chains. The experimental design comprised of tomatoes harvested at three maturity stages (red, pink and green); three transport routes with varying road quality conditions; seven disinfection treatments; and two storage conditions (ambient or 11°C). Samples were drawn at regular intervals over a 30-day storage period. Fruit color, firmness, weight loss, visual quality and marketability were assessed. The Esmefour-Pietermaritzburg route (ZZ) was longer than the Point Drift-Pietermaritzburg (PD) and Steve Mohale's Farm-Pietermaritzburg route (EM) by 263.44 and 223.81 km, respectively. The majority of the EM route (70%) had an International Roughness Index (IRI) value less than 2.5 m km⁻², while the ZZ and PD routes had 63 and 58% of their road length recording IRI values less than 2.5 m km⁻², respectively. The mean hue angle and firmness of fruit stored under cold storage was 16.3 and 19.2% higher than that of fruit stored under ambient conditions, respectively. Tomatoes transported through the EM route had the highest mean firmness (19.41 N) and marketability (74.5%), least cumulative mean weight loss (4.8%), while fruit transported through PD had the best color retention with an average hue angle of 52.56. Anolyte water in combination with biocontrol had the least weight loss, best visual appearance and marketability compared to fruit treated with hot water, hot water in combination with biocontrol or tap water (control). Timely maintenance of roads in and around farms is suggested due to the key role road quality plays in fruit quality degradation. Anolyte water can potentially be used as an alternative to chlorinated water as a disinfectant of tomato fruit.

Keywords: /Road Quality/ /IRI/ /Surface Disinfection/ /Post-harvest/ /Anolyte Water/

Pristijono, P., Bowyer, M.C., Scarlett, C.J., Vuong, Q.V., Stathopoulos, C.E. and Golding, J.B. (2019). The application of UV-C irradiation followed by storage in continuous low level ethylene atmosphere to delay the ripening of mature green tomatoes. Acta Hort. 1256, 335-342 DOI: 10.17660/ActaHortic.2019.1256.47 <https://doi.org/10.17660/ActaHortic.2019.1256.47>

Abstract

Mature green tomatoes (*Solanum lycopersicum* Neang Pich) were exposed to 0, 3.1, 7.1, 10.5 and 13.6 kJ m⁻² UV-C irradiation at 20°C. After treatment, tomatoes were stored in continuous air containing either <0.005 or 0.1 µL L⁻¹ ethylene at 20°C and 100% RH for up to 11 days. The untreated fruit (0 kJ m⁻² UV-C) ripened significantly faster than UV-C treatments in both storage conditions. All UV-C treatments followed by storage at either <0.005 and 0.1 µL L⁻¹ ethylene had significantly slower ethylene production rates throughout the ripening period. There was no difference between treatments in fruit TSS, TA and, TSS/TA ratio. After storage, fruit treated with 10.5 and 13.6 kJ m⁻² UV-C were significantly firmer than untreated fruits for both storage conditions. Overall, tomatoes stored at <0.005 µL L⁻¹ ethylene were significantly firmer and had lower TSS/TA ratio than fruits stored at 0.1 µL L⁻¹ ethylene. These results show that UV-C treatment delayed ripening of tomatoes in the presence of low level of ethylene during storage. In the absence of added ethylene, UV-C treatment resulted in firmer fruit with higher TSS and TSS/TA ratios. This new treatment could be used to extend the shelf-life of mature green tomatoes through the supply chain.

Keywords: /Storage/ /Ripening/ /Ethylene/ /Colour/ /Firmness/

Mottura, M.C., Perelló, R. and Orihuel-Iranzo, B. (2019). Effects of postharvest application of Citrocide® PLUS, a peracetic acid based formulation, on tomato decay control. Acta Hort. 1256, 407-412 DOI: 10.17660/ActaHortic.2019.1256.58 <https://doi.org/10.17660/ActaHortic.2019.1256.58>

Abstract

Tomato fruit, considered the second most important vegetable in the world in terms of quantity of vitamins and minerals contributing to the human diet, is affected by postharvest diseases that significantly increase spoilage after harvest. Furthermore, economic losses due to postharvest diseases are even greater than generally realized because the value of the produce increases several-fold while passing from the field to the consumer. Because the increased concerns regarding food safety of fresh vegetables we developed a PAA formulation and application system for the hygienic washing of tomatoes. It turns out that this application is also extremely effective reducing postharvest decay. In the present study, the postharvest application of Citrocide® PLUS on tomatoes was evaluated. Citrocide® PLUS, a PAA based formulation from Productos Citrosol S.A., was applied to three different tomatoes cultivars. In two cultivars, fruit was wounded simulating cracking, while in a third one, tomatoes were harvested from a greenhouse with, presumably, high level of fungi inoculum. The results obtained showed that the proper application of Citrocide® PLUS significantly reduces tomatoes postharvest decay in all cultivars tested. Decay reduction index varies from 85 to even 100% after 10 days at 10°C and 85% RH in wounded tomatoes, while in non-wounded tomatoes decay control was 100% after 13 days at 10°C and 85% RH. In addition, the results showed that the avoidance of washing tomato cannot be considered as an alternative to reduce postharvest decay. This study indicates that the postharvest application of Citrocide® PLUS is a reliable solution to improve postharvest life of tomatoes and therefore, reduce tomato economic losses caused by decay after harvest.

Keywords: /Tomatoes/ /Postharvest Decay/ /Decay Control/ /Peracetic acid/ /Citrocide® PLUS/

Pols, S., Botes, A., Williams, E. and Vries, F. (2019). Combined treatments of MAP and SO₂ to decrease postharvest losses in tomatoes. Acta Hort. 1256, 427-434 DOI: 10.17660/ActaHortic.2019.1256.61 <https://doi.org/10.17660/ActaHortic.2019.1256.61>

Abstract

Tomato is one of the most widely cultivated horticultural crops. Despite an exponential increase in production, a translation into profit is absent especially in developing countries, due to many factors including postharvest losses. Postharvest quality is drastically influenced by fungal infection, of which *Botrytis cinerea* and *Rhizopus stolonifer* are the most commonly reported postharvest pathogens in tomatoes. The aim was to investigate the efficacy of commercially available sulphur dioxide (SO₂) generating pads in controlling postharvest fungal infections in tomatoes. The study particularly focused on preventing the development of *B. cinerea* and *R. stolonifer*. The data showed that the most effective treatment was a combination of two SO₂ pads. The treatment successfully suppressed development of decay when the one pad was placed at the bottom of the carton, with the other pad placed on top of the fruit. Decay development of both pathogens was noticeably reduced but no statistical comparisons were made. When the SO₂ treatment was combined with modified atmosphere packaging (MAP), the decay inhibition was more effective than the SO₂ generating pads included on its own. Therefore, it was concluded that a combined treatment of SO₂ and MAP could act as a cost-effective, viable postharvest treatment to limit losses in the tomato industry.

Keywords: /Postharvest Treatment/ /Tomato/ /*Botrytis cinerea*/ /*Rhizopus stolonifer*/ /Sulphur dioxide pads/

Affandi, F. Y., Verdonk, J. C., Ouzounis, T., Ji, Y., Woltering, E. J., & Schouten, R. E. (2020). Far-red light during cultivation induces postharvest cold tolerance in tomato fruit. *Postharvest Biology and Technology*, 159, 111019. doi: 10.1016/j.postharvbio.2019.111019

Abstract

We investigated the role of far-red LED light during cultivation on postharvest cold tolerance in tomato fruit (*Solanum lycopersicum* cv Moneymaker). Red and blue top LED light, providing 150 $\mu\text{mol m}^{-2} \text{s}^{-1}$ photo-synthetically active radiation (PAR) at plant height for 16 h daily, was combined with 0, 30 or 50 $\mu\text{mol m}^{-2} \text{s}^{-1}$ (non-PAR) far-red LED light. Tomatoes were harvested at the mature green or red stage and subjected to cold storage for 0, 5, 10, and 15 d at 4 °C, followed by 20 d shelf-life at 20 °C.

Mature green harvested tomatoes, cultivated with additional far-red light, showed reduced weight loss, less pitting, faster red colour development during shelf-life (when prior long cold stored), and less softening (when prior short or non-cold stored). FR lighting during cultivation likely protects the membrane integrity of MG tomatoes and thus allows uninterrupted lycopene synthesis. Red harvested tomatoes cultivated with additional far-red light were firmer at harvest, showed reduced weight loss and less decay during shelf-life. Less red colouration was observed for red harvested fruits at the start of shelf-life when fruits were prior cold stored, indicative of lycopene breakdown during cold storage. The improved cold tolerance of red harvested fruits grown under additional far-red light is likely due to higher firmness at the start of the shelf-life period with lycopene acting as antioxidant during cold storage. In conclusion, additional far-red light during cultivation improved postharvest cold tolerance for tomatoes harvested at both the green and red maturity stage, and might therefore be suitable to prolong the storage potential of tomato at sub-optimal temperatures.

Keywords: /Chilling injury/ /Colour/ /Firmness/ /Weight loss/

Verma, S., Sharma, V., & Kumari, N. (2020). Microwave pretreatment of tomato seeds and fruit to enhance plant photosynthesis, nutritive quality and shelf life of fruit. *Postharvest Biology and Technology*, 159, 111015. doi: 10.1016/j.postharvbio.2019.111015

Abstract

The present study was undertaken to explore the effect of non-thermal microwave pretreatment of tomato seeds and fruit to enhance plant photosynthesis; nutritive value and shelf-life of fruit. The tomato fruit of two varieties i.e. NS-585 and NS-2535 were collected from the plants grown from control and single microwave dosed (9.3 GHz) seeds. The fruit collected from single dosed condition were again irradiated and further analyzed for various parameters. Cardinal points were calculated to assess the photosynthetic activity at the fruiting stage in plants of both the cultivars and were found to increase in plants raised from irradiated seeds in comparison to the control plants. The exposure of tomato fruit with double dosed microwave radiation showed high lycopene content, total protein content, phenolic and flavonoid content in unripe, ripe and overripe stages of both varieties. The activity of cell-wall degrading enzymes such as polygalacturonase, pectinmethylesterase and β -galactosidase decreased in doubled dosed microwave irradiated fruit of both varieties as compared with the other. The gene expression analysis of ACC synthase and ACC oxidase showed reduction in the enzyme activity in double dosed microwave irradiated tomato fruit. We conclude that post-harvest microwave exposure can be applied to increase the shelf-life of tomato fruit.

Keywords: / β -galactosidase/ /Pectinmethylesterase/ /Photosynthesis/ /Polygalacturonase/ /Microwave radiation/ /Non-thermal/

Khatri, D., Panigrahi, J., Prajapati, A., & Bariya, H. (2020). Attributes of Aloe vera gel and chitosan treatments on the quality and biochemical traits of post-harvest tomatoes. *Scientia Horticulturae*, 259, 108837. doi: 10.1016/j.scienta.2019.108837

Abstract

In this research paper, we report the efficiency of *Aloe vera* gel and chitosan, as edible coatings, in extending the post-harvest shelf-life of tomato fruits (*Solanum lycopersicum* Mill.), along with their biochemical attributes and antioxidative capacities. The tomato fruits were coated with *A. vera* gel or chitosan or a combination of both (*A. vera* + chitosan). Tomato fruits without any coating served as the control. Under all three coating treatments, the fruits showed a gradual increase in the total soluble sugar, total phenolic, and lycopene contents, and pectate lyase activity, and a gradual decrease in the titratable acidity and ascorbic acid content, as well as differentially induced antioxidative activities during cold storage, in comparison with the control fruits. The combined *A. vera* gel and chitosan treatment showed the best efficiency in delaying the ripening process and extended the fruit shelf-life up to 42 days.

Keywords: /*Aloe vera*/ /Chitosan/ /Edible coating/ /Shelf-life/ /Tomato/

WALNUT

Grosso, A. L., Asensio, C. M., Grosso, N. R., & Nepote, V. (2020). Increase of walnuts shelf life using a walnut flour protein-based edible coating. *Lwt*, 118, 108712. doi: 10.1016/j.lwt.2019.108712

Abstract

The present study aimed to improve walnut quality during storage. An edible coating was developed from defatted walnut flour and applied to the surface of walnut kernels, which were subsequently stored at 40 °C for 84 days along with walnuts coated with methylcellulose and uncoated kernels. On day 84, the walnuts coated with the walnut flour coating presented the lowest oxidized (13.33) and cardboard (34.73) flavors, the highest walnut flavor (72.27), the highest carotenoid (2.01 mg/kg) and γ -tocopherol contents (306.78 mg/kg) and the least deterioration of oleic/linoleic fatty acids ratio. Furthermore, the kernels covered in this coating displayed higher overall consumers' acceptance than those covered with methylcellulose (5.31). The methylcellulose and walnut flour coatings also prevented against polyunsaturated fatty acids' deterioration, while walnuts coated with methylcellulose displayed a better behavior for peroxide value. Both coatings protected walnuts against the deterioration processes. Walnut flour coating could be used as a natural alternative to prolong the shelf life of walnut kernels, without the introduction of allergens nor synthetic compounds in this food product.

Keywords: /Preservation/ /Oxidation/ /*Juglans regia*/ /Protection/ /Stability/

ZUCCHINI

Carvajal, F., Rosales, R., Palma, F., Manzano, S., Jamilena, M. and Garrido, D. (2019). Molecular response to cold storage in fruit of two zucchini cultivars differing in their chilling sensitivity. Acta Hortic. 1256, 187-194 DOI: 10.17660/ActaHortic.2019.1256.26 <https://doi.org/10.17660/ActaHortic.2019.1256.26>

Abstract

Cold storage in zucchini fruit extends the commercial life but causes the appearance of chilling injury (CI), characterized by peel pitting, weight loss, and softening. However, chilling sensitivity in zucchini is cultivar dependent. Among commercial hybrids, Natura and Sinatra were found to be one of the most cold-tolerant and cold-sensitive cultivars, respectively, i.e., after 14 days of storage fruit from Natura showed very low CI, while Sinatra fruit presented high CI index and a loss of fruit quality. To gain new insight into the molecular mechanisms underlying the response of zucchini fruit to chilling storage, a RNA-Seq study was performed in fruit exocarp from Natura and Sinatra fruit at harvest and after 14 days of storage at 4 or 20°C. This transcriptomic study revealed common mechanisms between zucchini fruit response to cold and other biotic and abiotic stresses and suggested a cross-talk between different stresses. In this sense, the most overrepresented biological processes (BPs) in cold-induced genes from Natura fruit after cold storage were those related to abiotic and biotic responses to stress conditions while in the sensitive cultivar Sinatra some of these processes were also overrepresented but the genes were downregulated. In this work, the expression profile of key genes from these BPs will be discussed, as well as the relation between level of expression and the degree of fruit sensitivity to low temperature from two different zucchini cultivars.

Keywords: /Zucchini Fruit/ /Postharvest Storage/ /Cold Tolerance/ /RNA-Seq/ /Stress Response/

García, A., Valenzuela, J.L., Manzano, S., Cebrián, G., Romero, J., Aguado, E., Garrido, D. and Jamilena, M. (2019). Postharvest fruit quality in ethylene insensitive mutants of zucchini squash. Acta Hortic. 1256, 217-222 DOI: 10.17660/ActaHortic.2019.1256.30 <https://doi.org/10.17660/ActaHortic.2019.1256.30>

Abstract

Three ethylene insensitive mutants (*Ein1*, *Ein2* and *Ein3*) were isolated from an EMS mutant library of zucchini squash by screening for a negative triple response of etiolated seedlings to ethylene. The ethylene insensitive mutations were isolated from other mutations in each one of the lines by backcrossing (BC) with the background genotype. To gain insight into the involvement of ethylene in postharvest fruit quality, WT and mutant fruit from BC3 generation was compared for different fruit quality parameters during 14 days of cold storage, including loss of weight and firmness, chilling injury (CI), and ethylene and CO₂ production. The oxidative status of the fruit was also analysed. The mutations stimulated the production of ethylene in rewarmed fruit after cold storage but, given that ethylene response pathway was partially blocked in the mutants, some fruit quality parameters were improved, concomitantly with a reduction of oxidative stress metabolites such as hydrogen peroxide and malonyl dialdehyde (MDA). The *Ein1* and *Ein3* mutant fruit exhibited reduced chilling injury, and *Ein1* also reduced the fruit respiration rate during cold storage. Weight loss was not altered in any of the ethylene mutants. The involvement of ethylene in postharvest deterioration of zucchini fruit quality, including CI and oxidative damage, is discussed.

Keywords: /Chilling Injury/ /Ethylene/ /Oxidative Stress/