

SELECTIVE DISSEMINATION OF INFORMATION
As of February 2021

APPLE

Du, M., Liu, Z., Zhang, X., Li, H., Liu, Z., Li, X., Song, J., Jia, X., & Wang, L. (2021). Effect of pulsed controlled atmosphere with CO₂ on the quality of watercored apple during storage. *Scientia Horticulturae*, 278, 109854. <https://doi.org/10.1016/j.scienta.2020.109854>

Abstract

Watercored 'Fuji' apple with special water core and unique flavor is a characteristic fruit. However, the problems of water core disappearance and browning in the apples are outstanding during postharvest storage. In this study, pulsed controlled atmosphere (pCA) with CO₂ was used to protect the water-core and resist browning of apples. Effects of different concentrations of CO₂ on the quality of apple fruits was investigated, and CO₂ injury characteristic to apple fruits were studied as well. Results showed that pCA with CO₂ could effectively maintain the sensory and texture qualities of watercored apples. Treated with pulsed controlled CO₂, the degree of membrane lipid peroxidation of the apples was effectively reduced and the membrane system was well maintained. Meanwhile, the activity of polyphenol oxidase (PPO) and phenylalanine ammonia-lyase (PAL) of the apples were inhibited and the browning was reduced. On the whole, pCA with 1% CO₂ presented the most significant effects on the quality preservation of watercored apples while higher CO₂ showed negative effects on the quality of the samples. Under the condition of pCA with 5% CO₂, the endurance of watercored apples was less than 45 days and the internal browning was serious. In conclusion, 2%~3% O₂ and pCA with 1% CO₂ was the best and most effective in the long-term preservation of watercored apples, and it is beneficial to guide for the preservation of apple fruits.

Keywords: /Watercored apples/ /Pulsed controlled atmosphere (pCA)/ /Fruit quality/ /CO₂ injury/ /Browning/

Pissard, A., Marques, E. J. N., Dardenne, P., Lateur, M., Pasquini, C., Pimentel, M. F., Pierna, J.A.F., & Baeten, V. (2021). Evaluation of a handheld ultra-compact NIR spectrometer for rapid and non-destructive determination of apple fruit quality. *Postharvest Biology and Technology*, 172, 111375. doi: 10.1016/j.postharvbio.2020.111375

Abstract

Benchtop and portable devices based on near infrared (NIR) spectroscopy are increasingly used to evaluate the quality parameters of fruits. This study aims to compare the analytical performance of a benchtop spectrometer (XDS) and a handheld ultra-compact spectrometer (MicroNIR) and to investigate calibration transfer between these devices for quality parameters of apples (soluble solids content, titratable acidity, pulp firmness, and starch-iodine index). Regression analyses were performed on a subset of apples measured with both spectrometers. The coefficient of determination (R^2) and the root mean square error of cross-validation (RMSECV) values obtained with Partial Least Squares (PLS) models were similar, which suggests that MicroNIR offers similar performance to the XDS device. For example, for soluble solids content, it was observed a $R^2 = 0.89$ with a RMSECV = 0.62 and a $R^2 = 0.91$ with a RMSECV = 0.57 for XDS and MicroNIR respectively. For the transfer, calibration models were built using XDS spectra and different regression methods. The best performances were obtained with Least Squares Support Vector Machines (LS-SVM). The Direct Standardization method was applied to achieve calibration transfer. Only two transfer samples were enough to significantly reduce the root mean square error of prediction (RMSEP) values with a relative reduction varying from 74 % to 93 % for PLS and Multiple Linear Regression (MLR) models respectively. It showed the potential of a simple calibration transfer method to allow the use of a historical database registered with a benchtop instrument.

Keywords: /Apple quality/ /Non-destructive analysis/ /NIR spectroscopy/ /Multivariate regression/ /Calibration transfer/

BLUEBERRY

Lobos, T.E., Retamales, J.B., & Hanson, E.J. (2021) Early preharvest calcium sprays improve postharvest fruit quality in 'Liberty' highbush blueberries. *Scientia Horticulturae*, 277, 109790. <https://doi.org/10.1016/j.scienta.2020.109790>

Abstract

Blueberry fruit are highly prone to deterioration, especially during storage. Calcium (Ca) can influence fruit quality of many fruit crops since it is an important mediating agent in the control of cell metabolism. Our aim was to determine if the application of foliar Ca sprays at different Ca rates (0, 400 or 800 g Ca ha⁻¹) and timings (early: fruit set, 8 and 16d after fruit set-dafs; or late: 16, 24 and 32 dafs) affect long-term postharvest quality and condition of highbush blueberry 'Liberty' (*V. corymbosum*) fruits. During the 2014/15 and 2015/16 seasons nine-year-old plants, located in Perquenco, Araucania Region, Chile (38°43'88" LS), were used in the trials. Fruits were harvested at > 90 percent full color and stored for 15, 30 and 45d at 0 °C + 1d at 18-20 °C. Fruit firmness and mass loss were the only quality attributes that registered significant interactions between Ca rates and spray timing, along with strong positive and negative correlations, respectively with fruit Ca concentrations. Firmer fruit (up to 10% higher than control) and lesser moisture loss (1% better than control) was obtained with early Ca foliar application treatments. Ca rates and spray timing had significant interactions and increased fruit Ca levels, total phenolic content, the proportion of sound fruits and reduced the percentage of dehydrated and decayed berries after storage. Fruit Ca concentration was lower in control and with late preharvest Ca sprays, which led to higher polygalacturonase activity during storage. Results evidence that early preharvest Ca sprays increase fruit quality and reduce deterioration in cold storage.

Keywords: /Calcium applications/ /Fruit calcium/ /Fruit condition/ /Preharvest applications/ /Postharvest quality/ /Postharvest storage/

Rokayya, S., Jia, F., Li, Y., Nie, X., Xu, J., Han, R., Yu, H., Amanullah, S., Almatrafi, M.M., & Helal, M. (2021). Application of nano-titanium dioxide coating on fresh Highbush blueberries shelf life stored under ambient temperature. *LWT Food Science and Technology*, 137, 110422. <https://doi.org/10.1016/j.lwt.2020.110422>

Abstract

Blueberries are non-climacteric fruits which have a limited shelf life due to the activities of rapid decay and softening. Coatings are eco-friendly by nature which helps in prolonging fruits and vegetable storage life. This research was carried out to determine the effects of nano-coatings on blueberries' life extension with 50–65% humidity for 8 days at ambient temperature. Different formulated coatings of chitosan (BC), chitosan/nano-titanium dioxide (BC-NT), and chitosan/nano-titanium dioxide (tween-thymol) (BC-NT-TT) were developed and used to check their effectiveness against some physical, mechanical and biochemical properties in addition to microbiological analysis and sensorial evaluations. The use of BC-NT-TT coating treatment was proved to prolong storage life as well as several quality parameters like weight loss (1.97%), decay rate (5.56%), shrinking rate (32.69%), ascorbic acid content (7.78 mg/100 g), appearance, texture, and antioxidant enzymes. Moreover, BC-NT-TT coating lessened the mesophilic aerobic bacteria, mould, and yeasts counts. BC-NT coatings enhanced pH (3.07), soluble solids content (9.64 °Brix), ripening index (21.42), and as well as anthocyanins (65.76 mg/100 g). BC coating significantly described the highest titratable acidity (0.41%) value. An over-all sensorial evaluation has remained acceptable and the final results indicated that BC-NT-TT should be used for preservation instead of other expensive and artificial chemicals.

Keywords: /Nano-titanium dioxide/ /Fresh highbush blueberry/ /Storage Quality/

CANTALOUPE

Burris, K. P., Simmons, O. D., Webb, H. M., Moore, R. G., Jaykus, L. A., Zheng, J., Reed, E., Ferreira, C.M., Brown, E., & Bell, R. L. (2021). *Salmonella enterica* colonization and fitness in pre-harvest cantaloupe production. *Food Microbiology*, 93, 103612. doi: 10.1016/j.fm.2020.103612

Abstract

Cantaloupes have emerged as significant vehicles of widespread foodborne illness outbreaks caused by bacterial pathogens, including *Salmonella*. The purpose of this study was to investigate the efficiency of *Salmonella* colonization and internalization in cantaloupes by relevant routes of contamination. Cantaloupe plants (*Cucumis melo* 'reticulatus') from two cultivars 'Athena' (Eastern) and 'Primo' (Western) were grown from commercial seed. Plants were maintained in the NCSU BSL-3P phytotron greenhouse. *Salmonella enterica* (a cocktail of cantaloupe associated outbreak serovars Javiana, Newport, Panama, Poona and Typhimurium) contamination was introduced via blossoms or soil at ca. 4.4 log₁₀ CFU/blossom or 8.4 log₁₀ CFU/root zone, respectively. Cantaloupes were analyzed for *Salmonella* by enrichment in accordance with modified FDA-BAM methods. Five randomly chosen colonies from each *Salmonella*-positive sample were typed using the Agilent 2100 bioanalyzer following multiplex PCR. Data were analyzed for prevalence of contamination and serovar predominance in fruit, stems and soil. Of the total cantaloupe fruit harvested from *Salmonella*-inoculated blossoms (n = 63), 89% (56/63) were externally contaminated and 73% (46/63) had *Salmonella* internalized into the fruit. Serovar Panama was the most commonly isolated from the surface of fruit while *S. Panama* and *S. Poona* were the most prevalent inside the fruit. When soil was inoculated with *Salmonella* at one day post-transplant, 13% (8/60) of the plants were shown to translocate the organism to the lower stem (ca. 4 cm) by 7 days post-inoculation (dpi). We observed *Salmonella* persistence in the soil up to 60 dpi with *S. Newport* being the predominant serovar at 10 and 20 dpi. These data demonstrate that contaminated soil and blossoms can lead to *Salmonella* internalization into the plant or fruit at a relatively high frequency.

Keywords: /*Salmonella*/ /Cantaloupe/ /Soil/ /Food safety/ /Internalization/ /Blossom/

CARROTS

Cozzolino, R., De Giulio, B., Pellicano, M.P., Pace, B., Capotorto, I., Martignetti, A., D'Agresti, M., Laurino, C., & Cefola, M. (2021). Volatile, quality and olfactory profiles of fresh-cut polignano carrots stored in air or in passive modified atmospheres. *LWT Food Science and Technology*, 137, 110408. <https://doi.org/10.1016/j.lwt.2020.110408>

Abstract

Volatile organic compounds (VOCs), quality attributes (respiration activity, total phenols and antioxidant activity) and olfactory profile by electronic nose of fresh-cut orange and purple Polignano carrots stored in Air or passive modified atmosphere (pMAP) were examined until 14 days of storage. The pMAP storage reduced the respiration rate, preserving the antioxidant activity and total phenols of the carrots. Moreover, it enhanced the peculiar aromatic notes of these carrots, as showed by Principal Component Analysis (PCA), which allowed also to select the VOCs associated to fresh carrots and to samples stored in Air or pMAP. Predictive models of selected volatiles by electronic nose data were build running Partial least squares regression (PLSR). In orange carrots, six significant models were obtained for β -pinene, δ -elemene, γ -curcumene, cis α -bisabolene, cariophyllene oxide and α -cedrol. In the case of purple carrots, E-nose signals were able to predict only two terpenes, trans β -cariophyllene and myristicin.

Keywords: /*Daucus carota* L./ /Fresh-cut polignano carrots/ /Modified atmosphere packaging/ /VOCs/ /Respiration rate/ /Electronic nose/

CAULIFLOWER

Martinez, M., Peixoto dos Santos, C., Verruma-Bernardi, M.R., Carrilho, E.N.V.M., da Silva, P.P.M., Spoto, M.H.F., Ciarrocchi, I.R., & Sala, F.C. (2021). Agronomic, physical–chemical and sensory evaluation of pepper hybrids (*Capsicum chinense* Jacquin). *Scientia Horticulturae*, 277, 109819. <https://doi.org/10.1016/j.scienta.2020.109819>

Abstract

Capsicum chinense peppers are considered the most Brazilian of the species and have wide genetic diversity among cultivars. Its demand is increasing, requiring the development of new hybrid cultivars, with better agronomic and nutritional categories. The objective of the study was to carry out agronomic, physical-applied and sensory evaluations of five hybrids and an open pollination cultivar (OP) (BRS Moema) of *C. chinense*. The five hybrids obtained higher productivity, yield and biometry of fruits, being ideal for the processed and fresh market. The cultivar BRS Moema and two hybrids (F1 10 and F1 12), had better fruit properties (lipids and fibers), and the F1 12 hybrid stood out for containing the highest antioxidant activity and capsaicin content. From the sensory point of view, the hybrids had greater sums for the attributes of preference (size, color, pungency and sweet taste). Thus, it is concluded that the hybrids F1 12 and F1 23 have the potential to be new cultivars in terms of productivity and yield, combining good agronomic, nutritional and sensory characteristics for a *C. chinense* species.

Keywords: /Antioxidant characteristics/ /Capsaicin/ /Plant breeding/ /Pungency/ /Sensory analysis/

CITRUS

Cavaco, A. M., Cruz, S. P., Antunes, M. D., Guerra, R., Pires, R., Afonso, A. M., Brazio, A., Silva, L., Lucas, M.R., Daniel, M., & Panagopoulos, T. (2021). Spatiotemporal modelling of the quality and ripening of two cultivars of “*Algarve Citrus*” orchards at different edaphoclimatic conditions. *Postharvest Biology and Technology*, 172, 111386. doi: 10.1016/j.postharvbio.2020.111386

Abstract

“*Algarve Citrus*” are non-climacteric Protected Geographical Indication (PGI) commodities. They are harvested with minimal levels of juice content ($\geq 35\%$), soluble solids content (SSC) ($\geq 10\%$) and maturation index (MI) (≥ 8), as required by the respective PGI normative reference. These internal quality attributes (IQA) are usually determined in small samples of fruit collected from the orchards close to harvest. This study aimed to use geostatistics to help predict the optimal harvest date (OHD) of two sweet orange (*Citrus sinensis* (L.) Osbeck) cultivars, namely, ‘Newhall’, and ‘Valencia Late’, at two different edaphoclimatic conditions observed in the locations of Quarteira, at the coast, and Paderne, near a mountainous area. Two orchards of 0.5-0.7 ha per cultivar were chosen and a total of 25 trees were georeferenced within each orchard, comprising 100 sampling points/trees. Firmness, juice content, SSC and MI of fruit were determined through time. In general, the fruit grown in Quarteira showed higher SSC and MI and lower firmness values, ripening two months earlier than those grown in Paderne, although the full effect of the various edaphoclimatic factors on these results are not fully understood. However, geospatial modelling of ripening has shown a large variability within the orchards, with some IQA evolution patterns observed in some orchards and/or cultivars but not in the others. Specifically, 1) a negative correlation between the firmness and MI spatial patterns; 2) a variable decay rate of firmness, much faster in Paderne for ‘Valencia Late’; 3) local minima in juice content, below 35 %, observed in restricted spatial areas and in specific time periods, and which were clearer in ‘Newhall’. These local variations highlight the need for an optimized management based on geospatial modelling. For example, the variable decay rate of firmness must be taken into account during fruit harvest and postharvest

handling. On the other side, the observation of localized plots with juice content below 35 % must be contextualized in the broader picture of the entire orchard which, in the present study, always had a consistent temporal average level above 35 %. This study has provided evidence that fruit ripening variability should be considered in the site-specific orchard management of citrus to optimize their harvest date.

Keywords: /Geostatistics/ /Geographic information system/ /Optimal/ /Harvest date/ /Ripening spatial variability/ /Site-specific orchard management/

Mesejo, C., Marzal, A., Martínez-Fuentes, A., Reig, C., & Agustí, M. (2021). On how auxin, ethylene and IDA-peptide relate during mature Citrus fruit abscission. *Scientia Horticulturae*, 278, 109855 <https://doi.org/10.1016/j.scienta.2020.109855>

Abstract

While the ethylene-auxin interactions are well documented in model dicots such as tomato (climacteric fruit) during mature fruit abscission, the process is not clearly understood in citrus (non-climacteric fruit). The mature fruit produces very little ethylene but is sensitive to ethylene treatments to induce abscission. By contrast, auxin treatments delay fruit abscission, but the particular role of auxin in the process is unknown. Since the IDA-HAE/HSL2 ethylene-independent pathway seem to regulate organ abscission in both model and crop species, we proposed that auxin treatment delays citrus fruit abscission by reactivating the basipetal auxin flux and reducing CitIDA3 expression, without modifying ethylene synthesis. Comparing orange (*C. sinensis*) genotypes which differ in their abscission rate, 'Navelate' vs. 'Valencia Late', we found that the force needed to detach the fruit from the tree (FDF) declines in parallel with 1) an increase of ethylene synthesis and CitIDA3 gene expression, and 2) a reduction of PIN1-like (auxin transporter) gene expression. Further, auxin (2,4-D) treatment maintains a higher force in the abscission zone upregulating PIN1-like and AUX1-like (auxin transporter) gene expression, and downregulating CitIDA3 gene expression, but without modifying ethylene production. We conclude that the 2,4-D treatment delays citrus mature fruit abscission through an ethylene-independent pathway.

Keywords: /Abscission zone/ /ACS/ /ACO/ /IDA/ /PIN1/ /Citrus sinensis/ /Yield/ /2,4-D/

Wang, Z., Zhong, T., Chen, K., Du, M., Chen, G., Chen, X., Wang, K., Zalan, Z., Takacs, K., & Kan, J. (2021). Antifungal activity of volatile organic compounds produced by *Pseudomonas fluorescens* ZX and potential biocontrol of blue mold decay on postharvest citrus. *Food Control*, 120(2), 107499. doi: 10.1016/j.foodcont.2020.107499

Abstract

In this research, postharvest citrus fruits with blue mold caused by *Penicillium italicum* were treated with volatile organic compounds (VOCs) produced by *Pseudomonas fluorescens* ZX incubated on NA and in NB. Treatments with pure individual components of the VOCs were also conducted. The VOCs from *P. fluorescens* ZX inhibited mycelial growth and conidial germination of *P. italicum* by 42.14% and 77.86%, respectively. In vivo experiments revealed that blue mold disease incidence and lesion size upon fruits were significantly suppressed by VOCs from *P. fluorescens* ZX incubated on NA, in NB and on healthy fruits. In addition, the VOCs produced by bacterial fluid provided higher biocontrol efficacy than did that from NA plates. The exposure to VOCs from bacterial fluid of *P. fluorescens* ZX resulted in morphological abnormalities of the conidia and hyphae of *P. italicum*. In vitro testing of the individual pure compounds comprising the VOCs suggested that organic acids and sulfur compounds are the active components of VOCs, with dimethyl disulfide (DMDS) and dimethyl trisulfide (DMTS) exhibiting the highest antifungal activity: concentrations of only 100 and 10 $\mu\text{L/L}$, respectively, afforded complete inhibition of blue mold on citrus fruits in vivo. Organic acids showed promise for controlling blue mold, but only in sufficiently low concentrations so as not to promote physiological disease or damage in the fruits.

Keywords: *Pseudomonas fluorescens* ZX/ *Penicillium italicum*/ Blue mold disease/ Biological control/ Volatile organic compounds (VOCs)

ELDERBERRY

Kiprovski, B., Malencic, D., Ljubojevic, M., Ognjanov, V., Veberic, R., Hudina, M. & Mikulic-Petkovsek, M. (2021). Quality parameters change during ripening in leaves and fruits of wild growing and cultivated elderberry (*Sambucus nigra*) genotypes. *Scientia Horticulturae*, 277, 109792. <https://doi.org/10.1016/j.scienta.2020.109792>

Abstract

This is the first report on the difference in the contents of the major quality compounds during development among cultivated ('Haschberg' cultivar and 'Ljubostinja' selection) and wild edible elderberry plants. Phenolics content in leaves (four stages) and fruits (unripe and ripe), as well as organic acids and sugars content in unripe and ripe fruits were determined. Quinic acid was the major organic acid in unripe fruits (especially in 'Wild' plants 16.7 g 100 g⁻¹), while ripe fruits accumulated citric acid in the highest amounts (the highest was in 'Ljubostinja' 10.2 g 100 g⁻¹). 'Wild' elderberry plants had significantly higher sugar content in fruits, in general (2.2 unripe and in ripe 8.4 g 100 g⁻¹), except for fructose content which was the highest in 'Ljubostinja' ripe fruits (up to 6-fold higher). Tested elderberry plants had four major groups of phenolics in their leaves and fruits during development: phenolic acids (caffeic and caffeoylquinic acid derivatives), flavanone, flavonols (quercetin, kaempferol and isorhamnetin derivatives) and anthocyanins (mostly cyanidin derivatives). 'Ljubostinja' had higher content of cyanidin derivatives in leaves in flowering stage and in all tested fruits (0.01% DW in unripe and 0.7% DW in ripe). Bearing in mind all tested quality parameters, 'Ljubostinja' selection had better quality of fruits, which position this selection as a valuable resource for further cultivation and breeding of elderberries.

Keywords: /Elderberry/ /Leaves and fruits/ /Organic acids/ /Phenolics/ /Ripening/ /Sugars/ /Selections/

FOOD SAFETY

Balkir, P., Kemahlioglu, K., & Yucel, U. (2021). Foodomics: A new approach in food quality and safety. *Trends in Food Science & Technology*, 108, 49-57. <https://doi.org/10.1016/j.tifs.2020.11.028>

Abstract

The progress in the analytical methods in food science and technology brought about a novel and modern approach concerning human health and food quality and safety. Foodomics is a recently coined term and is an integration of relevant omics disciplines. The constituent omics approaches have extensively been applied in biology and medical domains so far. Recently, food and nutrition scientists have also been interested in these omics research. Foodomics is a powerful tool in determining the food constituents and nutrients at the molecular level. Lately, researches in the food area have been fuelled by using the analytical techniques through different omics disciplines like proteomics, metabolomics, lipidomics, nutrigenomics, metagenomics and transcriptomics. Numerous research papers address the use of different omics technologies separately or in combination not only in analysing the food constituents but also in food authentication and evaluation of food safety and quality. It is evident that using the advanced analytical techniques in omics research has empowered the scientists looking into food and nutrition science at a broad perspective. This review discusses the recent developments in the analytical methodologies used in each "omics" discipline and how foodomics approach elucidates the arguments concerning food quality, food safety, the origin of food, human nutrition and relatedly human well-being.

Keywords: /Omics/ /Food safety/ /Food quality/ /Nutrition/ /Human health/ /Systems biology/

Mihalache, O.A., Dumitrascu, L., Nicolau, A.I., Borda, D. (2021). Food safety knowledge, food shopping attitude and safety kitchen practices among Romanian consumers: A structural modelling approach. *Food Control*, 120, 107545. <https://doi.org/10.1016/j.foodcont.2020.107545>

Abstract

This paper aimed to establish the relationship between food safety knowledge, food shopping attitude, and self-reported kitchen practices among Romanian consumers. The study used data collected in an online survey applied on 985 consumers. A knowledge, attitude and practice (KAP) model applied by structural equation modelling revealed significant correlations between knowledge and attitude ($r = 0.36$; $p < 0.001$). Also, knowledge and attitude depicted significant effects on self-reported safety kitchen practices ($\beta = 0.17$, $p < 0.001$; $\beta = 0.47$, $p < 0.001$) and explained 30% of the variance of the food safety practices applied by Romanian consumers. These findings suggest that higher levels of food safety knowledge than current ones could conduct to an improved attitude towards food shopping priorities and could incline consumers to adopt adequate food safety practices during food purchasing in shops and food manipulation in their kitchens. Case-studies from real life situations (an observational study including 15 Romanian households) support the findings of this study and urge interventions to improve consumers' food safety practices at home.

Keywords: /Structural equation modelling (SEM)/ /Hygiene/ /Hand washing/ /Risk/ /Knowledge-attitude-practice (KAP)/

FRESH CUTS

Yousuf, B., Wu, S. & Siddiqui, M.W. (2021). Incorporating essential oils or compounds derived thereof into edible coatings: Effect on quality and shelf life of fresh/fresh-cut produce. *Trends in Food Science & Technology* 108, 245-257. <https://doi.org/10.1016/j.tifs.2021.01.016>

Abstract

Fruits and vegetables constitute an integral part of diet for humans. Quality, safety and extended shelf life are important aspects governing the availability and acceptability of both fresh and fresh-cut agricultural produce. Among various approaches to ensure the uninterrupted and safe supply of fresh/fresh-cut fruits and vegetables, edible coatings have been widely investigated to retain quality and enhance shelf-life. Continuous efforts are being made for enhancing the effectiveness of edible coatings. One of the widely employed methods is to incorporate essential oils or the compounds derived from them into edible coatings to enhance their protective nature which consequently helps to better maintain quality of fruits and vegetables and extend their shelf life. Essential oil incorporation into edible coatings may deliver both positive and negative impacts on different quality attributes of fruits and vegetables. Therefore, this review paper is a critical analysis to recapitulate the effects of using essential oil incorporated-edible coatings on fresh/fresh-cut fruits and vegetables. Among many advantageous effects, essential oils present in edible coatings are effective in reducing microbial load on fresh/fresh-cut fruits and vegetables, and act as strong antioxidants. Despite their positive effects, use of essential oils in edible coatings for fresh/fresh-cut fruits and vegetables is challenging because of the high reactivity, volatility, intense aroma and more importantly the safety concerns associated with them. Nevertheless, the literature suggests the rise in publications investigating use of essential oils in edible coatings for fresh/fresh-cut fruits and vegetables.

Keywords: /Essential oil/ /Fresh-cut fruits/ /Fruit aroma/ /Antimicrobial/ /Sensory attributes/

FRUITS AND VEGETABLES

Ogunniyi, A. D., Dandie, C. E., Brunetti, G., Drigo, B., Aleer, S., Hall, B., Ferro, S., Deo, P., Venter, H., Myers, B., Donner, E., & Lombi, E. (2021). Neutral electrolyzed oxidizing water is effective for pre-harvest decontamination of fresh produce. *Food Microbiology*, 93, 103610. doi: 10.1016/j.fm.2020.103610

Abstract

There are growing demands globally to use safe, efficacious and environmentally friendly sanitizers for postharvest treatment of fresh produce to reduce or eliminate spoilage and foodborne pathogens. Here, we compared the efficacy of a pH-neutral electrolyzed oxidizing water (Ecas4 Anolyte; ECAS) with that of an approved peroxyacetic acid-based sanitizer (Ecolab Tsunami® 100) in reducing the total microbial load and inoculated *Escherichia coli*, *Salmonella Enteritidis* and *Listeria innocua* populations on post-harvest baby spinach leaves over 10 days. The impact of both sanitizers on the overall quality of the spinach leaves during storage was also assessed by shelf life and vitamin C content measurements. ECAS at 50 ppm and 85 ppm significantly reduced the bacterial load compared to tap water-treated or untreated (control) leaves, and at similar levels (approx. 10-fold reduction) to those achieved using 50 ppm of Ecolab Tsunami® 100. While there were no obvious deleterious effects of treatment with 50 ppm Tsunami® 100 or ECAS at 50 ppm and 85 ppm on plant leaf appearance, tap water-treated and untreated leaves showed some yellowing, bruising and sliming. Given its safety, efficacy and environmentally-friendly characteristics, ECAS could be a viable alternative to chemical based sanitizers for post-harvest treatment of fresh produce.

Keywords: /Food safety/ /Electrolyzed oxidizing water/ /Peroxyacetic acid/ /Postharvest sanitization /Baby spinach/ /Foodborne pathogens/

JUJUBE

Zhao, Y., Zhu, X., Hou, Y., Pan, Y., Shi, L., & Li, X. (2021). Effects of harvest maturity stage on postharvest quality of winter jujube (*Zizyphus jujuba Mill. cv. Dongzao*) fruit during cold storage. *Scientia Horticulturae*, 277, 109778. <https://doi.org/10.1016/j.scienta.2020.109778>

Abstract

Fruit maturity stage at harvest is a fundamental factor for successful storage and final quality of post-harvest fruit. The current study planned to investigate the changes in postharvest quality in winter jujube at three maturity stages (white maturity, half-red maturity, and red maturity stages) under cold storage (0 ± 1 °C). The results showed that there was a significant effect among the maturity stage at harvest on storage quality parameters in winter jujube during cold storage. Fruit firmness, titratable acid (TA), L*, and b* in winter jujube fruit significantly declined from white maturity stage to red maturity stage, and decreased significantly with the extension of cold storage time. Decay incidence, ratio of sugar and acid (TSS/TA), a*, ethanol content increased from white maturity stage to the red maturity stage, and rose significantly with the increase of cold storage time. At the end of storage, the white maturity stage showed the highest fruit firmness, TA content, L*, b* as well as the lowest decay incidence, a*, ethanol content, while the half-red maturity stage displayed the highest content of total soluble solid (TSS), ascorbic acid (AsA), total phenolics and total flavonoids as well as the lowest weight loss, respiration rate. In addition, the half-red maturity stage fruit maintained better sensory quality during the shelf life. Considering the results of all quality parameters mentioned above, the winter jujube fruit harvested at half-red maturity stages were the ideal harvest maturity for long-term low temperature storage attributing to its stable storability and a higher consumer acceptability after cold storage.

Keywords: /Winter jujube/ /Harvest maturity/ /Cold storage/ /Postharvest quality/ /Sensory attributes/

KIWIFRUIT

Yang, R., Lin, X., Dou, Y., Zhang, W., Du, H., Wan, C., Chen, J., Zhang, L., & Zhu, L. (2021). Transcriptome profiling of postharvest kiwifruit in response to exogenous nitric oxide. *Scientia Horticulturae*, 277, 109788. <https://doi.org/10.1016/j.scienta.2020.109788>

Abstract

Nitric oxide (NO) is a signal molecule that can regulate fruit physiology. Several studies have indicated that NO can inhibit the ripening of kiwifruit, but the mechanism underlying this process is unresolved. This study used transcriptome analysis to identify the essential genes related to NO regulation during kiwifruit softening. NO gas fumigation (15 $\mu\text{L L}^{-1}$) significantly delayed kiwifruit softening. There were 736 differentially expressed genes (DEGs) between the NO treatment and the control. The expression levels of polygalacturonase (PG), pectate lyase (PL), β -galactosidase (β -GAL), pectinesterase (PE), and the beta-amylases-related genes decreased in response to the NO treatment, while those of four genes encoding cellulose synthase increased. The expression of genes related to ethylene biosynthesis and signal transduction also differed; the expression levels of 1-aminocyclopropane carboxylic acid oxidase (ACO), the ethylene receptors (ERS1, ETR2), and the ethylene-responsive transcription factors (ERF016, ERF7, ERF010, ERF062, ERF110, ERF037, ERF008, ERF113, ERF12, ERF095) were lower in the NO-treated kiwifruit. Expression of the calcium ion (Ca^{2+}) signal-related genes (CNGC1, CPK1, CIPK2, CML31, CML48, ZIFL1) significantly differed and may be involved in the regulation of the NO softening response. These findings add to our understanding of the molecular mechanisms of the NO-delayed softening response in kiwifruit.

Keywords: /Kiwifruit/ /Nitric oxide/ /Softening/ /Transcriptome/

Wei, X., Mao, L., Wei, X., Guan, W., Lu, W., & Xu, C. (2021). ABA stimulates wound suberization through antagonizing the MYB4-mediated transcriptional repression of CYP86A1 and FAR in postharvest kiwifruit. *Postharvest Biology and Technology*, 172, 111354. doi: 10.1016/j.postharvbio.2020.111354

Abstract

Suberin biosynthesis involves a large number of genes, and many of them are induced by abscisic acid (ABA). However, the regulation of transcription factor (TF) in response to ABA on suberin biosynthetic genes in kiwifruit has been unexplored. In this study, two genes, *AchnCYP86A1* and *AchnFAR* respectively encoding a fatty acid ω -hydroxylase and fatty acyl-CoA reductase involved in suberin monomer biosynthesis were demonstrated in transient overexpressed tobacco (*Nicotiana benthamiana*). Notably, the negative regulation of *AchnMYB4* on *AchnCYP86A1* and *AchnFAR* was identified. *AchnMYB4* could repress *AchnCYP86A1* and *AchnFAR* transcript by directly binding to the gene promoter in yeast one-hybrid and dual-luciferase assays. These results were further confirmed in transient overexpressed tobacco leaves in that *AchnMYB4* significantly down-regulated suberin biosynthetic genes including *CYP86A1*, *FAR2* and *FAR3*, and reduced accumulation of ω -hydroxyacids and primary alcohols. Moreover, exogenous ABA could induce the expression of *AchnCYP86A1* and *AchnFAR*, and the accumulation of corresponding suberin monomers by inhibition of *AchnMYB4* in wound-tissue of kiwifruit. However, fluridone (an inhibitor of ABA biosynthesis) was found to counter the inductive effects of ABA. Taken together, the results suggest that ABA activates *AchnCYP86A1* and *AchnFAR* to promote suberin monomers biosynthesis by inhibiting *AchnMYB4*.

Keywords: /Kiwifruit/ /Suberization/ /Transcriptional repressor/ /Abscisic acid/ /*Nicotianabenthamiana*/

LETTUCE

Zhoua, B., Luo, Y., Teng, Z., Pearlstein, D., Millner, P.D. & Pearlstein, A.J. (2021). Assessment of a novel in-flight washing device: Microbial reduction and food quality of chopped iceberg lettuce during storage. *Food Control*, 120(2), 107538. <https://doi.org/10.1016/j.foodcont.2020.107538>

Abstract

Washing is an essential postharvest processing step for reducing microbial populations, tissue latex fluids, and soil on fresh and fresh-cut produce. This study focuses on the performance of a novel in-flight washer (IFW) in which produce falls through a round vertical canister, equipped with an array of nozzles near its interior boundary, spraying a sanitizing liquid upward and radially inward so as to directly impact the falling produce. The spray retards downward motion of the produce, while reorienting it as it falls, thus improving contact between liquid and produce. Chopped iceberg lettuce was passed through an IFW, a flume system, or sequentially through both, with different free chlorine levels. Microbial reduction and quality parameters (sensory attributes and tissue membrane integrity) were evaluated on days 0, 7, and 14 of a 14-day storage period. When washed only in the IFW with 200 mg/L free chlorine (FC), 1.0 and 1.4 log reductions of inoculated *E. coli* were achieved on Days 0 and 14, respectively. These reductions are comparable to or greater than those achieved with only flume washing at 20 mg/L FC. Among all treatments, washing in IFW at 200 mg/L FC resulted in the lowest aerobic plate count and yeast and mold values, as well as the highest overall quality score. These results indicate that use of the IFW can improve postharvest food safety and quality of fresh-cut lettuce, compared to conventional flume washing.

Keywords: /In-flight wash/ /Fresh and fresh-cut produce/ /Shelf-life/ /Escherichia coli/ /Sanitizer/

LONGAN

Intarasit, S. & Saengnil, K. (2021). Transient production of H₂O₂ and NO induced by ascorbic acid coincides with promotion of antioxidant enzyme activity and reduction of pericarp browning of harvested longan fruit. *Scientia Horticulturae*, 277, 109784. <https://doi.org/10.1016/j.scienta.2020.109784>

Abstract

Ascorbic acid (AsA) plays an important role in the protection against oxidative stress in plants. Although the underlining mechanism is yet to be fully elucidated, it is believed that hydrogen peroxide (H₂O₂) and nitric oxide (NO) play a key role as a signaling agent. This study investigated the relationship between exogenously applied AsA and the activation of antioxidant defense through these signaling molecules, which coincided with reduced pericarp browning of harvested longan (*Dimocarpus longan* Lour. cv. Daw). It was found that the level of H₂O₂ in longan pericarp increased immediately after treatment with 2.5 mM AsA, reaching maximum 9 h afterward. The expression of nicotinamide adenine dinucleotide phosphate oxidase (NOX) and the activity of NOX simultaneously peaked after the AsA treatment and remained so for the next 9 h. NO content, on the other hand, did not rise until H₂O₂ peak was reached, attaining the highest level 3 h later. The change in NO content correlated well with the increase in nitric oxide synthase (NOS) gene expression and enzyme activity. Interestingly, the AsA treatment differently altered gene expression and activities of some vital antioxidant enzymes including superoxide dismutase, catalase, ascorbate peroxidase and glutathione peroxidase during the first 4 d of storage. With the exception of catalase, the treatment positively affected both the expression and the activity. Catalase activity remained constant for the first 9 h before rising afterward. These changes in the activity of the antioxidant enzymes were closely associated with the reduction in pericarp browning. These results suggested that H₂O₂ and NO generation triggered by AsA may activate the antioxidant defense mechanism in longan pericarp. This, in turn, helps overcome subsequent stressed-induced H₂O₂ and NO production, thereby reducing the pericarp browning.

Keywords: /Ascorbate/ /NADPH oxidase/ /Nitric oxide synthase/ /Dimocarpus longan/ /Antioxidant enzyme/ /Fruit browning/

PEACH

Alves, G., Nesi, C.N., Kulka, V.P., & May-De Mio. L.L. (2021). Relationships between blossom blight and brown rot incidence at postharvest vary within seasons, peach cultivars and maturation period. *Acta Horticulturae*, 1304, 347-353. doi:10.17660/ActaHortic.2021.1304.48

Abstract:

This paper aimed to evaluate the relationships between blossom blight and brown rot incidence at postharvest on peach cultivars with different maturation periods under the subtropical conditions of Brazil. The cultivars 'Aurora 1', 'Premier' and 'Vanguardia' (early maturing); 'Chimarrita', 'Coral', 'Granada', 'Leonense', 'Maciel', 'Marli' (intermediate maturing) and, 'Eldorado' and 'Chiripá' (late maturing) were grown in commercial orchards in three consecutive seasons. Completely open flowers were collected and incubated at 25°C for three days and then 4°C for another three days to assess presence of the pathogen. Harvested mature fruit were maintained under artificial white light (60 W) at room temperature (23 + 4°C) and the incidence of brown rot was evaluated daily until the tenth day after harvest. An AMMI biplot analysis was carried out allowing grouping of cultivars based on the similarity of performance across diverse environments (seasons). The incidence of the disease in the flower and postharvest did not follow a uniform pattern between ripening periods, cultivars and seasons. The incidence of blossom blight varied from 6 to 11%, during the first season. It was the best season for differentiating the cultivars. There was a significant correlation between blossom blight and brown rot in only one early maturing cultivar ($R=0.87$) and one late cultivar ($R=0.75$). The later the ripening period of the cultivar, the higher the incidence of postharvest disease. According to the AMMI model and biplot graph, the incidence of blossom blight and brown rot was above average in the 'Chimarrita' and 'Leonense' (intermediate) and 'Eldorado' and 'Chiripá' (late) cultivars.

Keywords: /Prunus persica/ /Flowers/ /Fruit/ /Epidemiology/

Belisle, C.E., Adhikari, K., & Chavez, D.J. (2021). Understanding the variation in volatile compounds among commercial peach cultivars. *Acta Horticulturae* 1304, 367-376. doi: 10.17660/ActaHortic.2021.1304.51

Abstract:

Volatile organic compounds or VOCs in mature fresh peaches constitute the aroma and flavor perceived by consumers. This study compared four fresh late-season commercial peach cultivars ('Augustprince', 'Early Augustprince', 'Early Big Red', and 'Flameprince') grown in Fort Valley, GA, USA in 2015 and 2016 for the presence and abundance of individual volatile compounds. Fruit were harvested at commercial maturity and stored in a refrigerated room for 5-7 days at $5\pm 2^\circ\text{C}$, followed by 2-3 days at room temperature ($21\pm 1^\circ\text{C}$) for ripening. Ripen fruit ($<1\text{ kg f}$ for puncture and $<1\text{ kg f g}^{-1}$ for compression and Kramer firmness tests) were used. Volatiles were extracted by headspace solid-phase micro-extraction (HS-SPME) and separated on a gas chromatograph-mass spectrometer (GC-MS). Compounds were then identified using the NIST MS library based on their mass spectra. Concentrations of individual compounds were calculated using the peak area and concentration of the internal standard (1,3-dichloro benzene). The primary compounds associated with these peaches included: alcohols, esters, hydrocarbons/alkanes, aldehydes, and lactones. Thirty-four compounds were identified in 'Early August Prince' (EAP) in both seasons. These compounds were previously reported to be in fruit and/or plants. Thirty-three and 30 compounds were found in 'Augustprince' (AP) fruit during 2015 and 2016, respectively. Thirty-two compounds were observed in 'Early Big Red' (EBR) in 2015 and 20 in 2016. Twenty-five compounds were identified for 'Flameprince' (FP) in both seasons. In 2015, hexenol, hexyl ethanoate, benzaldehyde, and γ -decalactone were the prominent hexane, ester, aldehyde, and lactone compounds, respectively. In

2015, alcohols showed no trend for compounds being predominantly higher in concentration. Similar results were found in 2016, with the exception of (E)-2-hexen-1-ol as the prominent hexane. Esters were the most abundant compounds in 2016 while lactones were the most abundant compounds in 2015. EBR cultivar in both seasons had the highest concentration for lactone compounds (272 ng g⁻¹ in 2015 and 238.9 ng g⁻¹ in 2016) and esters in 2016 (810.8 ng g⁻¹). Esters and lactones give peaches their fruity and floral aromas. Understanding the chemical make-up of individual cultivars and their seasonal variation can provide insight into the different cultivars and their capabilities in regard to fresh peach aroma and flavor.

Keywords: /Aroma/ /Flavor/ /Gas chromatography/ /Mass spectrometry/ /Season/

Dallagnol, L.J., Silva-Junior, G.J., Moreira, A.S., Nogueira-Junior, A.F., & Amorim, L. (2021). Potassium silicate reduces postharvest nectarine decay caused by *Rhizopus stolonifer*. *Acta Horticulturae*, 1304, 385-390. doi:10.17660/ActaHortic.2021.1304.53

Abstract:

Rhizopus soft rot (RSR) is a destructive postharvest disease in nectarine. *Rhizopus stolonifer* produces abundant airborne spores which are easily spread by air currents. As the inoculum of *R. stolonifer* is frequently present in packinghouses of peaches and nectarines, protective measures are necessary to control RSR. In Brazil only dicloran is registered to control RSR after harvest. Silicon-based products such as potassium silicate are generally recognized as safe compounds with antifungal activity on several plant pathogens. In this study, the protective effect of potassium silicate was compared to potassium chloride and potassium hydroxide for RSR control on nectarines after harvest. The effect of potassium silicate, potassium chloride, potassium hydroxide, monosilicic acid, and polyethylene glycol on spore germination was also assessed in vitro (optical microscopy) and over fruit skin (scanning electron microscopy). Potassium silicate reduced the incidence of nectarine decay (20-85%), and the highest RSR reduction was achieved at 300 mM (pH=11.3). Potassium chloride was inefficient for RSR control and potassium hydroxide favored *R. stolonifer* infection due to its abrasive damage on fruit surface. Spore germination was inhibited only by potassium silicate (65 and 80 mM) and potassium hydroxide (270 mM). The correlation between spore germination and pH was significantly negative ($r=-0.98$). The effectiveness of potassium silicate in reducing RSR may be associated, at least in part, with the reduction of spore germination due to the alkalisation of fruit surface. Potassium silicate is a promising and useful alternative compound for reducing postharvest nectarine decay.

Keywords: /Silicon/ /Postharvest diseases/ /Disease control/ /Fruit decay/ /*Rhizopus* soft rot/

Dini, M., Scariotto, S., Raseira, M.C.B., & Ueno, B. (2021). Heritability and segregation of resistance to brown rot in peach fruits. *Acta Horticulturae*, 1304, 339-346. doi:10.17660/ActaHortic.2021.1304.47

Abstract:

Brown rot caused by the fungus *Monilinia fructicola* is the most important disease in peach production areas of Brazil. The increased concern with the environment, consumers and workers' health, emphasizes control strategies other than fungicide applications. Among them genetic resistance is the most efficient. However, availability of resistant genotypes is still limited. Thus the main objective of this work was to seek sources of brown rot resistance, as well as to study the segregation, estimate the heritability and verify the possible existence of maternal effects. Heritability of brown rot resistance was investigated in peach fruits of several genotypes from the Embrapa peach breeding program. Sixteen progenies and 20 parents were evaluated. Disinfested fruits were wounded with a microsyringe and inoculated by deposition of a 10 µL drop of a 2.5×10⁴ spores mL⁻¹ of *M. fructicola*. The fungus inoculum was obtained from a culture originated from peach mummies from four different sites. After inoculation, the fruits were incubated under controlled conditions for 72 h, before evaluation of lesion size and sporulation. High phenotypic variability and transgressive segregation were observed for brown rot

resistance in fruits. Several genotypes showed similar resistance as 'Bolinha', the standard Brazilian cultivar for resistance. The heritability of brown rot resistance in fruits (diameter of the lesion and sporulation), was medium. Parental selection based on phenotype, enables a medium genetic advance for brown rot resistance. The selections Conserva 947 and Conserva 1600 were the parents with higher brown rot resistance (similar to 'Bolinha'), with the potential of passing this trait to their offspring.

Keywords: /Prunus persica/ /Monilinia fruticola/ /Genetic resistance/ /Genetic variability/ /Brazilian genotypes/

Ji, N., Wang, J., Zuo, X., Li, Y., Li, M., Wang, K., Kin, P., & Zheng, Y. (2021). PpWRKY45 is involved in methyl jasmonate primed disease resistance by enhancing the expression of jasmonate acid biosynthetic and pathogenesis-related genes of peach fruit. *Postharvest Biology and Technology*, 172, 111390. doi: 10.1016/j.postharvbio.2020.111390

Abstract

Methyl jasmonate (MeJA) and WRKY transcription factors (TFs) are documented to exert vital defensive functions. Research concerning WRKY TFs together with MeJA-primed defense against *Rhizopus stolonifer* in peach fruit is still in its infancy. In the present study, the mode of MeJA on inducing resistance against soft rot caused by *Rhizopus stolonifer* in peaches during the postharvest storage and the involvement of WRKY TFs were investigated, and the results manifested that MeJA at 10 μ M significantly reduced disease occurrence and lesion diameter after *R. stolonifer* infection during 60 h of storage at 20 °C. Moreover, the MeJA treatment promoted the activity of CHI and GLU and elevated the expression levels of PpLOX, PpAOS and PpOPR3. More importantly, the expression of PpCHI, PpGLU, PpPR-like, PpLOX, PpAOS and PpOPR3 were substantially and rapidly elevated in the peach fruit that pretreated with MeJA and inoculated with *R.stolonifer*, indicating that MeJA stimulated a specific priming defense against *Rhizopus* rot in peaches. Furthermore, a MeJA-related transcription factor PpWRKY45 was identified and characterized as a nucleus-localized protein that could activate the expression of PpCHI, PpGLU, PpPR-like, PpLOX, PpAOS and PpOPR3 by binding to W-box elements in their promoters. These results indicate that PpWRKY45 is involved in MeJA-primed defense against *R. stolonifer* by activating JA biosynthetic and PR genes of peach fruit.

Keywords: /Peach fruit/ /WRKY transcription factor/ /Induced disease resistance/ /MeJA/ /Priming/

Schnabel G., Hu, M., Melgar, J.C., & Reighard, G.L. (2021). Mystery blotches on peach skin - what we know and don't know about bronzing. *Acta Horticulturae*, 1304, 283-288. doi:10.17660/ActaHortic.2021.1304.39

Abstract:

Blotches on peach fruit skin, commonly referred to as 'bronzing' have been observed in several peach growing regions (North America, Central America, and Mediterranean Basin). In recent years, it has become a major issue for peach producers in the southeastern United States, and it has been reported by growers in other states in the US. Symptoms occur as irregular-shaped blotches ranging from a single blotch to covering almost the entire fruit. The blotches are yellow at first but then turn to a bronze color after a few days of storage. It is a problem that occurs during ripening especially in years with high rainfall preceding harvest. In contrast to a skin disorder with similar symptoms described for California peaches called 'skin burning', bronzing is initiated in the field prior to harvest and symptom severity intensifies during storage. We do not know yet its underlying cause nor are there management recommendations in place. However, we found no evidence of fungal pathogen, insect, phytoplasma or pesticide involvement. Rapid cooling and storage exacerbate but do not causes bronzing. New evidence based on symptom patterns suggest that water relations in the fruit perhaps associated with the lack of supply of nutrients and/or yet undescribed viroids may be a predisposing factor to bronzing.

Keywords: /Prunus persica/ /Virus/ /Viroid/ /Fruit disorder/ /Postharvest/ /Preharvest

Trandafirescu, M. & Văsii, B.(2021). Identification and biological control of postharvest diseases of peach. *Acta Horticulturae*, 1304, 361-366. doi:10.17660/ActaHortic.2021.1304.50

Abstract:

Peaches are very appreciated by consumers as fresh fruit because of their qualitative and technological characteristics: the finesse of the pulp, their specific flavour, the high sugar content, their acidity, as well as other useful substances for the organism. Unfortunately, these fruits are extremely perishable, displaying a high degree of sensitivity to manipulation and transport and a short period of storage and maintenance of their post-harvest commercial qualities. During the period between harvest and consumption, major fruit losses may be recorded, according to: cultivar sensitivity, ecological conditions, harvesting maturity, pre-harvest treatments and so on. An important cause for these losses is represented by the attack of certain postharvest pathogen agents. Therefore, the purpose of the research carried out within this paper is to identify the species of pathogen agents which develop on the fruit after the harvesting, as well as the means to fight their attack, in order to prolong the consumption period of the fruit as fresh. The studied material consisted in samples of fruit belonging to the Southland cultivar. These were harvested immediately upon reaching maturity, after which they were stored at room temperature at 20-25°C for 4 days, and for the next 30 days at 2-4°C. Research have highlighted the fact that the main diseases involved in postharvest losses, as concerns peach trees, are results of the following pathogen agents: *Monilinia laxa*, *M. fructigena* (brown rot) and *Botrytis cinerea* (grey rot). Of reduced importance are the following species: *Rhizopus stolonifer* (Rhizopus rot), *Penicillium expansum* (blue rot) *Mucor piriformis* (Mucor rot) and *Geotrichum candidum* (sour rot). In order to control these agents, highly effective is the applying of certain postharvest antagonists, using the different microorganisms

Keywords: /Antagonist/ Brown mold/ /Grey rot/ /Blue mold/ /Rhizopus rot

Tsvakirai, C.Z. & Mosikari, T. (2021). An innovative market approach to analysing the impact of policy changes to South Africa's peach cultivar market. *Acta Horticulturae*, 1304, 17660. doi10.17660/ActaHortic.2021.1304.52

Abstract:

The global peach and nectarine industry have achieved major milestones in producing good quality and high quantities of cultivars. The proliferation of cultivars national boundaries has been facilitated by various policies such as intellectual property policy, trade policies and production policies. This paper analyses the quality trends of eight genetic attributes in the cultivars that were used in South Africa's fresh export market between 1956 and 2015 that has resulted from the policy facilitated development in this market. Ranking "quality" in the cultivars' attributes was achieved by utilising a three-point Likert scale and this was done according to the characteristics' ability to meet the industry's changing production and consumer demands. The results of the analysis show a general improvement in quality for both the production and organoleptic cultivar characteristics. The paper showcases the positive contribution of scientific research to market development and makes a case for an increase in financial support for cultivar development

Keywords: /Market development/ /Consumer value/ /Consumer demand/ /Sustainable production/ /international trade/

Xu, W., Wei, Y., Wang, X., Han, P., Chen, Y., Xu, F., & Shao, X. (2021). Molecular cloning and expression analysis of hexokinase genes in peach fruit under postharvest disease stress. *Postharvest Biology and Technology*, 172, 111377. doi: 10.1016/j.postharvbio.2020.111377

Abstract

Hexokinase (HXK) is a bifunctional enzyme and plays a critical role in plants growth and stress response. HXK is encoded by a multi-gene family in a wide range of plants. However, information of HXK family members in peach and their expression pattern under disease stress remains unclear. In the present study, 5 *PpHXK* genes in peach fruit, including *PpHXK1-3* and *PpHKL1-2*, were identified and isolated, and clustered into 4 groups by phylogenetic tree analysis. Furthermore, we investigated HXK activity, transcript levels of the 5 *PpHXK* genes and sugar content in peach fruit under *Monilinia fructicola* infection in 2018 and 2019. The results in both 2018 and 2019 showed that *M. fructicola* infection increased HXK activity and *PpHXK2* gene expression, and accelerated sucrose decomposition. HXK activity showed significantly positive correlation with *PpHXK2* expression and negative correlation with sucrose content. *PpHXK2* was localized in the cytoplasm by subcellular localization, and contained 3 W-box cis-acting elements in the promoter, indicating that *PpHXK2* may function as a sugar sensor and regulate sugar signaling and metabolism in defense response against pathogen infection. Thus, *PpHXK2* in peach fruit is capable of responding to postharvest disease stress, and the involved mechanism needs to be further studied.

Keywords: /Peach fruit/ /Hexokinase/ /Postharvest disease/ /*Monilinia fructicola*/

Zhang, B.B., Ma, R.J., Cai, Z.X., Yan, Z.M., Yu, M.L. (2021). A linear regression freezing point prediction model for peach (*Prunus persica*) fruits. *Acta Horticulturae*, 1304, 299-308. doi: 10.17660/ActaHortic.2021.1304.41

Abstract:

Peaches and nectarines in unsuitable cold temperature can suffer cold injury, but cold temperature storage can maintain better fruit quality than storage at higher temperatures. The aim of this study was to develop an optimal model to calculate fruit freezing points that have a direct relationship to cold temperature storage. Four types of peach fruit (nectarine, flat peach, juicy peach and yellow peach) were put into a cryostat with thermocouples at two opposite points on the fruit's equator to estimate the critical temperatures (freezing points) at which fruit can be held with the least danger of either freezing or internal breakdown. Freezing points of the peach cultivars were between -0.1 and -0.9°C except 'Nectaross' (-1.8°C, nectarine) which had a highly acidic flavor. Different freezing points existed in different types of peaches. The factors that affected freezing point were analyzed, including soluble solids content (SSC), individual fruit weight, fruit volume and density. Both gray relational grade analysis and correlation analysis showed that SSC was very closely related with freezing point. Three outlier samples were eliminated after analyzing studentized residuals, Cook distance and leverage methods. It was concluded that the linear regression equation (freezing point = $-0.0996 \times \text{SSC} + 0.6765$) is an accurate and reliable regression model for calculating the freezing point of peach fruits

Keywords: /Fruit/ /Storage/ /Influencing factor/ /Quality character/ /Gray relational grade analysis/ /Correlation analysis/

PEAR

Bonora, A., Noronha, H., Corelli Grappadelli, L., & Sánchez, C. (2021). Preharvest factors affecting quality during 'Rocha' pear long-term storage. *Acta Horticulturae*, 1303, 45-460 doi:10.17660/ActaHortic.2021.1303.62

Abstract:

The present work focuses on studying the effect of preharvest treatments, such as different watering rates and nitrogen supplementation, on the postharvest physiology and quality of 'Rocha' pear. After harvest, pears were stored up to 5 months in refrigerated chambers with dynamic controlled atmosphere (DCA). Besides physical properties such as size, firmness and peel color, several key compounds were analyzed, for instance, acids, carbohydrate rates (glucose, sucrose, fructose and sorbitol), phenolics, antioxidants and α -farnesene. Physiological disorders such as superficial scald and internal browning, which can cause important economic losses to producers, were also assessed during this period of conservation. The treatments, excess irrigation and normal nitrogen or excess irrigation and excess nitrogen, showed a lower level of total phenolics and antioxidant activity, when compared with the control, after 3 or 5 months of storage. Additionally, a higher incidence of internal browning was observed in the same treatments. In normal irrigation and excess nitrogen, fruit showed an increase in fructose, with nutraceutical properties, and sorbitol, considered an osmoprotectant under abiotic stress. Therefore, although good storability and fruit quality can be ensured by DCA, an excess of water and/or nitrogen affects biochemical parameters, affecting the long-term storage capacity and nutritional value of 'Rocha' pears. These findings suggest the need for consolidated guidelines to manage the pre- and postharvest of this cultivar.

Keywords: /*Pyrus communis*/ /Nitrogen/ /Water excess/ /Dynamic controlled atmosphere/ /Fruit quality/ /Physiological disorders/ /Sugars/ /HPLC/ /Antioxidants/ /Phenolics/ / α -farnesene

Gomes, R., Silva, F., & Oliveira, C.M. (2021). Utilizing the IAD index to predict 'Rocha' pear quality and physiological disorders after storage. *Acta Horticulturae*, 1303, 461-467. doi:10.17660/ActaHortic.2021.1303.63

Abstract:

In order to use the index of absorbance difference (IAD), as a fruit maturity evaluator and to assess postharvest physiological disorders, fruits from three 'Rocha' pear orchards (A, B, C orchards) were harvested on 8 dates during 6 weeks. At harvest, the fruits were separated into three classes of IAD (1.4-1.6, 1.6-1.8 and 1.8-2.0 or class I, II and III, respectively). One batch of fruits was stored in normal atmosphere storage (NA) for 23 weeks and the other batch in a dynamic controlled atmosphere (DCA) for 31 weeks. Standard quality parameters of the fruits were evaluated at harvest, and after 0 and 5 days of shelf life at 20°C. At 7 days of shelf life superficial scald and internal browning fruit incidence were evaluated. At harvest, the IAD index was related with firmness and ethylene production rate ($r^2=0.74$ and 0.76 , respectively) but the correlation was poor between IAD and total sugar content and fruit size ($r^2=0.10$ and 0.45 , respectively). Regarding NA storage, with the exception of orchard C, the fruits of IAD class I, for orchards A and B, 13.1% of the fruits showed superficial scald and 11.1% internal browning. The best results were from fruit of the orchard C of the IAD class III, which had 0.8 and 9.2% of superficial scald and internal browning, respectively. Considering the fruits of DCA, fruits from orchard B and of the IAD class III showed the lowest incidence of internal browning (6.2%). These results show that the orchard has a strong influence on physiological disorders and the IAD index may be insufficient to be used as the only criterion to set the harvest date and predict the level of incidence of physiological disorders

Keywords: /Ethylene/ /Internal browning/ /Non-destructive analysis/ /Ripening/ /Superficial scald/ /VIS/NIR measurement/

Petriccione, M., Caracciolo, G., Zampella, L., Mastrobuoni, F., Baruzzi, G. (2021). Antioxidant enzymes change in relation to superficial scald development in pear fruit during cold storage. *Acta Horticulturae* 1303, 485-492. doi:10.17660/ActaHortic.2021.1303.66

Abstract:

Superficial scald is a physiological disorder of apple and pear fruits associated with preharvest factors, postharvest treatment and genetic traits of each cultivar. In the Po Valley, two pear cultivars ('Abbé Fétel' and 'Doyenne du Comice') and two advanced selections (CREA 171, CREA 264), obtained by CREA Centro di Ricerca Olivicoltura, Frutticoltura e Agrumicoltura (Forlì, Italy) pear breeding program, picked in August-September, were stored at -1°C and 95% RH until January. In this study, the antioxidant enzymatic system of four cultivars/selections was evaluated during storage to investigate differences in scald susceptibility. In pear peel, superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), guaiacol peroxidase (POD), polyphenol oxidase (PPO), and lipoxygenase (LOX) were evaluated. Significant differences in scald incidence were observed both in pear cultivars and selections. 'Abbé Fétel' and CREA 171 showed lower superficial scald susceptibility compared to 'Doyenne du Comice' and CREA 264, after being cold stored for five months. In fruit peel, SOD and CAT activities were higher in scald-resistant than in scald-susceptible pear cultivars and selections. However, APX activity in peel was very similar in all tested pear fruits. Superficial scald induced an increase in PPO and POD activities involved in fruit-browning during cold storage. Furthermore, an increase in LOX activity due to deoxygenation of polyunsaturated fatty acids producing toxic hydroperoxy fatty acids and consequent membrane damage in fruit peel was observed. This study shows that some pear cultivars and selections have different superficial scald susceptibility enabling them to induce activities of several antioxidant enzymes following cold storage. Regulation of antioxidant enzymes alleviates oxidative damage and in addition to other biochemical features could be involved in determining the susceptibility/resistance to superficial scald development of pear fruit.

Keywords: /Oxidative stress/ /Physiological disorder/ /Pear cultivars and advanced selections/

Stefanelli, D., Peavey, M., Lopresti, J., Jaeger, J., Jones, R., Hale, G., & Tomkins, B. (2021). The influence of harvest maturity on postharvest performance of new blush pear cultivars from Australia. *Acta Horticulturae* 1303, 493-500. doi:10.17660/ActaHortic.2021.1303.67

Abstract:

Most European pear (*Pyrus communis*) cultivars require a cold conditioning phase after harvest to fully ripen. Few blush pear cultivars have been studied, but they appear to have long conditioning requirements. Maturity stage at harvest influences fruit postharvest behaviour, storability and final fruit quality. To determine the effect of harvest maturity on storage performance, this study investigated the new Australian blush pear cultivars 'ANP-0118' and 'ANP-0131' (referred to as '118' and '131', respectively) picked at different maturities (early, commercial and late) and stored for 6 storage durations (8, 12, 16, 20, 24 and 28 weeks) at -0.5°C in air. Fruit quality was assessed at harvest, immediately after removal from cold storage and after 7 days ripening at 18°C. The quality parameters measured were the index of absorbance difference (IAD), flesh firmness, soluble solids concentration (SSC) and incidence of superficial scald. From harvest until storage removal at 28 weeks, Early '118' fruit lost 36.7% firmness, commercial 35.1% and late 40.4%. In contrast, early '131' fruit lost 11.6% firmness, commercial lost 6.2%, and late 6.4%, indicating that '131' better maintained 'crispness'. All storage treatments of '118' dropped substantially in firmness after 7 days ripening, whereas '131' remained crisp after 8 weeks storage followed by 7 days ripening. There were no significant differences in SSC throughout storage for either cultivar. '131' took longer than '118' to reach peak SSC and the duration required to peak differed among harvest maturities. In both cultivars, there remained significant differences in IAD after 28 weeks. '118' consistently dropped in IAD across the 3 maturities, but '131' dropped IAD at a higher rate for later pickings. No rots or symptoms of superficial scald were found in '131' fruit after storage or ripening. In contrast, '118' suffered from superficial scald when stored for 16 weeks or longer

Keywords: /'ANP-0118'/ /'ANP-0131'/ /*Pyrus communis*/ /Maturity/ /Fruit quality/ /IAD/ /Cold storage/ /Firmness/

Torregrosa, L., Echeverria, G., Illa, J., García, J., & Giné-Bordonaba, J. (2021). A comparative study between different sensors used to detect the lower oxygen level during dynamic controlled storage of 'Conference' pears. *Acta Horticulturae* 1303, 537-544 doi: 10.17660/ActaHortic.2021.1303.73

Abstract:

To guarantee the availability of high quality pears throughout the year, the new trend in storage is to reduce the oxygen levels within a chamber and continuously monitor the lower oxygen level (LOL) tolerated by the fruit prior to anaerobiosis (referred to dynamic controlled atmosphere (DCA)). LOL monitoring includes measurements of chlorophyll fluorescence (CF), respiratory quotient (RQ) and/or ethanol accumulation (EtOH), all of them well implemented in apples but not in pears. The objectives of this study were to explore the suitability of DCA to store 'Conference' pears, to reveal the best method to determine the LOL based on the fruit physiology and to check possible key volatiles emitted by the fruit into the storage atmosphere as markers of LOL. To do so, we used 'Conference' pears harvested at the optimal commercial maturity and stored them in a semi-commercial chamber at 0°C for up to 8 months under DCA conditions. The O₂ and CO₂ levels within the storage atmosphere were controlled by an advanced control respiration (ACR) system which decreased O₂ levels until a consistent LOL signal (depicted by either RQ, CF or EtOH) was clearly observed. Changes in the volatiles concentration within the storage atmosphere were also recorded. In general, DCA storage allowed preservation of 'Conference' pears at optimum quality. Our data showed a correlation between CF and RQ measurements during the first 6 weeks of the cold storage, having a CF peak when RQ values were higher than 1. However, this correlation was lost as the storage period increased, observing exclusively CF peaks that did not match either higher RQ values or ethanol levels. Overall, both RQ and CF signals were only useful during the period of acclimatization of the fruit to the cold or when moving from relatively high (ca. 2%) to low O₂ levels. Further variables such as the emitted fruit volatiles can be used to monitor the LOL levels tolerated by the fruit

Keywords: /Chlorophyll fluorescence/ /Superficial scald/ /Respiratory quotient/ /Volatile organic compound/

Torres, C. A., Sepulveda, G., Mejía, N., Defilippi, B. G., & Larrigaudière, C. (2021). Understanding the key preharvest factors determining 'Packham's Triumph' pear heterogeneity and impact in superficial scald development and control. *Postharvest Biology and Technology*, 172, 111399 doi: 10.1016/j.postharvbio.2020.111399

Abstract

Although superficial scald (SS) is well characterized on apples, there is still few information regarding the influence that initial fruit's maturity heterogeneity may have on the development of this disorder on pears. In this study we aimed to understand the effect of growing season and site, harvest maturity, and their interaction with postharvest treatments on superficial scald development. Pears (*Pyrus communis* L.) cv 'Packham's Triumph' were picked during three consecutive seasons at three harvest maturities (H1, H2, H3) from different commercial orchards. Different SS control treatments (DPA vs. 1-MCP; season # 2) and storage scenarios (RA, CA and RA + stepwise cooling (SWC); season # 3) were evaluated. Bioclimatic indices, superficial scald incidence, maturity indices and biochemical analysis associated with SS were carried out at harvest and periodically postharvest in all treatments. In general, bioclimatic indexes (GDA and HL10) were poorly correlated with SS incidence. Only in season #1, harvest maturity was positively correlated with SS after 140 and 180 d into storage ($r_s = 0.621^*$ and 0.620^* , respectively), the more mature fruit being more sensitive. The opposite was observed in season #3, and no pattern in season #2. There was a good and positive correlation between CTols dynamic (δ CTols/ δ t) and SS development, with

variation between seasons. DPA and 1-MCP effectively reduced SS up to 180 d regardless of years and orchard location. In contrast, the beneficial effect of CA storage was orchard dependent and SWC strategy did not control SS and affected fruit quality. Collectively our results suggest that initial fruit heterogeneity at harvest is an important factor that modulates SS development in 'Packham triumph pears. Climatic and fruit maturity indexes are not reliable for a multi-year prediction of SS development. In contrast to CA storage that reduced the disorder in an orchard dependent manner, 1-MCP and DPA treatments effectively controlled SS independently of initial fruit heterogeneity.

Keywords: /Physiological disorder/ /Pome fruit/ /Storage/ /Fruit quality/ /Fruit biochemistry/ /Chilling injury/

Visscher, I., Peavey, M., McClymont, L., Goodwin, I., Chandra, S. (2021). The effects of light exposure on colour development in the blush pear 'ANP-0534'. *Acta Horticulturae* 1303, 529-536. 10.17660/ActaHortic.2021.1303.72

Abstract:

Pear breeding programs throughout the world have released new fresh market cultivars that are premium quality and aim to increase world consumption of pears. Red colour of the fruit peel is a key quality requirement of many of the new cultivars. The degree of red coloration is determined by the concentration and composition of anthocyanins in the peel of pears. Biosynthesis of anthocyanins in plant tissues either requires or is enhanced by light. During this experiment, the effect of artificial shading on the red colour development of newly bred 'ANP-0534' pear was investigated. Six treatments were applied: a control treatment and five artificial shading periods which differed in duration and timing. Sample fruit were harvest 124 days after full bloom (DAFB). Peel colour was measured during the experiment. Red colour in the control treatment increased substantially between 21 and 42 DAFB, and thereafter gradually increasing in red colour until the last period where the rate of increase was highest. No red colour development was observed when fruit were artificially shaded from 21 until 105 DAFB. Artificial shading did not affect the maximum red colour when applied for 3-week periods between 21 and 84 DAFB. Later shading and longer periods of shading resulted in lower red colour at harvest. Maximum red colour occurred at the end of the season which is favourable and can make 'ANP-0534' a novel cultivar compared to other blush or fully red cultivars. The implications of these results in terms of managing fruit exposure to light are discussed

Keywords: /Pyrus communis/ /Anthocyanin/ /Artificial shading/ /Solar radiation/ /Spectrophotometer

Wang, D., Ma, Q., Li, D., Li, W., Li, L., Aalim, H., & Luo, Z. (2021). Moderation of respiratory cascades and energy metabolism of fresh-cut pear fruit in response to high CO₂ controlled atmosphere. *Postharvest Biology and Technology*, 172. 111379. doi: 10.1016/j.postharvbio.2020.111379

Abstract

Controlled atmosphere (CA) package serves as a nascent research tool in post-harvest, while validation of high levels of CO₂ is plausible owing to the deficiency of biological understanding. Hence, the effect of 10 % CO₂ on the respiration pathway and energy metabolism of fresh-cut pears was investigated in this study. During 5 days of storage, total respiratory rate was moderated with maintained mitochondrial membrane integrity and slowly increasing membrane permeability under 10 % CO₂. Under the 10 % CO₂ CA package, the energy charge was 1.6 times than that of control. Enzymes involving in energy metabolism were induced or inhibited in activity and expression level. Comprehensively considering the changes among enzymes and genes, the preservative effects of high level of CO₂ CA package on fresh-cut pear fruit could be divided into three aspects: inhibition of senescence, decrease of energy status and promotion of stress resistance. This work revealed the undergoing biochemical mechanism of how fresh-cut pears act in response to high CO₂ CA package, from the perspective of respiration pathway and energy metabolism.

Keywords: /Carbon dioxide/ /Fresh-cut/ /Pear/ /Respiratory pathway/ /Energy metabolism/

Wenneker, M., Pham, K.T.K., & Köhl, J. (2021). Important postharvest pathogens of pear and their dynamics in plant residues in Dutch pear orchards. *Acta Horticulturae*, 1303, 501-508. doi: 10.17660/ActaHortic.2021.1303.68

Abstract:

Postharvest diseases of pear cause significant losses. Epidemiological knowledge of these diseases is limited. Packinghouse surveys of postharvest diseases on stored pear fruit were conducted from 2012 to 2018. TaqMan PCR assays were developed for quantification of *Neofabraea alba* and *Cadophora luteo-olivacea* in environmental samples from orchards. Various host tissues, dead weeds and grasses, soil and applied composts were collected in 10 pear orchards. The temporal dynamics of pathogens was followed in four pear orchards. The most important pathogens in terms of incidence and severity of stored pears were *Cadophora* spp., causing side rot, and *Fibulorhizoctonia psychrophila*, causing lenticel spot. These pathogens, as well as *Neofabraea* spp., infect fruits during the growing season and remain quiescent until disease symptoms occur after several months in storage. *Neofabraea alba* was detected in 58% of environmental samples from pear orchards. *Cadophora luteo-olivacea* was detected in 95% of environmental samples. In these orchards, *N. alba* and *C. luteo-olivacea* were found in highest concentrations in pear leaf litter and in dead weeds. Substrate colonization varied considerably between orchards. Knowledge on population dynamics is essential for the development of preventative measures to reduce risks of fruit infections during the growing season

Keywords: /Epidemiology/ /Fungal pathogens/ /Inoculum sources/ /Postharvest losses/ /qPCR/

POTATO

Dong, T., Cao, Y., Li, G., Zhu, Z., Zhang, S., Jiang, C. Z., & Wang, Q. (2021). A novel aspartic protease inhibitor inhibits the enzymatic browning of potatoes. *Postharvest Biology and Technology*, 172, 111353. doi: 10.1016/j.postharvbio.2020.111353

Abstract

Enzymatic browning greatly affects the quality of fresh-cut potatoes (*Solanum tuberosum* L.). The transcript level of a novel aspartic protease inhibitor gene, *StASPI*, was found significantly higher in browning-less potatoes than in browning-susceptible potatoes, and exogenous aspartic protease inhibitor Pepstatin A inhibited the browning of potato pulp. Therefore, we speculated that *StASPI* plays important roles in the browning-resistance of potatoes. The effects of overexpressed-*StASPI* on browning, total free amino acids (FAAs), antioxidant enzyme activity and ROS accumulation in potatoes were investigated in this study. Results showed that overexpression of *StASPI* effectively reduced enzymatic browning after cutting, significantly decreased protease activity, and reduced the accumulation of total FAAs in potatoes. Browning degrees of transgenic potato mash were increased by supplementing exogenous FAAs, but the degrees were still significantly lower than that of wild-type (WT) mash. Furthermore, overexpression of *StASPI* decreased PPO activity, enhanced the activities of antioxidant enzymes SOD and CAT, and reduced H₂O₂ and O₂^{·-} contents. These results indicated that overexpression of *StASPI* inhibited the enzymatic browning of potatoes, decreasing FAAs accumulation, reducing PPO activity, and enhancing activity of antioxidant enzymes. This study provides a new perspective on the strategies for inhibiting enzymatic browning of potatoes.

Keywords: /Potato/ /Enzymatic browning/ /Aspartic protease inhibitor/ /Total free amino acids/ /Antioxidant enzyme activity/ /ROS accumulation/

SAFFRON

Fallahia, H.R., Aghhavani-Shajarib, M., Sahabic, H., Behdaniad, M.A., Sayyari-Zohana, M.H., & Vatandooste, S. (2021). Influence of some pre and post-harvest practices on quality of saffron stigmata. *Scientia Horticulturae*, 278, 109846. <https://doi.org/10.1016/j.scienta.2020.109846>

Abstract

Saffron (*Crocus sativus* L.) yield and quality are affected by many pre and post-harvest activities. Therefore, four separate experiments were carried out to investigate the effect of some agronomic (irrigation, fertilization, and organic/ conventional cultivation) and post-harvest practices on color parameters (L, a, b, h°, and C) and apocarotenoid content (crocin, picrocrocin, and safranal) in stigmata. Required plots for the first and the second experiments were constructed in September 2013 and again in 2014 for corm planting. Sampling of the first experiment was done one year after each planting. When two years passed since corm planting, sampling was done for the second experiment. In the first study, the combined effect of the production system (one-year-old organic or conventional fields) and drying temperature (25 °C at shade; 55 and 75 °C in the electric oven) were evaluated during two flowering seasons of 2014 and 2015. In both production systems, oven-dried samples at 55 °C had better quality. In the second experiment, the organic and non-organic stigmata (obtained from two-year-old fields in flowering seasons of 2015 and 2016) were stored for 1, 2, or 3 years under room temperature in a dark place. Color coordinates (a, a/b, and C) increased by longer storage duration. The maximum crocin and safranal contents were obtained from organic samples, which were being stored for less than one year. In the third experiment, the effect of irrigation level (3600, 4200, and 4600 m³ ha⁻¹) and fertilization (humic acid, *Rhizophagus irregularis*, and unfertilized control) was evaluated during two flowering seasons (2016 and 2017) on saffron yield and quality. Deficit irrigation treatment (3600 m³ ha⁻¹), associated with the use of humic acid, had the highest yields of flower and stigmata. However, the effect of mycorrhizal inoculation was negative on flowering. Lower water availability plus mycorrhizal inoculation had the highest picrocrocin and safranal content but the lowest C, a/b, and a color parameters. In the fourth experiment, 48 stigmata samples were collected, and then the relationships between color parameters and apocarotenoids content were evaluated using correlation and regression procedures. Safranal had a correlation with a (-0.411**), b (0.295*), a/b (-0.454**) and h° (0.410**). Similarly, crocin had a positive correlation with b and h°, but a negative one with a and a/b indexes. Overall, the results of four separate experiments revealed that saffron stigmata quality is highly affected by pre and post-harvest practices. It was also concluded that stigmata quality assessment is somewhat possible through measurement of color parameters as a quick and cheap method.

Keywords: /Deficit irrigation/ /Humic acid/ /Organic farming/ /Oven drying/ /Short storage duration/

SPINACH

Lara, O.A., Amorós, A., Tapia, M.L., & Escalona, V.H. (2021). Effect of a photoselective filter on the yield and postharvest quality of 'Viroflay' baby spinach (*Spinacia oleracea* L.) leaves cultivated in a hydroponic system. *Scientia Horticulturae*, 277, 109804. <https://doi.org/10.1016/j.scienta.2020.109804>

Abstract

Consumers are demanding foods with high sensory and nutritional quality including a higher content of compounds that help maintain good health. Given this scenario, new technologies are emerging to produce fresh salads that have the characteristics currently in demand. Shade nettings or photoselective filters on fruit and vegetable crops are a technology that provides protection, modifies the light spectrum resulting in a higher accumulation of antioxidant compounds, making them more desirable to consumers. The objective of this study was to compare the effect of shade netting on the fresh quality parameters of baby leaf spinach grown in a hydroponic system at harvest and after a period of 10 days at 4 °C. By using different shade netting colors, the average photosynthetic photon flux density (PPFD) that reaches the

plants was modified during the growing period of baby leaf spinach (red: 118.35 $\mu\text{mol m}^{-2} \text{s}^{-1}$; blue: 117.96 $\mu\text{mol m}^{-2} \text{s}^{-1}$; gray: 63.18 $\mu\text{mol m}^{-2} \text{s}^{-1}$ and control without shade nettings: 278.12 $\mu\text{mol m}^{-2} \text{s}^{-1}$). At harvest, baby leaf spinach grown under the red shade netting reached the highest yield. However, with the blue filter, leaves showed a value of 9.3 % dry weight, significantly higher than the values from red and gray filters with values of 7.3 and 6.3 %, respectively. The phenolic compound contents reached significantly higher values of 485.5 mg gallic acid equivalent (GAE) per 100 g⁻¹ FW for the baby leaf spinach grown under the red filter compared to the blue, gray and control filters with values of 472.5; 387.6 and 316.5 mg GAE per 100 g⁻¹ FW, respectively. The antioxidant capacity was significantly higher under the red filter. The sensory quality parameters indicated that spinach grown under color filters did not show off-flavors and maintained its turgidity and appearance at harvest. In the postharvest period, baby leaf spinach grown under red filter maintained the highest total phenol content and antioxidant activity after 10 days at 4 °C with similar appearance and turgidity as the control.

Keywords: /Shade netting/ /PAR/ /Antioxidant capacity/ /Phenolic compounds/ /Sensory analysis/ /Cold storage/

Ogunniyi, A. D., Tenzin, S., Ferro, S., Venter, H., Pi, H., Amorico, T., & Trott, D. J. (2021). A pH-neutral electrolyzed oxidizing water significantly reduces microbial contamination of fresh spinach leaves. *Food Microbiology*, 93, 103614. doi: 10.1016/j.fm.2020.103614

Abstract

Pre-harvest sanitization of irrigation water has potential for reducing pathogen contamination of fresh produce. We compared the sanitizing effects of irrigation water containing neutral electrolyzed oxidizing water (EOW) or sodium hypochlorite (NaClO) on pre-harvest lettuce and baby spinach leaves artificially contaminated with a mixture of *Escherichia coli*, *Salmonella Enteritidis* and *Listeria innocua* (~1 × 10⁸ colony-forming units/mL each resuspended in water containing 100 mg/L dissolved organic carbon, simulating a splash-back scenario from contaminated soil/manure). The microbial load and leaf quality were assessed over 7 days, and post-harvest shelf life evaluated for 10 days. Irrigation with water containing EOW or NaClO at 50 mg/L free chlorine significantly reduced the inoculated bacterial load by ≥ 1.5 log₁₀, whereas tap water irrigation reduced the inoculated bacterial load by an average of 0.5 log₁₀, when compared with untreated leaves. There were no visual effects of EOW or tap water irrigation on baby spinach or lettuce leaf surfaces pre- or post-harvest, whereas there were obvious negative effects of NaClO irrigation on leaf appearance for both plants, including severe necrotic zones and yellowing/browning of leaves. Therefore, EOW could serve as a viable alternative to chemical-based sanitizers for pre-harvest disinfection of minimally processed vegetables.

Keywords: /Electrolyzed oxidizing water/ /Sodium hypochlorite/ /Pre-harvest sanitization/ /Lettuce/ /Baby spinach/ /Foodborne pathogens/

STRAWBERRY

Gu, N., Zhang, X., Gu, X., Zhao, L., Godana, E. A., Xu, M., & Zhang, H. (2021). Transcriptomic and proteomic analysis of the mechanisms involved in enhanced disease resistance of strawberries induced by *Rhodotorula mucilaginosa* cultured with chitosan. *Postharvest Biology and Technology*, 172, 111355. doi: 10.1016/j.postharvbio.2020.111355

Abstract

Rhodotorula mucilaginosa cultured in a medium amended with chitosan significantly enhances biological control efficacy against postharvest fungal diseases of strawberries. The molecular mechanisms underlying the enhanced disease resistance of strawberries, however, have not been explored. In this study, a transcriptomic and proteomic approach was used to analyze the induced resistance response in strawberry. Results revealed that several genes involved in JA/ET, ABA and GA signal transduction

pathways, as well as downstream genes and protein, were up-regulated by *R. mucilaginosa* cultured in a medium amended with 0.5% (w/v) chitosan. Several genes and proteins related to the synthesis of resistance-related compounds and processes were also up-regulated, including genes related to ROS regulation, and genes involved in cell wall reinforcement. Collectively, results indicated that disease resistance in strawberries can be induced by *R. mucilaginosa* cultured with chitosan. A global view of gene expression and protein abundance in hosts treated with an antagonist provides a theoretical reference for understanding the enhancement of disease resistance of fruits by antagonistic yeast incubated with elicitors, information that will also help in obtaining regulatory approval for the commercial use of yeast as biocontrol agents.

Keywords: /Strawberry/ /Disease resistance/ /Chitosan/ /Proteomic/ /Transcriptomic/

SWEET POTATO

de Araújo, N. O., Santos, M. N. de S., de Araujo, F. F., Vêras, M. L. M., Tello, J. P. de J., Arruda, R. da S., Fugate, K.K., & Finger, F. L. (2021). Balance between oxidative stress and the antioxidant system is associated with the level of cold tolerance in sweet potato roots. *Postharvest Biology and Technology*, 172, 111359. doi: 10.1016/j.postharvbio.2020.111359

Abstract

The balance between oxidative stress and antioxidant defense system was investigated in roots of the cold-sensitive (cvs. BRS Rubissol and BRS Cuia) and cold-tolerant (cv. Beauregard) sweet potato stored at 6 or 13 °C for 60 d. We hypothesized that the absence of chilling injury symptoms on cv. Beauregard stored at 6 °C depends on the induction capacity of enzymatic and non-enzymatic antioxidant systems. The manifestation of chilling injury symptoms on cvs. BRS Rubissol and BRS Cuia were associated with the loss of membrane integrity, increased lipid peroxidation, accumulation of hydrogen peroxide (H₂O₂), and low catalase (CAT) and ascorbate peroxidase (APX) activities. In these cold-sensitive cultivars, proline and total phenolics increased with the progression of chilling injury, acting as markers for cold sensitivity, and parallel increased activity of phenylalanine ammonia-lyase. In contrast, constitutive levels of enzymatic and non-enzymatic antioxidants, as well as stress-induced increased CAT and APX activity played an important role in the detoxification of H₂O₂ in the tolerant cv. Beauregard. Our results suggest that the balance between oxidative stress and antioxidant system is involved in the tolerance of cv. Beauregard to chilling injury.

Keywords: //pomoea batatas/ /Antioxidant enzymes/ /Proline/ /Total phenolics/ /Phenylalanine ammonia-lyase/

TOMATO

Li, Q., Xie, F., Zhao, Y., & Cao, J. (2021). Inhibitory effect of postharvest yeast mannan treatment on Alternaria rot of tomato fruit involving the enhancement of hemicellulose polysaccharides and antioxidant metabolism. *Scientia Horticulturae*, 277, 109798. <https://doi.org/10.1016/j.scienta.2020.109798>

Abstract

In order to study the effects of yeast mannan (YM) treatment on postharvest infection of tomatoes, the fruit were vacuum-infiltrated and coated with different concentrations of YM. The YM treatment at 1.0 g L⁻¹ effectively reduced the decay of tomatoes caused by *Alternaria alternata*, and suppressed fruit color change and ethylene biosynthesis during storage. The YM-treated tomatoes retained a high level of tightly bonded hemicellulose (TBH) in cell wall materials, and compared to the control, the TBH possessed many structural polymers rich in xylose and mannose. YM treatment reduced lipid peroxidation and hydrogen peroxide accumulation in tomato by enhancing the activities of antioxidant

enzymes including peroxidase, superoxide dismutase and catalase. The alleviation of oxidative stress by YM helped inactivate the nonenzymatic cleavage of TBH polysaccharides in the cell wall architecture, which could enhance fruit resistance against pathogenic infections and thereby suppress postharvest quality deterioration of tomatoes during storage.

Keywords: /Tomato/ /Yeast mannan/ /Alternaria rot/ /Tightly bonded hemicellulose/ /Antioxidant metabolism/ /Postharvest/

Tolasa, M., Gedamu, F., & Woldetsadik, K. (Reviewing editor: Moral, M.T.) (2021). Impacts of harvesting stages and pre-storage treatments on shelf life and quality of tomato (*Solanum lycopersicum* L.). *Cogent Food and Agriculture*, 7, 1863620. <https://doi.org/10.1080/23311932.2020.1863620>

Abstract

Post-harvest loss is the greatest impediment, which reduces tomato (*Solanum lycopersicum* L) production in many developing countries, including Ethiopia. A research was carried out to evaluate the effect of harvesting stages and pre-storage treatments on fruit quality and shelf life of tomato, variety Roma VF. The experiment comprised three levels of harvesting stages (mature green, turning and light red) and eight levels of pre-storage treatments, viz., 500 ppm sodium hypochlorite (NaClO), 8% calcium chloride (CaCl₂), 50% cactus mucilage (CM), 500 ppm NaClO+8% CaCl₂, 500 ppm NaClO+50% CM, 8% CaCl₂ + 50% CM and 500 ppm NaClO+8% CaCl₂ + 50% CM. Treatments laid out in 3 × 8 factorial arrangements in a completely randomized design with three replications. Tomato fruits were stored for about 20 days at ambient temperatures, placed on fixed tables. Quality attributes and shelf life parameters were collected at four-day interval during 20 days of storage. The results showed that harvesting stages and pre-storage treatments indicated highly significant ($p \leq 0.01$) impacts on quality and shelf life of tomato fruits. Fruits harvested at mature green stage and coated with 50% cactus mucilage significantly retained low percentage of decay (41.67%), highest marketable fruit (50%), low pH (4.25) and highest ascorbic acid (13.4 mg/100 g) during the storage period and it increased the shelf life the fruits by about 10 days as compared to the control. From the results of the study, harvesting tomatoes at mature green stages and coating them with 50% cactus mucilage can be recommended for increasing the shelf life and quality of the tomato fruits.

Keywords: /Cactus mucilage/ /Harvesting stage/ /Pre-harvest treatments/ /Quality/ /Tomato shelf life/