

**SELECTIVE DISSEMINATION OF INFORMATION (SDI)  
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**GENERAL**

**FRESH PRODUCE**

Millan-Sango, M., A. Allende, D. Spiteri, J.F. Van Impe. 2017. Treatment of **fresh produce** water effluents by non-thermal technologies. J Food Eng 199:77-81.

**Abstract**

Washing is the traditional technique applied by the fresh produce industry to reduce the bacteria load. However, this method requires a high volume of water and a big challenge for the food industry is to minimize the use of water by for example recycling the water effluents. However, in order to avoid any possible cross-contamination, a disinfection step has to be carried out before the recirculation of the water. Non-thermal technologies (i.e. ultrasound (US) and ultraviolet-C (UV-C) light) were applied in this research for the disinfection of fresh produce water effluents. Lettuce wash water was recirculated (3 L/ min) for 30 min in a closed system which consisted of an US device (26 kHz, 90  $\mu\text{m}$ , 41.85 W/L) and an UV-C light system (1.64 kJ/m<sup>2</sup>). Disinfection processes of (i) US, (ii) UV-C light and (iii) US combined with UV-C light were applied (US/UV-C), and aliquots were taken at different time intervals to analyze the microbial load, the colour and the suspended particles. The US/UV-C treatment was the most efficient process tested, regarding bacteria inactivation ( $3.57 \pm 0.39$  log CFU/mL), colour reduction (43.31%) and reduction of suspended particles (30%). Moreover, chemical oxygen demand (COD) was determined at the beginning and at the end of each disinfection process. The US/UV-C treatment was reported to cause the highest COD reduction (79%) in lettuce wash water. The energy requirements of US, UV and US  $\beta$  UV were found to be 0.107, 0.040, 0.114 kW/h, respectively while corresponding microbial reduction in relation to the energy spent was  $4.15 \times 10^{-6}$  CFU/mL/J for US,  $21.53 \times 10^{-6}$  CFU/mL/J for UV and  $8.72 \times 10^{-6}$  CFU/mL/J for US/UV. These results prove that the combined effect of US and UV-C light may be a promising energy efficient disinfection technology for fresh cut wash water effluents when taking into account quality and safety parameters.

**Keywords:** /Fresh Produce/ /Leafy Greens/

**HERB QUALITY**

Duncan, S.E., et.al. 2017. Process to preserve spice and **herb quality** sensory integrity during pathogen inactivation. J. Food Sci. 82(5): 1208-1215.

**Abstract**

Selected processing methods, demonstrated to be effective at reducing *Salmonella*, were assessed to determine if spice and herb quality was affected. Black peppercorn, cumin seed, oregano, and onion powder were irradiated to a target dose of 8 kGy. Two additional processes were examined for whole black peppercorns and cumin seeds: ethylene oxide (EtO) fumigation and vacuum assisted-steam (82.22 °C, 7.5 psia). Treated and untreated spices/herbs were compared (visual, odor) using sensory similarity testing protocols ( $\alpha = 0.20$ ;  $\beta = 0.05$ ; proportion of discriminators: 20%) to determine if processing altered sensory quality. Analytical assessment of quality (color, water activity, and volatile chemistry) was completed. Irradiation did not alter visual or odor sensory quality of black peppercorn, cumin seed, or oregano but created differences in onion powder, which was lighter (higher  $L^*$ ) and more red (higher  $a^*$ ) in color, and resulted in nearly complete loss of measured volatile compounds. EtO processing did not create detectable odor or appearance differences in black peppercorn; however visual and odor sensory quality differences, supported by changes in color (higher  $b^*$ ; lower  $L^*$ ) and increased concentrations of most volatiles, were detected for cumin seeds. Steam processing of black peppercorn resulted in perceptible odor differences, supported by increased concentration of monoterpene volatiles and loss of all sesquiterpenes; only visual differences were noted for cumin seed. An important step in process validation is the verification that no effect is detectable from a sensory perspective.

**Keywords:** /Herb Quality/ /Ethylene/ /Irradiation/ /Sensory/

## PACKAGING

Chopra, S., et.al. 2017. Metal-organic frameworks have utility in adsorption and release of ethylene and 1-methylcyclopropene in fresh produce **packaging**. *Postharvest Biol & Technol* 130: 48–55.

### Abstract

Metal organic frameworks (MOFs) are synthetic porous materials consisting of metal ions or ion clusters bound to organic molecules to create a crystalline structure with a very high internal surface area. MOF molecules have been found to have potential utility in the selective adsorptive binding and release of gaseous fuel and other chemicals. We explored the ability of selected MOFs to bind ethylene and the ethylene action inhibitor, 1- methylcyclopropene (1-MCP) with the intent of evaluating their usefulness in regulating ethylene responses for perishable produce. We screened several MOF compounds and selected two (Basolite C300 and Basolite A520) for in-depth characterization based on their superior capacity for binding ethylene. Basolite C300 is a copper- based MOF with a trimesic acid linker group and Basolite A520 is an aluminum-based MOF with a fumaric acid linker group. Binding efficacy was compared to zeolite Z13X, which was also found to bind ethylene. The copper-based Basolite C300 was more effective at binding and retaining ethylene than the other compounds tested. When ethylene-charged sorbents were moved to dry air, they released little ethylene. However, in the presence of free water, Basolite C300 desorbed a majority of its bound ethylene. Adsorption and desorption behavior differed for other alkenes. Basolite C300 had the highest affinity for 1-MCP, but did not release bound 1-MCP in the presence of humidified air. In contrast, the compound 1-butene, often used as a surrogate to quantify 1-MCP, was bound tightly by the MOF and quickly released in the presence of humidified air. We tested the potential for in-package release of bioactive compounds from

a MOF. In a proof-of-concept experiment, we found that ethylene-loaded Basolite C300 released ethylene rapidly into packages of banana fruit and induced ripening; MOF without ethylene loading did not induce ripening. The data suggest that MOFs have the potential to sorb, store, and release gaseous compounds that impact plant physiology and may have some utility as a delivery system for volatile plant growth regulators.

**Keywords:** /Packaging/ /Ripening/ /Storage/ /1-MCP/

Ramirez, D.O.S., et.al. 2017. Wool keratin film plasticized by citric acid for food **packaging**. Food Packag. & Shelf Life 12: 100-106.

### **Abstract**

Wool keratin (natural resource) and citric acid (effective preservative) were mixed in water to produce a transparent film for application in active packaging. This film showed excellent biocidal effect, high elongation value (600%) and little loss of keratin after immersion in water. The capability of citric acid to bind keratin macromolecules by hydrogen bonds is probably responsible for the improvement of film's extensibility. On the other hand, the study of FT-IR spectrum allows understanding that the presence of citric acid in aqueous solution enhances the content of alpha helix structure in the film, with a reduction in the amount of side chain and disordered conformations in the macromolecular structure. Carrot shelf-life was qualitatively improved with this film in comparison with a commercial film for preserving food. Consequently, this film can have possible application for food packaging as a substitute of synthetic polymers replacing them with a natural, environmental friendly and renewable resource.

**Keywords:** /Packaging/ /Active Packaging/

### **READY TO EAT SALAD**

Soderqvist, K., et.al. 2017. Fate of *Listeria monocytogenes*, Pathogenic *Yersinia enterocolitica*, and *Escherichia coli* O157:H7 *gfp*<sup>+</sup> in **Ready-to-Eat Salad** during Cold Storage: What Is the Risk to Consumers? J. Food Prot. 80(2): 204-212.

### **Abstract**

In this study, we investigated the fate of *Listeria monocytogenes*, pathogenic *Yersinia enterocolitica*, and *Escherichia coli* O157:H7 *gfp*<sup>+</sup> inoculated in low numbers into ready-to-eat baby spinach and mixed-ingredient salad (baby spinach with chicken meat). Samples were stored at recommended maximum refrigerator temperature (8°C in Sweden) or at an abuse temperature (15°C) for up to 7 days. Mixed-ingredient salad supported considerable growth when stored at 15°C during shelf life (3 days), with populations of *L. monocytogenes*, pathogenic *Y. enterocolitica*, and *E. coli* O157:H7 *gfp*<sup>+</sup> increasing from less than 2.0 log CFU/g on day 0 to 7.0, 4.0, and 5.6 log CFU/g, respectively. However, when mixed-ingredient salad was stored at 8°C during shelf life, only *L. monocytogenes* increased significantly, reaching 3.0 log CFU/g within 3 days. In plain baby spinach, only pathogenic *Y. enterocolitica* populations increased significantly during storage for 7 days, and this was

exclusively at an abuse temperature (15°C). Thus, mixing ready-to-eat leafy vegetables with chicken meat strongly influenced levels of inoculated strains during storage. To explore the food safety implications of these findings, bacterial numbers were translated into risks of infection by modeling. The risk of listeriosis (measured as probability of infection) was 16 times higher when consuming a mixed-ingredient salad stored at 8°C at the end of shelf life, or 200,000 times higher when stored at 15°C, compared with when consuming it on the day of inoculation. This indicates that efforts should focus on preventing temperature abuse during storage to mitigate the risk of listeriosis. The storage conditions recommended for mixed-ingredient salads in Sweden (maximum 8°C for 3 days) did not prevent growth of *L. monocytogenes* in baby spinach mixed with chicken meat. Manufacturers preparing these salads should be aware of this, and recommended storage temperature should be revised downwards to reduce the risk of foodborne disease.

**Keywords:** /Ready-to-eat-Salad/ /Leafy Vegetables/

## STORAGE

Pathak, N., et.al. 2017. Effect of process variables on ethylene removal by vacuum ultraviolet radiation: Application in fresh produce storage. Biosyst Eng. 159:33-45.

### Abstract

Detrimental effects of ethylene on fresh produce make ethylene removal one of the major challenges in storage of horticultural commodities. Novel techniques based on advanced oxidation processes such as photocatalysis and photolysis by vacuum ultraviolet light (VUV) offer good potential for ethylene removal. This study focused on the use of VUV photolysis and the impact of different process variables on the efficiency of this technique. The set objectives of this study were to investigate the combined effects of three process variables; flow rate, initial ethylene concentration, and ultraviolet radiation on the efficiency of VUV photolysis for removal of ethylene at normal atmospheric conditions. Response surface methodology along with BoxBehnken design was applied to determine the combined effect of these variables. Flowrate exerted the most significant effect on the amount of ethylene removed, followed by initial ethylene concentration and ultraviolet lamp power. The combined effect of these three process parameters exerted a significant effect on percentage ethylene removal. Reducing the flowrate and increasing the lamp power as well as the initial ethylene concentration had a positive effect on the amount of ethylene removed. For an initial ethylene concentration of 5 ppm, the percentage ethylene removal (76%) was highest under optimised process variable of 9 W lamp power and 0.5 L/ min flowrate. The developed reactor was tested on short term storage of apples and kiwifruit. The reactor effectively reduced ethylene concentrations in storage space of both products. Kiwifruit storage connected to the reactor had higher flesh firmness compared to the control samples.

**Keywords:** /Storage/ /Ethylene/ /Postharvest/

## FRUITS

### AVOCADO

Fuentealba, C., et.al. 2017. New insights into the heterogeneous ripening in Hass avocado via LC–MS/MS proteomics. *Postharvest Biol & Technol.* 132: 51-61

#### Abstract

Hass avocado postharvest ripening heterogeneity creates several logistics problems at destination markets. Although several approaches mainly based on targeted analysis have been undertaken to broaden our understanding of the potential causes of this postharvest ripening heterogeneity, still the secret is not yet unveiled. In this study biopsies from individual fruit displaying contrasting ripening behavior (slow vs fast) and subjected to different storage conditions (immediately after harvest, 30 d regular air at 5 °C and 30 d at 5 °C and 4 kPa O<sub>2</sub> and 6 kPa CO<sub>2</sub>) were analyzed for targeted fatty acid analysis and cell wall enzyme activity combined with a more integrative approach based on gel free proteomics LC–MS/MS. The high throughput proteomics was capable of discriminating between slow and fast ripening avocado fruit. Proteins that were mainly less abundant in the slow ripening phenotype were annotated to correct protein folding, translation and de novo synthesis and higher abundant proteins were annotated to amino sugar and nucleotide metabolism, detoxification and stress response and proteolysis. Our study opens new insights into the causes of heterogeneous ripening and may provide new markers for avocado ripening at harvest and after prolonged storage.

**Keywords:** /Avocado/ /Ripening/

### BLUEBERRY

Moggia, C., et.al. 2017. Variation in the impact of stem scar and cuticle on water loss in highbush blueberry fruit argue for the use of water permeance as a selection criterion in breeding. *Postharvest Biol & Technol* 132:88-96

#### Abstract

The role of fruit scar on water loss from fresh harvested, fully blue highbush blueberry (*Vaccinium corymbosum* L.) fruit was studied on three germplasm lines from each of three half-sib families at University of Talca, Chile. The stem scar of half of the harvested fruit was sealed using nail polish and weight loss of sealed and non-sealed fruit determined daily at 20 °C (5 d storage) and bi-weekly at 0 °C (15 d storage). Fruit firmness was determined at the end of the storage period. The stem scar accounted for approximately 40% of the moisture lost at 20 °C, but percentages varied considerably between lines. While the stem scar covered 0.19% to 0.74% of the fruit surface area, its rate of transpiration was 170-times higher than for the cuticle at 20 °C. The larger the fruit scar area, the greater was the absolute rate of water loss, but scar size scar did not affect the rate of weight loss expressed on a per gram fruit basis. Higher levels of water loss were associated with a greater loss in

firmness; fruit having a large scar had a greater rate of water loss and were less firm than those having medium or small scars. The water permeance of the fruit cuticle varied two-fold and the apparent permeance of the scar varied three-fold among the 9 lines evaluated when held at 20 °C. Interestingly, one line exhibited a 75% lower rate of water loss from its stem scar than the other lines than would be predicted based on its scar diameter. Storage at 0 °C reduced the rate of water loss by 90% but the cuticle permeance was not affected by temperature. Sealing the stem scar increased fruit firmness retention at 0 °C and 20 °C, but provided less benefit at 0 °C vs. 20 °C. The highly variable nature of water loss through the stem scar and the cuticle in this study suggests that large gains in reductions in water loss are possible for the highbush blueberry once the mechanisms for transpiration are better understood.

**Keywords:** /Blueberry/ /Cold Storage/ /Maturity/

### **CAMU-CAMU**

Neves, L.C., et.al. 2017. Days after anthesis and postharvest behavior define maturity, harvesting time and nutraceutical content of camu-camu fruit. *Scientia Horti* 224: 37–47

#### **Abstract**

Days after anthesis (DAA) and postharvest behavior were used as a novel integrative holistic approach to define the physiological and horticultural maturity of fruit and implement appropriate harvesting times for quality and nutraceutical content. Camu-camu fruit used as a model system was sampled between 74 and 116 DAA, studied on their chemical, enzymatic and sensory characteristics when still attached to the plant and during the postharvest life. At 74–81 DAA fruit were physiologically immature, while 88–116 DAA fruit were physiologically mature, with 116 DAA fruit showing overripe behavior. From a horticultural maturity view scenario there is a dual harvesting time for camu-camu fruit where 88 DAA fruit shows a maximum peak for bioactive compound accumulation (phenolics, ascorbic acid, AOX) appropriate for the nutraceutical market, while 88–102 DAA fruit reach higher sensory acceptance appropriate for the juice industry and fresh market. The horticultural maturity of camu-camu fruit overlaps with its physiological maturity. This holistic approach can be extended to a diverse range of fruit crops.

**Keywords:** /Camu-camu/ /Postharvest Behavior/

### **CANTALOUPE**

Ukuku, D.O., et.al. 2017. Appearance and overall acceptability of fresh-cut cantaloupe pieces from whole melon treated with wet steam process. *LWT - Food Sci & Technol* 82: 235-242.

#### **Abstract**

Minimally processed fresh-cut fruits have a limited shelf-life because of deterioration caused by spoilage microflora and changes in physiological processes. Whole melons was inoculated with  $10^7$

CFU/ml of *Salmonella*, *Escherichia coli* O157:H7 and *Listeria monocytogenes* to achieve 4.8, 4.5 and 4.1 log CFU/cm<sup>2</sup>, respectively on melon surfaces. The inoculated melons were treated with a wet steam processing unit for 180 s before fresh-cut preparation. Microbial safety was studied and the overall appearance and acceptability of the fresh-cut pieces were investigated by trained panelists. There were no visual signs of physical damage on all treated cantaloupe surfaces immediately after treatments and during storage. All fresh-cut pieces from treated cantaloupes were negative for bacterial pathogens while aerobic mesophilic bacteria were recovered. Appearance and overall acceptability of fresh-cut pieces from treated melons during 6 days at 5 ° C were not significantly ( $p < 0.05$ ) different from control pieces prepared from fresh melons but were significantly ( $p < 0.05$ ) different from untreated pieces from day 0 under the same storage conditions for 14 days. The results of this study suggests that wet steam treatment of cantaloupes rind surfaces designated for fresh-cut preparation will enhance the microbial safety of fresh-cut pieces, and the overall acceptability of cut pieces.

**Keywords:** /Cantaloupe/ /Fresh-cut/

## CARAMBOLA

Shao-Wei Chen, et.al. 2017. Effect of harvest season, maturity and storage temperature on storability of carambola 'Honglong' fruit. *Scientia Horti* 220: 42–51.

### Abstract

*Averrhoa carambola* L. cv. Honglon is a species newly bred in Taiwan to commercial purposes. However, few studies have been conducted on the storage and transportation of this fruit. Accordingly, the present study investigated the influences of harvest reasons, fruit maturity, and storage temperature on the food quality and storage life of 'Honglong' fruits. The results showed that the color and firmness of summer fruits were superior to those of winter fruits; the winter fruits at 70% or 80% maturity had a significantly longer the storage life than the corresponding summer fruits. Fruits with 70% maturity (i.e., when half of the fruit is yellow) are bright green-yellow, high in total soluble solids (7.1° Brix for winter fruits and 7.5° Brix for summer fruits), and low in titratable acidity (0.34% for winter fruits and 0.32% for summer fruits). In addition, the storage life and cold resistance of fruits with 70% maturity had a longer life and were more resistant to cold than those with 60% maturity were. The transportation storage temperature of 5 ° C caused slight chilling injury but was optimal for maintaining food quality, storage life, and shelf life. Storage temperatures of 0 and 3 ° C caused severe chilling injury, and 10 ° C caused the fruits to rapidly turn yellow and rot. We suggest that 'Honglong' fruits be harvested at 70% maturity and be stored at 5 ° C to achieve optimal quality for commercial production.

**Keywords:** /Carambola/ /Chilling injury/ /Storage Life/ /Shelf Life/

## CHERRY

Munoz, M., et.al. 2017. In-field hydrocooling: effect on postharvest quality of sweet cherries. *Acta Horti* 1161: 535-542

## Abstract

Shelf-life of sweet cherries is limited even in ideal storage conditions. The hydrocooling systems implanted in some fruit plants of the Jerte Valley represent a great advance for shelf-life improvement expanding market opportunities. However, the elapsed time between fruit harvesting and hydrocooling is sometimes too high. In an attempt to extend the success of this system, the postharvest quality of 'Sweetheart' cherries subjected to a fast hydrocooling in field was assessed shortly after harvesting. The results show that this new cooling strategy would likely have a big impact in customer acceptance. Compared to sweet cherries cooled 24 h after harvesting, those precooled in the field showed a higher acceptability index (total soluble solid/total acidity), and improved appearance, due to their greener and more turgid pedicels, and their minor visual dehydration. An undesirable side effect of the in-field hydrocooling was a slight increase in mechanical damage.

**Keywords:** /Cherry/ /Shelf-life/

## DURIAN

Wisutiamonkul, A., et.al. 2017. Carotenoid accumulation and gene expression during **durian** (*Durio zibethinus*) fruit growth and ripening. *Sci Hortic* 220: 233–242.

## Abstract

Carotenoid content in durian (*Durio zibethinus*) fruit is an important aspect of fruit quality. We analyzed fruit size, color, carotenoid composition and expression of genes involved in carotenogenesis of two durian cultivars 'Chanee' and 'Monthong' with differences in pigmentation during growth and ripening. The ripe fruit of 'Monthong' has a greater diameter and fruit weight than that of 'Chanee', while total carotenoid concentration was approximately 6-fold higher in 'Chanee' than in 'Monthong'. The major carotenoids in the fruit pulp were  $\beta$ -carotene and  $\alpha$ -carotene, with minor carotenoids being lutein and zeaxanthin. Significant differences in  $\alpha$ -carotene and  $\beta$ -carotene levels were seen between the two cultivars. We cloned fragments of *PSY*, *PDS*, *ZDS*, *CRTISO*, *LCYB*, *LCYE*, *CYCB*, *BCH*, *ECH* and *Or* genes from durian. Expression analysis of the carotenoid biosynthetic genes using qPCR showed that *ZDS* expression positively correlated with increases in total carotenoids,  $\beta$ -carotene,  $\alpha$ -carotene, and lutein content and *LCYE* expression correlated with total carotenoids and  $\beta$ -carotene content. In contrast, *LCYB* showed a negative correlation with total carotenoids,  $\beta$ -carotene,  $\alpha$ -carotene and lutein. It can be concluded that carotenoid accumulation during durian fruit growth is regulated by the balanced expression of the *ZDS*, *LCYE* and *LCYB* genes.

**Keywords:** /Durian/ /Ripening/

## FIG

Allegra, A., et.al. 2017. The effectiveness of *Opuntia ficus-indica* mucilage edible coating on post-harvest maintenance of 'Dottato' **fig** (*Ficus carica* L.) fruit. *Food Packag. & Shelf Life* 12: 135–141

## Abstract

Breba figs are highly perishable and their shelf-life is very short. In this study, breba figs (cv. 'Dottato') were treated with a mucilage solution of *Opuntia ficus-indica* cladodes, sealed in plastic bags, and stored at 4 °C for 14 days. The effect of the edible coating on the shelf-life and qualitative attributes of the fruit were evaluated by colors, content of total soluble solids, titratable acidity, total phenol, total carotenoids. Results showed that coating improves the quality of breba fig during storage. The edible coating was effective in maintaining fruit fresh weight, visual score values, fruit firmness and total carotenoid content. Coated fruit showed a significantly lower development of *Enterobacteriaceae* than control ones during the entire period of observation.

**Keywords:** /Fig/ /Edible Film/ /Quality/ /Ethylene/

## GOJI BERRY

Jatoi, M.A., et.al. 2017. The effects of postharvest application of lecithin to improve storage potential and quality of fresh **goji** (*Lycium barbarum* L.) berries. Food Chem 230: 241–249.

## Abstract

To enhance storage life and post-storage quality of fresh goji berries, three treatments with lecithin (1, 5, 10 g·L<sup>-1</sup>) and two storage times (8, 16 days) were evaluated. The significant effects on the physiological and biochemical parameters were varied. 1 g·L<sup>-1</sup> lecithin showed its main effects after 8 days of storage by reduction in total weight loss and decay, SSC/TA ratio (also at 16 days), and chlorophyll content and with highest scores of sensory attributes (also at 16 days). 5 g·L<sup>-1</sup> lecithin showed its main effects after 16 days of storage: highest SSC, highest TA (also at 8 days), highest TPC, only significant reduction in DPPH antioxidant activity, and highest total flavonoid content. 10 g·L<sup>-1</sup> lecithin showed its main effects after 8 days of storage with highest SSC, chlorophyll content, total flavonoid, DPPH, and ABTS antioxidant activity (also at 16 days), but with least scores of sensory attributes.

**Keywords:** /Goji Berry/ /Fruit Quality/ /Postharvest Decay/

## GRAPE

Baert, A. and K. Steppe. 2017. Automatic plant-based water status monitoring in **grapevine** using an improved water transport and storage model. Acta Hort 1157: 191- 196.

## Abstract

As all plants, grapevines (*Vitis vinifera* L.) need water to function properly. A certain level of drought stress might however be beneficial as it improves the composition of the grape. Earlier research has shown that differences in water status result in wines with different appearance, aroma, flavour and colour. Nevertheless, the level and timing is of utmost importance. Therefore, an adequate monitoring

of the water status is crucial for improving grape (and wine) quality. It is internationally recognised that this should be based on plant measurements, because only then information is gained about the actual plant water status. Mechanistic models are promising for this purpose and allow a deeper understanding of the underlying mechanisms. In this study we use a dynamic water transport and storage model that links sap flow, or whole plant water consumption, and stem diameter variations in order to simulate stem water potential. This variable is considered as one of the best indicators for water status. We aimed at improving the model to perform well under both wet and pronounced dry conditions and evaluated it for real-time water status monitoring. To this end, the former constant flow resistance in the xylem has been replaced by a dynamic resistance depending on measured soil water potential and combines the resistance experienced in the soil, roots and stem. Furthermore, also the radial flow resistance (between xylem and storage tissues), originally implemented as a constant value, has been replaced by an equation. The improved model is able to accurately simulate the plant water status during both wet and pronounced dry conditions. The model seems very promising to apply as an automatic plant-based water status monitoring system and may be a tool to improve grape and wine quality.

**Keywords:** /Grape/ /Quality/

Bondada, B. and M. Keller. 2017. Structural and fruit compositional anomalies related to various shrivel types developing during ripening of grape berries. Acta Hort 1157. 49-54.

## **Abstract**

In order to gain an insight into the origin and probable causes of various shrivel types developing during ripening of grape berries, it is important that one first perform an integrated analyses to understand structural and compositional anomalies of the afflicted berries. The objective of this study was to analyze different kinds of shrivels that afflict grape (*Vitis vinifera* L.) berries during their growth and development by dissecting their morpho-anatomy and shriveling nature, and analyzing fruit composition. Field-grown 'Cabernet Sauvignon' vines with a history of physiological disorders were monitored for the incidence of various types of shrivels. These included: sunburn (SB), prolonged dehydration (PD), late-season bunch stem necrosis (LBSN), early bunch stem necrosis (EBSN), and SOUR shrivel (SS). Except for SB berries, the pericarp of all other afflicted berries evolved with distinct morphological (shriveling pattern) and compositional characteristics (sugars, acids, pH, anthocyanins, phenolics, nutrients). Common to all shrivel types was the loss of volume despite retaining an intact morphology of epicuticular wax that occurred as upright platelets excluding on the sun-exposed hemisphere of SB berries wherein its crystalline structure was transitioned into amorphous masses. A chlorophyllous inflorescence framework persisted in all shrivel forms but in LBSN rachis in which the necrotic regions developed tylosis. Unlike the translucent mesocarp of healthy, SB and PD berries, the mesocarp was collapsed in SS and LBSN berries, nevertheless all had well-developed seeds. Overall, the integrated structural and compositional analysis of different shrivel types revealed a severe reduction in fruit quality of clusters afflicted with SS and therefore were not suitable for making wine. In contrast, despite shriveling of the pericarp, clusters of SB, PD, and LBSN berries had several sought-after compositional attributes rendering them suitable for making certain style of desirable wines.

**Keywords:** /Grape/ /Ripening/

Pilati, S., et.al. 2017. The onset of **grapevine** berry ripening is characterized by reactive oxygen species accumulation and 13-lipoxygenase-derived galactolipid peroxides in the chloroplasts. *Acta Hort* 1157: 105-112.

### **Abstract**

The ripening of fleshy fruits is a complex developmental program characterized by extensive transcriptomic and metabolic re-modelling in the pericarp tissues (pulp and skin). The onset of ripening is triggered by a network of external and endogenous signals. Previous studies reported the accumulation of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), proposing reactive oxygen species (ROS) may be involved in the regulatory mechanisms. We therefore carried out a detailed investigation of their accumulation during seven weeks of *Vitis vinifera* 'Pinot Noir' berry ripening centred on véraison. We demonstrated that both H<sub>2</sub>O<sub>2</sub> and singlet oxygen (<sup>1</sup>O<sub>2</sub>) accumulated in berry skin cells during softening, in the cytosol and plastids, respectively. H<sub>2</sub>O<sub>2</sub> peak at véraison was followed immediately by a peak of catalase activity. The analysis of lipid extracts by HPLC-mass spectrometry showed that only membrane galactolipids accumulate oxidized species at véraison, namely monogalactodiacylglycerols (MGDGs) and digalactodiacylglycerols (DGDGs) peroxidized on one or both α-linolenic fatty acid chains, with a 13(S) absolute configuration implying the participation of an enzymatic activity. We identified a lipoxygenase (PnLOXA) which is expressed at véraison and localized at the plastid thylakoid membranes. This enzyme was able to catalyze membrane galactolipid peroxidation in tobacco leaves overexpressing PnLOXA, strongly supporting its role in berry lipid peroxidation and possibly oxylipins synthesis. We provide evidence that H<sub>2</sub>O<sub>2</sub>, <sup>1</sup>O<sub>2</sub> and the peroxy-galactolipids are candidate signaling molecules during grape berry ripening.

**Keyword:** /Grape/ /Ripening/

### **KIWIFRUIT**

Burdon, J., et.al. 2017. Softening of 'Hayward' **kiwifruit** on the vine and in storage: The effects of temperature. *Sci Hort* 220: 176–182.

### **Abstract**

Observations were made on the softening of 'Hayward' kiwifruit on the vine, in storage and in response to low temperatures. The pattern of 'Hayward' softening on the vine and in storage was sigmoidal, as is typical for kiwifruit. On the vine, the initial slow softening rate of 'Hayward' fruit was consistent across seasons, and similar to other cultivars, at ~2.9 N/week or less. The rate of rapid softening differed among cultivars at 5.9–14.7 N/ week. In storage, the initial slow phase of softening was seen only in less mature fruit harvested before any increase in softening rate had occurred on the vine. Maturing 'Hayward' fruit developed a capacity to soften in response to low temperatures 1–2 weeks before the on-vine period of faster softening commenced. There appear to be three aspects of fruit softening to consider in response to temperature: induction of softening at low (e.g. 8–10 °C) but

not chilling temperatures, slowing of the biochemical reaction rates that cause softening by lower temperatures (e.g. 4 °C) and chilling by low temperatures close to 0 °C. These findings are discussed in the context of implementing research and the potential commercial impacts from a better understanding of temperature effects on kiwifruit softening.

**Keywords:** /Kiwifruit/ /Storage/ /Ripening/

## LIME

Gonzales-Estrada, R.R., et.al. 2017. Antimicrobial soy protein based coatings Application to Persian **lime** (*Citrus latifolia* Tanaka) for protection and preservation. *Postharvest Biol & Technol* 132: 138–144.

### Abstract

Preventive antifungal activity of postharvest treatments with SPI (soy protein isolate) –coatings forming solutions against blue mould decay were evaluated on Persian lime (*Citrus latifolia* Tanaka) artificially inoculated in rind wounds with *Penicillium italicum*. Stimulatory effects were observed with the use of citral, however with the use of limonene an inhibitory effect was obtained. After 13 d of storage, significant preventive activity against blue mould was observed with a 20% of disease incidence applying SPI-coating forming solutions with limonene added. SEM micrographs showed that limonene could act as an inhibitor of germ tube elongation, delaying the process of infection. Quality parameters like water losses, change in colour and aroma compounds release were assessed on fruit coated. Depending to storage condition, SPI-coating forming solutions were effective to reduce water losses, maintain colour and controlling the liberation of active agent.

**Keywords:** /Lime/ /Postharvest Quality/ /Coatings/

## LITCHI

Wu, Y., et.al. 2017. Effects of biocontrol bacteria *Bacillus amyloliquefaciens* LY-1 culture broth on quality attributes and storability of harvested **litchi** fruit. *Postharvest Biol & Technol* 132: 81-87

### Abstract

Effects of postharvest biocontrol treatment with antagonistic bacteria *Bacillus amyloliquefaciens* LY-1 on quality attributes and storability of harvested litchi fruit were investigated. “Wuye” litchi fruit were immersed in  $1.0 \times 10^8$  colony-forming units (CFU)  $\text{mL}^{-1}$  *B. amyloliquefaciens* LY-1 culture broth (BLCB) or sterile water (control) for 5 min, respectively. Litchi fruit were then air-dried and stored at  $25 \pm 1$  °C and 85%–90% relative humidity. Comparing to control litchi fruit, the BLCB-treated litchi fruit exhibited lower pericarp browning index, and percentages of fruit decay and weight loss. Moreover, the BLCB-treated litchi fruit maintained higher contents of total soluble solids, titratable acidity, total soluble sugars and vitamin C in pulp, as well as higher activities of disease resistance-related enzymes (phenylalanine ammonia lyase, chitinase, and  $\beta$ -1, 3-glucanase) and higher content of natural disease-

resistive material like lignin in pericarp. Thus, it can be concluded that the  $1.0 \times 10^8$  CFU mL<sup>-1</sup> BLCB treatment delayed the progress of pericarp browning, lowered fruit decay and weight loss, and maintained higher quality of harvested “Wuye” litchi fruit during storage, which might suggest that the BLCB treatment was a promising and effective biological control method for prolonging the shelf-life of harvested litchi fruit.

**Keywords:** /Litchi/ /Storability/ /Quality/

Zhang, Z., et.al. 2017. Effect of tea seed oil treatment on browning of **litchi** fruit in relation to energy status and metabolism. *Postharvest Biol & Technol.* 132: 97-104.

### **Abstract**

‘Dadingxiang’ litchi fruit were treated with 0.1% tea seed oil (TSO) and then stored at 25 °C for up to 8 days to investigate the effects of TSO and possible mechanisms on pericarp browning. The results showed that TSO effectively delayed the development of pericarp browning and the loss of red color in litchi fruit. TSO treatment markedly maintained membrane integrity as indicated by a lower relative electrical conductivity, which might contribute to delayed fruit senescence. In addition, TSO treatment enhanced the ATP level, energy charge and activities of H<sup>+</sup>-ATPase and Ca<sup>2+</sup>-ATPase and regulated the expression of four genes related to energy metabolism, including *LcAtpB*, *LcAAC1*, *LcAOX1* and *LcSnRK2*. These results indicate that the process of browning and senescence in litchi fruit may be closely associated with energy status via the regulation of energy metabolism-related enzymes and genes. We suggest that TSO treatment is a convenient and safe approach for reducing browning of harvested litchi fruit.

**Keywords:** /Litchi/ /Postharvest/ /Browning/

### **MANDARIN**

Khalid, S., et.al. 2017. Tree age and fruit size in relation to postharvest respiration and quality changes in ‘Kinnow’ **mandarin** fruit under ambient storage. *Sci Horti* 220: 183–192.

### **Abstract**

The conducted research focused on the impact of tree age and fruit size on postharvest respiration as well as changes in physico-chemical quality of ‘Kinnow’ mandarin fruit, stored in ambient conditions ( $20 \pm 2$  °C). Fruit from three different tree age groups (6, 18 and 35-years) and fruit size (large, medium and small) groups were analyzed for respiration and fruit quality during seven days ambient storage. Fruit from tree age group of 35-years surpassed the fruits from tree age group of 6-years in carbon dioxide (CO<sub>2</sub>) production, while fruit size had non significant influenced CO<sub>2</sub> production following ambient storage. Ethylene production was predominantly more in fruit from tree age group of 35-years, while fruit of small size irrespective of tree age group had significantly higher ethylene production. In general, CO<sub>2</sub> production indicated a non-climacteric pattern, while ethylene production followed climacteric pattern, with two peaks. As regards fruit quality, fruit of tree age group of 35-years,

had more TSS (10.6° Brix) titratable acidity (TA) (0.81%), sugars {reducing (1.9%), non reducing (5.3%) and total sugars (7.5%)} as compared to tree age group of 6 and 18-years. Final fruit quality data after seven days of ambient storage showed more decrease in TA (0.1%) and reducing sugars (0.26%) and increase in ascorbic acid (AA) (3.38 mg 100 mL<sup>-1</sup>) and non reducing sugars (0.61%) in fruit of trees age group of 35-years. Fruit from 18-years old trees had higher mass loss (8.39%), irrespective of fruit size and the interactive response of tree age and fruit size revealed that more mass loss (11.71%) was observed in small sized fruit from 18-year-old trees. Ethylene production was positively correlated with mass loss ( $r = +0.734$ ) in fruit from 18-year-old trees and negatively ( $r = -0.692$ ) in fruit from 6-year-old trees. Irrespective of tree age and fruit size ethylene and CO<sub>2</sub> correlated positively with TSS, titratable acidity and total sugars and negatively with rind thickness.

**Keywords:** /Mandarin/ /Fruit Quality/ /Storage/

## MANGO

dos Santos Neto, J.P., et.al. 2017. Determination of 'Palmer' **mango** maturity indices using portable near infrared (VIS-NIR) spectrometer. *Postharvest Biol & Technol* 130: 75–80.

### Abstract

'Palmer' mango cultivar is a late season variety which is greatly accepted by European consumers. However, it is common to get reports of fruit quality problems, mainly due to maturity. Thus, the objective of this study was to develop calibration models for soluble solids content (SSC) and dry matter (DM) of 'Palmer' mangoes using portable (VIS-NIR) spectrometer. Interactance spectra were obtained with a portable F-750 spectrometer in the wavelength range of 306–1140 nm, 8 nm spectrum resolution, and 4 scans averaged per spectra. Spectra were used to develop SSC and DM models using partial least square regression (PLSR) with full cross validation. The best SSC calibration model was developed using spectra pre-processed with standard normal variate (SNV), first 2 derivative of Savitzky–Golay and window of 699–999 nm. It was observed a RMSE<sub>CV</sub> of 1.39%, with a R<sub>cv</sub><sup>2</sup> of 0.87, and RPD of 2.77. Better results were observed for the DM calibration model which was built with raw 2 spectra using the window of 699–981 nm (RMSE<sub>CV</sub> of 8.81 g kg<sup>-1</sup>, R<sub>cv</sub><sup>2</sup> of 0.84, and RPD of 2.51). Poor calibration models were obtained for firmness. The results indicated that portable VIS-NIR spectrometer can be used as a non-destructive technique to assess SSC and DM content for 'Palmer' mangoes. It is necessary to incorporate more sources of variation, to reduce RMSE values and improve robustness, especially for fruit SSC and DM prediction.

**Keywords:** /Mango/ /Maturity/

## ORANGE

Carmona, L., et.al. 2017. Anthocyanin biosynthesis and accumulation in blood **oranges** during postharvest storage at different low temperatures. *Food Chem* 237: 7–14.

## Abstract

Blood oranges require low temperature for anthocyanin production. We have investigated the activation of anthocyanin biosynthesis and accumulation in the pulp of Moro blood and Pera blond oranges (*Citrus sinensis* L. Osbeck) stored at either 4 or 9 °C after harvesting. Both temperatures stimulated anthocyanin accumulation in blood but not in blond oranges. Nonetheless, blood orange fruits stored at 9 °C reached a darker purple coloration, higher anthocyanin contents and enhanced upregulation of genes from the flavonoid pathway in the pulp and juice than those kept at 4 °C. Our results indicated that dihydroflavonol channeling toward anthocyanin production was boosted during the storage at 9 °C compared to 4 °C, providing more leucoanthocyanidins to enzymes downstream in the pathway. Finally, despite both low temperatures stimulated the expression of key transcription factors likely regulating the pathway, their expression profiles could not explain the differences observed at 9 and 4 °C.

**Keywords:** /Orange/ /Cold storage/

## PEACH

Jiaying Wei , Xicheng Wen and Ling Tang. 2017. Effect of methyl jasmonic acid on peach fruit ripening progress. *Scientia Hortic.* 220: 206–213.

## Abstract

In order to investigate the role of jasmonates (JAs) during the ripening of peach fruit, two concentrations of methyl jasmonate (MeJA, 10 and 100 mM) were evaluated using field system. Fruit quality parameters, such as the contents of anthocyanin, volatile compounds and cell wall enzymes, and the transcriptional profiles of several ripening-related genes were analyzed. Our results showed that MeJA promoted fruit chlorophyll degradation and anthocyanin accumulation, volatile compounds enhancement, but it would also delay fruit softening through regulation cell wall enzymes activities of PG and cellulase. MeJA increased fruit anti-stress because of the promotion of SOD, POD, CAT, PPO enzyme activities. MeJA reduced fruit endogenous ethylene content, although ethylene accelerated fruit softening and decreased titratable acidity that resulted in fruit ripening. MeJA altered the expression profiles of its biosynthesis pathway genes of *PpLOX*, *PpAOS*, and *PpOPR3*, which resulted the accumulation of JA accumulation in peach fruit. MeJA also increased the expression levels of anthocyanin-associated genes *PpMYB*, *PpPAL*, *PpCHS*, *PpCHI*, *PpF3H*, *PpDFR*, and *PpUFGT*. MeJA increased chlorophyll degradation gene of *PpPAO*, as well as decreased its biosynthesis gene of *PpPORC*, which led to chlorophyll reduction. However, ethylene had a reverse effect on the genes' expression levels, and it inhibited anthocyanin accumulation. Ultimately, heterologous expression peach *PpAOS* in strawberry showed that JA promoted fruit anthocyanin accumulation. The present findings suggest that JA promotes peach fruit ripening through regulation anthocyanin accumulation, which is different from the way triggered by ethylene in regulation peach fruit ripening.

**Keywords:** /Peach/ /Ripening/ /Ethylene/

## PEAR

Bexiga, F., et.al. 2017. A TSS classification study of 'Rocha' pear (*Pyrus communis* L.) based on non-invasive visible/near infra-red reflectance spectra. *Postharvest Biol & Technol.* 132: 23–30

### Abstract

The study focuses on the application of machine learning techniques for classifying the internal quality of 'Rocha' Pear (*Pyrus communis* L.), i.e., the total soluble solids (TSS), using the non-invasive technique of visible/ near infra-red reflectance spectroscopy. Six representative classifiers were evaluated under realistic experimental conditions. The classifiers include representatives of classic parametric (logistic and multiple linear regression), non-parametric distance based methods (K-nearest neighbors), correlation-based (partial least squares), ensemble methods (random forests) and maximum margin classifiers (support vector machines). The classifiers were assessed against metrics such as accuracy, Cohen's Kappa, F-Measure, and the area under the precision-recall curve (AUC) in a 10 × 10-fold cross-validation plan. For result analysis non-parametric statistical test of hypotheses were employed. A total of 4880 fruit samples from different origins, maturation states, and harvest years were considered. The main conclusion is that the maximum margin classifier outperforms all the others studied ones, including the commonly used partial least squares. The conclusion holds for both a reflectance spectrum with 1024 features and for a 128 subsample of these. An estimate of the out-of-sample performance for the best classifier is also provided.

**Keywords:** /Pears/ /Quality/

Deuchande, T., et.al. 2017. Mineral concentrations at harvest as novel markers to predict internal browning disorders in 'Rocha' pear during storage under high CO<sub>2</sub>. *Scientia Horti* 220: 102–106.

### Abstract

This study aimed to identify mineral markers at harvest capable of predicting internal browning disorders (IBDs) in pear (*Pyrus communis* L. cv Rocha) during storage, and develop an IBD predictive model. Fruit from five orchards harvested at two different maturity stages were stored for 45 days in cold air (−0.5 °C) followed by 100 days under controlled atmosphere (CA) (1 kPa O<sub>2</sub> + 10 kPa CO<sub>2</sub> at −0.5 °C). Concentrations of ten minerals were measured at harvest and a multivariate predictive model using this data was developed. The model explained 78% of variance in IBD incidence during storage and after validation it showed high accuracy ( $R^2 = 0.97$ ; RMSEP = 7.7%). Amongst the ten analysed minerals, copper (Cu), being significantly correlated to IBD incidence during storage, was the most promising IBD marker. This type of model may be a very useful tool to predict at harvest fruit's sensitivity to IBD during storage allowing the selection of the most adequate storage conditions for the long-term storage of a fruit batch.

**Keywords:** /Pear/ /Storage/ /Browning/

Deuchande, T., et.al. 2017. Transcriptional and biochemical regulation of internal browning disorder in 'Rocha' pear as affected by O<sub>2</sub> and CO<sub>2</sub> concentrations. *Postharvest Biol & Technol* 132: 15-22.

### **Abstract**

The biochemical basis of internal browning disorders (IBD) in 'Rocha' pear has been linked to alterations in the antioxidant and fermentative metabolism. In order to further elucidate the involvement of these metabolic pathways on IBD development, we investigated their regulation at a metabolic and transcriptional level in pears that were stored under four distinct conditions: i) cold air (-0.5 °C); ii) standard controlled atmosphere (CA; 2 kPa O<sub>2</sub> + 0.5 kPa CO<sub>2</sub>); iii) high CO<sub>2</sub> (2 kPa O<sub>2</sub> + 10 kPa CO<sub>2</sub>), and iv) high CO<sub>2</sub>+ low O<sub>2</sub> (O<sub>2</sub>-switch: 60 d under high CO<sub>2</sub>+ 80 d under high CO<sub>2</sub> and 1 kPa O<sub>2</sub>). Only the fruit stored under high CO<sub>2</sub> were affected by IBD. The faster depletion of ascorbate in high CO<sub>2</sub> - stored fruit was associated with the down-regulation of glutathione reductase (*PcGR*) and ascorbate peroxidase (*PcAPX*) as well as a down-regulation of mono-dehydroascorbate reductase (*PcMDHAR*). The O<sub>2</sub> -switched fruit had the highest IBD incidence. Increased incidence in this sample was associated to a sharp increase in fermentation immediately after transfer to lower O<sub>2</sub> atmosphere suggesting a synergistic effect between high CO<sub>2</sub> and low O<sub>2</sub> concentrations in IBD development. Overall, our results suggest that biochemical and transcriptional regulation of the antioxidant system affects IBD occurrence in 'Rocha' pear, and that fermentation, resulting from fruit exposure to low O<sub>2</sub> concentrations, may further promote the browning process.

**Keywords:** /Pear/ /Browning/

Nham, N.T., et.al. 2017. 'Bartlett' pear fruit (*Pyrus communis* L.) ripening regulation by low temperatures involves genes associated with jasmonic acid, cold response, and transcription factors. *Plant Sci* 260: 8–18.

### **Abstract**

Low temperature (LT) treatments enhance ethylene production and ripening rate in the European pear (*Pyrus communis* L.). However, the underlying molecular mechanisms are not well understood. This study aims to identify genes responsible for ripening enhancement by LT. To this end, the transcriptome of 'Bartlett' pears treated with LT (0 °C or 10 °C for up to 14 d), which results in faster ripening, and control pears without conditioning treatment was analyzed. LT conditioned pears reached eating firmness (18 N) in 6 d while control pears took about 12 d when left to ripen at 20 °C. We identified 8,536 differentially expressed (DE) genes between the 0 °C-treated and control fruit, and 7,938 DE genes between the 10 °C-treated and control fruit. In an attempt to differentiate temperature-induced vs. ethylene-responsive pathways, we also monitored gene expression in fruit sequentially treated with 1-MCP then exposed to low temperature. This analysis revealed that genes associated with jasmonic acid biosynthesis and signaling, as well as the transcription factors TCP9a, TCP9b, CBF1, CBF4, AGL24, MYB1R1, and HsfB2b could be involved in the LT-mediated enhancement of ripening independently or upstream of ethylene.

**Keywords:** /Pear/ /Ethylene/ /Low Temperature/ /Ripening/

## PITAHAYA

Vilaplana, R., et.al. 2017. Control of black rot caused by *Alternaria alternata* in yellow pitahaya (*Selenicereus megalanthus*) through hot water dips. LWT - Food Sci. & Technol 82: 162-169.

### Abstract

Black rot by *Alternaria alternata* causes the majority of losses in yellow pitahaya (*Selenicereus megalanthus*) during postharvest period. Leading strategy for decay control is the use of synthetic fungicides, but constraints associated with the use of this kind of products have led to the search for alternative methods to reduce fungal infections. The efficacy of hot water dips at different temperatures and times (40 ° C for 1 min; 40 ° C for 2 min; 50 ° C for 1 min and 50 ° C for 2 min) for controlling black rot on yellow pitahaya was evaluated by measuring disease severity on fruit pre-inoculated with *A. alternata*. The results showed that both treatments, 50 ° C for 2 min and the imazalil fungicide (0.4 g L<sup>-1</sup>), significantly reduced lesion diameter (63.1 and 70.5%, respectively) after 21 days at 12 ° C compared with non-treated control fruit. Hot water dips at 50 ° C for 2 min before cold storage maintained firmness, reduced weight loss, slowed the changes in fruit skin color, soluble solid content (SSC) and titratable acidity (TA) and did not affect sensory quality of yellow pitahaya. These results showed that dips in hot water may provide a postharvest alternative treatment to control or reduce black rot caused by *A. alternata* in yellow pitahaya.

**Keywords:** /Pitahaya/

## POMEGRANATE

Munhuweyi, K., et.al. 2017. Investigating the effects of crab shell chitosan on fungal mycelial growth and postharvest quality attributes of pomegranate whole fruit and arils. Scientia Hort. 220: 78-89.

### Abstract

Postharvest disease management for pomegranate fruit remains a critical challenge and the need for effective alternative treatments is essential in order to minimise losses. This study investigated the *in-vitro* and *in-vivo* antifungal activities of crab shell chitosan and fludioxonil (a registered postharvest fungicide) as a control against *Botrytis sp.*, *Penicillium sp.* and *Pilidiella granati* isolated from pomegranate fruit. Mycelial growth inhibition was evaluated using potato dextrose agar amended with varying concentrations of 0–1 g/L for fludioxonil, and 0–10 g/L of chitosan. Complete mycelial growth inhibition was observed at 0.10 g/L and 10 g/L for fludioxonil and chitosan, respectively. Chitosan concentrations causing a 50% reduction in mycelial growth (EC<sub>50</sub>) were 0.47, 1.19, and 2.21 g/L for *P. granati*, *Botrytis sp.*, and *Penicillium sp.*, respectively. The EC<sub>50</sub> concentrations for fludioxonil were 0.02, 0.48, and 0.90 mg/L for *Penicillium sp.*, *P. granati*, and *Botrytis sp.*, respectively. For *in-vivo* investigation of artificially inoculated pomegranate fruit; chitosan effectively reduced rot incidence by 18–66%, and was most efficient when applied as a preventative treatment regardless of cultivar ('Herskawitz' and 'Wonderful'). Additionally, chitosan treatments (0, 2.5, 7.5 and 15 g/L) were applied on minimally

processed pomegranate arils as edible coating prior to packaging and storage at 4 ° C for 14 days. The chitosan treated arils best maintained physico-chemical quality attributes and significantly lower microbial counts for mesophilic aerobic bacteria, yeast and moulds. This study showed that crab shell chitosan has a potential as a green fungicide or postharvest disease management of pomegranate.

**Keywords:** /Pomegranate/ /Postharvest Quality/ /Chitosan/ /Edible Coating/

## STONE FRUIT

Gotor-Villa, A., et.al. 2017. Biocontrol products based on *Bacillus amyloliquefaciens* CPA-8 using fluid-bed spray-drying process to control postharvest brown rot in **stone fruit**. LWT - Food Sci & Technol 82: 274-282.

### Abstract

Two products based on the biocontrol agent *Bacillus amyloliquefaciens* CPA-8 have been developed as an effective alternative to chemical applications to control postharvest brown rot in stone fruit. As part of the production and formulation processes, the effects of three different nitrogen sources on growth media and the effects of different carrier materials and protectants on fluid-bed spray-drying were studied. CPA-8 populations achieved  $10^9$  CFU/mL after 72 h of culture. However, the protein PROSTAR 510A at 20 g/L provided better growth curves compared to the boiled extract from Defatted Soy Flour and protein PROSTAR 510A at 10 g/L. Furthermore, culture ages of 72 h were needed to obtain high endospore production and therefore, suitable heat tolerance of CPA-8. The use of the protectants 20% sucrose plus 10% skimmed milk resulted in the best formulations when either carrier material, maltodextrin or potato starch, was used. These two products were then selected for assays of shelf life and efficacy. CAP-8 viability was unchanged after 15 months of storage at 4 and 22°C, maintaining concentrations between  $7.8 \times 10^9$  and  $1.2 \times 10^{10}$  CFU/g. Finally, the efficacy of the CPA-8 products against *Monilinia* spp. was confirmed (>44.4% disease reduction) on peaches, nectarines, flat peaches, cherries, apricots and plums.

**Keywords:** /Stone Fruit/ /Biocontrol/ /Postharvest Disease/

## STRAWBERRY

Elmi, F., et.al. 2017. Effect of ethylene on postharvest **strawberry** fruit tissue biochemistry. Acta Hort. 1156: 667 – 672.

### Abstract

The effect of continuous ethylene supplementation ( $50 \mu\text{L L}^{-1}$ ) on cold-stored strawberry fruit physiology and biochemistry, including phytohormone (abscisic acid) metabolism was investigated. In comparison with control fruit which exhibited high sucrose and malic acid contents during storage, ethylene-treated fruits showed increased respiration, sucrose hydrolysis and concomitant reducing sugars accumulation. Ethylene supplementation did not have any effect on phenolic profile. ABA

biosynthesis, in both flesh and achenes, was promoted by ethylene. The results here in suggest that controlling ethylene after harvest could suppress senescence and extend shelf-life.

**Keywords:** /Strawberry/ /Shelf-life/ /Ethylene/

Kafkas, E. and S. Kafkas. 2017. Preliminary results on the polyphenol content of **strawberry** (*Fragaria × ananassa* Duch. 'Florida Fortuna') fruits during ripening. Acta Hort. 1156: 563-568.

### **Abstract**

Strawberries are a common and important fruit worldwide and its production and consumption increases year after year. One of the most important reasons for this constant growth of the industry is that recent studies have shown that strawberry fruits are rich in health benefit compounds such as antioxidant and polyphenolic compounds. According to recent epidemiological studies, many beneficial compounds play a crucial role in the prevention of several diseases, particularly, cancer, cardiovascular, neurodegenerative and other chronic pathologies. The contents of those compounds can vary according to genotype, ecological conditions, cultural applications and ripen stages. The aim of this investigation was to characterize strawberry (*Fragaria × ananassa* Duch. 'Florida Fortuna') fruits content in phenolic and bioactive compounds during various ripening (green, pink, ripe) stages by HPLC techniques.

**Keywords:** /Strawberry/ /Ripening/ /Phenolics/

## **VEGETABLES**

### **LETTUCE**

Kang Huang and Nitin Nitin. 2017. Enhanced removal of *Escherichia coli* O157:H7 and *Listeria innocua* from fresh **lettuce** leaves using surfactants during simulated washing. Food Control 79: 207-217.

### **Abstract**

Removal of foodborne bacterial pathogens from fresh produce during washing and sanitation process can significantly improve inactivation of the bacteria. Currently, produce wash systems mainly rely on mechanical forces to aid in removal of bacteria attached to the produce surface during washing and sanitation. This study evaluates the potential of surfactants to enhance removal of pathogens from the surface of fresh produce. Influence of three types of commercial food-grade surfactants, including Tween-20, sodium dodecyl sulfate (SDS), and lauric arginate (LAE), on the mechanical removal of pathogenic bacteria and viruses from fresh lettuce leaves in the presence of soil was evaluated. The addition of surfactants did not increase the removal of T7 phages from lettuce leaf surface ( $P > 0.05$ ). The improvement of bacterial removal by addition of surfactants to wash water is corresponding to the decrease of the contact angle between wash water and leaf surface. The most effective *Escherichia coli* O157:H7-*lux* removal was obtained by washing with 0.1% LAE, followed by 0.1% Tween-20, then 0.1%

SDS. The most enhanced detachment of *Listeria innocua* was achieved by 0.1% LAE, followed by 0.1% SDS, then 0.1% Tween-20. The presence of soil resulted in an increased resistance of bacterial cells to the washing process. There was no significant difference in the cell persistence on the lettuce surface within the extended incubation period ( $P > 0.05$ ). The evaluation of lettuce quality indicated that the introduction of surfactants during the washing procedure may affect the firmness of leaves, but the color and electrolyte leakage rate were not affected by the exposure to wash water with surfactants ( $P > 0.05$ ). Overall, these results suggest the potential of food grade surfactants to enhance the removal of bacteria particularly foodborne pathogens from the surface of fresh produce.

**Keywords:** /Lettuce/ /Fresh Produce/

## **MORINGA**

Rahim, M.A. 2017. Improving the moringa value chain in Bangladesh and linking growers with the market. Acta Hort. 1158: 381-390.

### **Abstract**

The demand for food in Bangladesh and around the world is changing rapidly. Driven by economic growth, rising incomes, and urbanization, demand is shifting away from traditional staples toward high-value vegetable commodities. In Bangladesh, additional demand for these commodities is projected to be worth about \$ 10 billion by 2020. More than 80% of people living on less than \$ 2.5 a day in Bangladesh live in rural areas. This spatial distribution of poverty makes capitalizing on the opportunities afforded by high value vegetables like moringa production an important strategic priority for those seeking to reduce poverty in the country. Insufficient processing capacity, the lack of cold storage facilities or a functioning cold chain, and the persistence of transport bottlenecks are significant constraints to high value moringa production in Bangladesh. The promise of generating higher income and increased export revenues by accessing international markets is matched by the challenges of meeting the exacting quality and safety standards that apply in those markets and by the prospect of having to compete with high quality imports from those markets. There is limited processing of moringa in Bangladesh leading to value addition. The majority of moringa produce is not processed at all and, thus lacks any value addition. Most farmers do not have adequate knowledge of moringa processing and value addition. This paper mainly deals with the present status, value addition, processing and marketing of moringa in Bangladesh. Suggestions were also made on the improvement of the moringa value chain, market access and generation of additional household income.

**Keywords:** /Moringa/ /Value Chain/

## **RADISH**

Lee, J.G., et.al. 2017. The mechanism of deterioration of the glucosinolate-myrosinase system in radish roots during cold storage after harvest. Food Chem 233: 60–68.

## Abstract

The hydrolysis of glucosinolates (GSLs) by myrosinase yields varieties of degradation products including isothiocyanates (ITCs). This process is controlled by the glucosinolatemyrosinase (G-M) system. The major ITCs in radish roots are raphasatin and sulforaphene (SFE), and the levels of these compounds decrease during storage after harvest. We investigated the GM system to understand the mechanism behind the decrease in the ITCs in radish roots. Six varieties of radish roots were stored for 8 weeks at 0–1.5 °C. The concentrations of GSLs (glucoraphasatin and glucoraphenin) were maintained at harvest levels without significant changes during the storage period. However, SFE concentration and myrosinase activity remarkably decreased for 8 weeks. Pearson correlation analysis between ITCs, GSLs, and myrosinase activity showed that a decrease of SFE during storage had a positive correlation with a decrease in myrosinase activity, which resulted from a decrease of ascorbic acid but also a decrease of myrosinase activity-related gene expressions.

**Keywords:** /Radish/ /Cold Storage/

## SPINACH

Dewhirst, R.A., et.al. 2017. Novel insights into ascorbate retention and degradation during the washing and post-harvest storage of **spinach** and other salad leaves. *Food Chem* 233: 237–246.

## Abstract

Post-harvest treatments of pre-packaged salad leaves potentially cause L-ascorbate loss, but the mechanisms of ascorbate degradation remain incompletely understood, especially in *planta*. We explored the extent and pathways of ascorbate loss in variously washed and stored salad leaves. Ascorbate was assayed by 2,6-dichlorophenolindophenol titration, and pathways were monitored by <sup>14</sup>C-radiolabelling followed by high-voltage electrophoresis. All leaves tested showed ascorbate loss during storage: lettuce showed the greatest percentage loss, wild rocket the least. Spinach leaves were particularly prone to losing ascorbate during washing, especially with simultaneous mechanical agitation; however, washing in the presence of hypochlorite did not significantly increase ascorbate loss. In spinach, [<sup>14</sup>C]oxalate was the major product of [<sup>14</sup>C]ascorbate degradation, suggesting that commercial washing causes oxidative stress. This study highlights that ascorbate/dehydroascorbic acid are lost via the oxidative pathway during washing and post-harvest storage of salad leaves. Thus changes to washing procedures could potentially increase the post-harvest retention of ascorbate.

**Keywords:** /Spinach/ /Postharvest Storage/

## TOMATO

Jiayin Li, et.al. 2017. Global transcriptome profiling analysis of ethylene-auxin interaction during **tomato** fruit ripening. *Postharvest Biol & Technol* 130:) 28–38.

## Abstract

Auxin-ethylene interactions are crucial for fruit ripening processes. However, the molecular basis of the regulatory network of auxin-ethylene interaction during ripening is still not very clear. To reveal the potential molecular mechanism of ethylene-auxin interplay in tomato (*Solanum lycopersicum* L.) fruit ripening, global transcriptome profiling analysis was performed on cherry tomato fruit treated with auxin, ethylene or the combination of the two hormones. The results showed that ethylene modulated auxin transport, metabolism and signaling processes by affecting the expression patterns of genes encoding auxin carrier proteins, aldehyde dehydrogenase and primary auxin-responsive proteins. Most genes involved in ethylene biosynthesis and signaling were regulated 7 days after treatment with exogenous auxin. Furthermore, the expression levels of mitogen-activated protein kinase (MAPK) and of ubiquitination-related genes were altered in auxin-treated fruit, suggesting that auxin regulates ethylene metabolism and signaling via complicated mechanisms. The potential interaction points in auxin-ethylene crosstalk were also identified and a model was proposed. Our analyses provide a global insight into the ethylene-auxin interaction and predict the potential regulators in the crosstalk of the two hormones during the fruit ripening process.

**Keywords:** /Tomato/ /Ethylene/ /Ripening/

## HERBS AND SPICES

### OLIVE

Jimenez, M.R., et.al. 2017. Internal fruit damage in table olive cultivars under superhigh-density hedgerows. *Postharvest Biol & Technol* 132: 130–137.

## Abstract

This study describes fruit damage of the Manzanilla de Sevilla and Manzanilla Cacereña cultivars under super high-density conditions at morphological and histological levels. Fruits were harvested both manually and by a grape straddle harvester. Dark spots and tissue ruptures were found throughout the mesocarp of both cultivars, particularly after mechanical harvesting. Quantitative traits previously described by our group were used to evaluate internal damage. ‘Manzanilla de Sevilla’ always showed the highest total damaged area in the mesocarp, as well as the highest sum of the areas of all of the tissue ruptures, and number of tissue ruptures intersected by the second circumferential arc. Tissue ruptures in the exocarp were also observed in this cultivar as well as a general increase in this type of damage over time (from 2 to 24 h after harvesting). Investigation of the cuticle and epidermal cell dimensions in undamaged fruits shows that ‘Manzanilla Cacereña’ presents a thicker cuticle and a greater cuticle area per epidermal cell than ‘Manzanilla de Sevilla’. The relationship between these results and the different bruising susceptibilities of the two cultivars studied is discussed.

**Keywords:** /Olive/

## **ONION**

Sekara, A., et.al. 2017. Interactions among genotype, environment and agronomic practices on production and quality of storage **onion** (*Allium cepa* L.) – A review. Hort. Sci. 44(1): 21–42.

### **Abstract**

The aim of this review is a wide description of the relationships between growing conditions and bulb yield and quality of onion (*Allium cepa* L.), focused particularly on long-day cultivars suitable for storage. Marketable yield decreases according to the reduction of crop length caused by the increase of growth temperature. The nutritive requirements of storage onion are highest during the vegetative growth. The application of humic substances and the inoculation of mycorrhizae may enhance bulb growth and quality, mainly under stress conditions. Onion is a slow-growth, shallow-rooted crop with non-shading habitus and therefore its productivity is highly dependent on water availability in the soil, proper fertilization and weed control. The shelf-life of onion bulbs is a genetic trait, improvable by efficient crop and post-harvest management, and adequate conditions of bulb storage. The quality of storage onion bulbs is ascribed to several indicators, such as thiosulfonates, pyruvic acid, soluble solids, sugars, and many other biological compounds. This review is also focused on onion quality as affected by the interactions among genotype, environment, farming practices and post-harvest management

**Keywords:** /Onion/ /Shelf-life/ /Storage/