

**SELECTIVE DISSEMINATION OF INFORMATION**  
**As of May 2019**

**BLUEBERRY**

**De, J.1, Sreedharan, A.1, Li, Y.12, Gutierrez, A.1, Brecht, J. K.3, Sargent, S. A.3, & Schneider, K. R.1. (2019). Comparing the Efficacy of Postharvest Cooling Methods to Enhance Fruit Quality and Reduce Salmonella in Artificially Inoculated Southern Highbush Blueberry, HortTechnology, 1-6. DOI: 10.21273/HORTTECH04238-19**

Abstract

Cooling procedures used by blueberry (*Vaccinium* sp.) growers often may include delays up to 24 hours that can damage the fruit through rough handling and adverse temperatures, thereby potentially compromising quality and, subsequently, safety. The objectives of this experiment were to compare forced-air cooling (FAC) compared to hydrocooling without sanitizer (HW) and hydrocooling with sanitizer (HS) regarding the quality and shelf life of southern highbush blueberry [SHB (*Vaccinium corymbosum*)] and to determine the efficacy of these treatments for reducing *Salmonella* in SHB. Freshly harvested SHB that were inoculated with a five-serovar cocktail of rifampin-resistant *Salmonella* were rapidly chilled by FAC or hydrocooling (HW and HS) using a laboratory model system. FAC did not show any significant reduction ( $P > 0.05$ ) in *Salmonella* or in the effects on the microbiological quality of blueberries. HW and HS reduced *Salmonella* by  $\approx 2$  and  $>4$  log cfu/g SHB, respectively, on day 0. These postharvest treatments were also evaluated for their ability to help maintain fruit quality throughout a storage period of 21 days at 1 °C. Hydrocooling (both HS and HW) provided more rapid cooling than FAC. Hydrocooled blueberries showed significant weight gain ( $P < 0.05$ ), whereas FAC resulted in a slight, but insignificant ( $P > 0.05$ ), reduction in final weight. The results of hydrocooling, both HS and HW, shown in this study could help to extend the shelf life while maintaining or increasing the microbiological quality of fresh market blueberries. Information obtained by this study can be used for developing the best temperature management practices to maintain the postharvest safety and quality of blueberries.

Keywords: /Forced-air cooling/ /Hydrocooling/ /7/8 cooling/ /Sanitizer/ /shelf life/ /*Vaccinium corymbosum*/

**BANANA**

**Yan, H., Wu, F., Jiang, G., Xiao, L., Li, Z., Duan, X., & Jiang, Y. (2019). Genome-wide identification, characterization and expression analysis of NF-Y gene family in relation to fruit ripening in banana. Postharvest Biology and Technology, 151, 98–110. DOI: 10.1016/j.postharvbio.2019.02.002**

Abstract

Nuclear factor Y (NF-Y) is a heterotrimeric transcription factor, which plays important roles in plant growth, development and stress responses. Yet little information regarding the role of

NF-Y in regulating fruit ripening is available. In this study, a total of 44 NF-Y genes (14 MaNF-YAs, 16 MaNF-YBs, and 14 MaNF-YCs) were isolated and confirmed from the banana genome. Their distribution on chromosomes, gene structures, phylogenetic relationship with other species, cis-acting elements, genome synteny and tissue-specific expression were characterized. Furthermore, it was found that expression of six MaNF-Ys, i.e. MaNF-YA5/B1/B2/C9/C11/C14, were up-regulated as harvested fruit ripened, and their expression were accelerated by ethylene, but delayed by 1- MCP. In contrast, harvested banana fruit ripening was accompanied by down-regulation of MaNF-YA1/A3/A6/ B3/B6/C2/C5. Ethylene accelerated their down-regulation while 1-MCP delayed the process. These results indicated that MaNF-YA5/B1/B2/C9/C11/C14 and MaNF-YA1/A3/A6/B3/B6/C2/C5 were implicated in the regulation of harvested banana fruit ripening, functioning as transcriptional activators and repressors, respectively.

Keywords: /Banana/ /Nuclear factor Y/ /Fruit ripening/

## CITRUS FRUIT

**Li, L., Tang, X., Ouyang, Q., & Tao, N. (2019). Combination of sodium dehydroacetate and sodium silicate reduces sour rot of citrus fruit. *Postharvest Biology and Technology*, 151, 19–25. DOI: 10.1016/j.postharvbio.2019.01.006**

### Abstract

Sodium dehydroacetate (SD) and sodium silicate ( $\text{Na}_2\text{SiO}_3$ ) are food preservatives with antifungal activities against many pathogens. In this paper, the antifungal activity of the combination treatment of SD and  $\text{Na}_2\text{SiO}_3$  against *Geotrichum citri-aurantii*, the postharvest pathogen of sour rot in citrus fruit, was tested. SD and  $\text{Na}_2\text{SiO}_3$  combination (1:4, w/w) showed a synergistic inhibitory effect compared to single compound on the mycelial growth of *G. citri-aurantii*, with the minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) being 1.8 and 3.6 g L<sup>-1</sup>, respectively. The spores' germination and the plasma membrane integrity of the pathogen could also be visibly influenced by the 1× MFC SD +  $\text{Na}_2\text{SiO}_3$  treatment. The application of various SD +  $\text{Na}_2\text{SiO}_3$  concentrations (1×, 5×, and 10× MFC) to citrus fruit inoculated with *G. citri-aurantii* significantly ( $P < 0.05$ ) decreased the incidence of sour rot during the entire storage period. After 8 d of storage, the disease incidences in SD +  $\text{Na}_2\text{SiO}_3$  (10×, 5× or 1× MFC)-treated fruit were only 20%, 30%, 65%, respectively, in contrast to 100% of the control fruit. Meanwhile, SD +  $\text{Na}_2\text{SiO}_3$  treatments maintained the fruit quality of citrus fruit. Results indicate that the combination of SD and  $\text{Na}_2\text{SiO}_3$  is a promising approach in controlling the postharvest decay of citrus fruit.

Keywords: / Sodium dehydroacetate/ /Sodium silicate/ /*Geotrichum/ /citri-aurantii/ /Citrus/ /Fruit quality/*

## COWPEA

**de Souza Alves, M., Campos, I. M., de Mello Conde de Brito, D., Cardoso, C. M., Pontes, E. G., & de Souza, M. A. A. (2019). Efficacy of lemongrass essential oil and citral in**

**controlling *Callosobruchus maculatus* (Coleoptera: Chrysomelidae), a post-harvest cowpea insect pest. Crop Protection, 119 (2019), 191-196. DOI: 10.1016/j.cropro.2019.02.007**

#### Abstract

The cowpea weevil, *Callosobruchus maculatus* (F.), is a storage pest that mainly infects cowpea (*Vigna unguiculata* (L.) Walp), spending part of its life cycle inside the grains. Depending on the region, the decrease in cowpea production by cowpea weevils can exceed 70% during a six-month storage period. This study investigated the fumigant effect of lemongrass essential oil (*Cymbopogon citratus* (DC.) Stapf.) and citral on the reproductive cycle, sexual behavior, lipid composition and the enzymatic activity of biotransformation enzymes in cowpea weevils. Mortality (61.43%, 85.00%), oviposition (4.00%, 29.51%) and emergence (10.32%, 1.51%) were observed for lemongrass essential oil and citral treatments, respectively. Exposure to lemongrass essential oil led to changes in behavior for both sexes, decrease in triacylglycerol content of virgin and mated females, and reduction of the activities of acetylcholinesterase (females and males) and  $\beta$ -esterase (females). These changes may affect the survival, energy resource transfer during oogenesis and oviposition, which are likely mechanisms involved with essential oil toxicity.

Keywords: /Cowpea weevil/ /*Cymbopogon citratus*/ /*Vigna unguiculata*/ /Biotransformation enzymes/ /Fumigant effect/

#### CUFLOWERS

**Loyola, C. E., Dole, J. M., & Dunning, R. (2019). North American Specialty Cut Flower Production and Postharvest Survey, HortTechnology hortte, , 1-22. DOI: <https://doi.org/10.21273/HORTTECH04270-19>**

#### Abstract

In the United States and Canada, there has been an increase in the demand for local specialty cut flowers and a corresponding increase in production. To assess the needs of the industry, we electronically surveyed 1098 cut flower producers and handlers in the United States and Canada regarding their current cut flower production and postharvest problems, and customer issues. We received a total of 210 responses, resulting in a 19% response rate. The results showed that the main production problem was insect management; crop timing was the second most important problem and disease management was the third. Crop timing encompasses a range of related issues such as determining the correct harvest stage, harvest windows that are too short, flowering all at once, or lack of control when the crop is ready to harvest. The main postharvest problems were temperature management, hydration, and flower food management. Timing and stem length were the two most mentioned species-specific production issues, with each one listed by 10% or more of the respondents for eight of the total 31 species. Regarding on-farm postharvest handling, hydration and vase life were the two most mentioned issues; they were reported for five and three species, respectively. For postharvest during storage and transport, damage and hydration were the most common issues; these were listed for three species each. The most commonly mentioned customer complaints were vase life and

shattering, which were reported for six and two species, respectively. These results will allow researchers and businesses to focus on the major cut flower production and postharvest issues and on crops that are most in need of improvement in North America.

Keywords: /Bbotrytis/ /Hydration/ /Pests/ /Temperature/ /Timing/ /Zinnia/

## **FABA BEANS**

**Collado, E., Venzke Klug, T., Martínez-Hernández, G. B., Artés-Hernández, F., Martínez-Sánchez, A., Aguayo, E., ... Gómez, P. A. (2019). Nutritional and quality changes of minimally processed faba (*Vicia faba* L.) beans during storage: Effects of domestic microwaving. *Postharvest Biology and Technology*, 151, 10–18. DOI: 10.1016/j.postharvbio.2019.01.008**

### **Abstract**

The present study evaluated the effect of different sanitizers (an edible coating (EC) based on sucrose fatty acid esters, and UV-C (3kJ m<sup>-2</sup>), compared with a control consisting of a conventional NaOCl washing (CTRL)) on the quality changes of fresh-cut (FC) faba (*Vicia faba* L.) seeds stored for 10 d at 4 °C. Additionally, domestic cooking of samples was assessed by periodically microwaving (3 min, 700 W) during FC samples storage to obtain a ready-to-eat product. The modified atmosphere gas composition at the steady was the same for all treatments. The EC treatment better retained vitamin C, total phenolics content (TPC) and tannins, while UV-C better maintained the sugars levels of samples. EC and UV-C controlled mesophilic and enterobacteria growth with 1 and 2-log units lower contents than CTRL after 10 d at 4 °C. Microwaving reduced the microbial loads below detection limits. EC or UV-C treatments extended the shelf-life of fresh-cut faba seeds from 7 to 10 d at 4 °C comparing with CTRL. As expected, microwaving decreased the bioactive compounds contents, but retained the quality of faba seeds allowing to obtain a ready-to-eat tasteful food.

Keywords: /*Vicia faba*/ /Microwaves/ /Edible coatings/ /NaOCl/ /UV-C/

## **FRUITS and VEGETABLES**

**Fernandez, M. V., Denoya, G. I., Jagus, R. J., Vaudagna, S. R., & Agüero, M. V. (2019). Microbiological, antioxidant and physicochemical stability of a fruit and vegetable smoothie treated by high pressure processing and stored at room temperature. *LWT-Food Science and Technology*, 105 (2019), 201-210. DOI: <https://doi.org/10.1016/j.lwt.2019.02.030>**

### **Abstract**

This study aims to evaluate the physicochemical, antioxidant and microbiological stability of a fruit and vegetable smoothie treated with a previously optimized high pressure processing treatment (HPP: 630 MPa, 6min, 20 °C), stored at 25 °C. The control samples presented a significant increase in microbiological counts during the first days, while treated samples

showed counts below the detection limit ( $< 1.0 \log\text{CFU/g}$ ) throughout the 26 days of storage. Total soluble solids and pH did not change with treatment or along storage. Initially, HPP treatment reduced pectinmethylesterase, peroxidase and polyphenoloxidase activities (PME, POD, PPO) by 83.9%, 31.4%, and 9.7%, respectively. During storage, PPO was maintained whereas POD decreased significantly on treated and control samples, while PME decreased on control, the slow value of treated ones was maintained. All the antioxidant indicators presented an initial increase in their values (5–75%) with treatment, presenting similar or better performance than control during storage. All samples presented initially a reddish color ( $a^*$ :  $12.4 \pm 0.8$ ) tending towards an orange-brownish color with storage time, probably due to the significant loss of betacyanin, smoothie's main red pigment. In conclusion, although adjustments are necessary to achieve pigments's stability, HPP-treatment is adequate to ensure the microbiological and antioxidant stability of the product at 25 °C.

Keywords: /High hydrostatic pressures/ /Storage/ /Vegetable smoothie/

## GLADIOLUS

**Hassan, F. A. S., & Fetouh, M. I. (2019). Does moringa leaf extract have preservative effect improving the longevity and postharvest quality of gladiolus cut spikes? *Scientia Horticulturae*, 250, 287–293. DOI: 10.1016/j.scienta.2019.02.059**

MLE treatment prolonged the vase life of gladiolus cut spikes. • RWC, total chlorophyll and fresh weight were improved due to MLE. MLE application reduced MDA and  $\text{H}_2\text{O}_2$  thus maintained the membrane integrity. MLE treatment increased the total phenolic and antioxidant enzyme activities. MLE could potentially be used as a novel preservative in cut flower industry. Abstract Gladiolus is one of the most popular cut flower crops that manifest postharvest problems of rapidly losing the aesthetic value and short vase life that cause quality loss. The study was therefore carried out to investigate whether moringa leaf extract (MLE) has the ability to act as postharvest preservative solution to improve the quality and longevity of gladiolus spikes. Gladiolus spikes were subjected to various concentrations (0, 1, 2, 3, 4%) of MLE in vase solution. All MLE concentrations significantly extended the vase life and resulted in 10 days longer than the control when 3% MLE was applied. MLE treatment also improved the floret opening and reduced the weight loss of cut spikes. The relative water content (RWC), chlorophyll content, and membrane stability were considerably maintained while the microbial growth was suppressed in vase solution by MLE treatments. Also, malondialdehyde (MDA) and  $\text{H}_2\text{O}_2$  production was significantly suppressed by MLE treatments. MLE significantly increased the total phenolics and the activities of antioxidant enzymes (CAT and POX) in the florets. These ameliorative effects of MLE were more pronounced by the concentration 3% and further higher level causes no improvement in cut gladiolus spike longevity and quality. It is concluded that MLE showed these effects via alleviation the oxidative stress induced in the cut spike, maintaining photosynthetic pigments and water relations. We recommend MLE to be applied as a potential and promising eco-friendly alternative to common chemicals used in preservative solutions of cut flowers. MLE could also be commercialized as a novel floral preservative for future floral industry application

Keywords: /Antioxidant enzymes/ /Membrane stability/ /Moringa extract/ /Total phenolic/ /Vase life/

## KIWI FRUIT

**Wei, X., Xie, D., Mao, L., Xu, C., Luo, Z., Xia, M., ... Lu, W. (2019). Excess water loss induced by simulated transport vibration in postharvest kiwifruit. *Scientia Horticulturae*, 250, 113–120. DOI: 10.1016/j.scienta.2019.02.009**

### Abstract

Fruit usually suffers from water loss after transportation and storage, which largely blemishes the quality characteristics including appearance, saleable weight and texture. This study was conducted to interpret the potential relations between fruit water loss and transport vibration. Kiwifruit were subjected to vibration using an electrodynamic shaker followed by storing at 25 °C and 75% RH (relative humidity) in dark for 12 d. Fruit weight loss and water content in the epidermis (EP), outer pericarp (OP), inner pericarp (IP) and core tissues were determined. Shrinkage of EP cells and water movement were evaluated using laser scanning confocal microscopy and magnetic resonance imaging, respectively. Cell damage was investigated by observing the ultrastructure and electrolyte leakage. The results showed that fruit water loss was accompanied with the spatial movement of water from interior IP, OP and external EP. Vibration damaged the fruit cells with plasmolysis, membrane contracting and increased electrolyte leakage, which accelerated movement of water from the tissues to outward resulting in severe water loss of fruit. However, the electrolyte leakage and water content in the core were little changed in both control and vibrated fruit. Shrinkage of EP cells coupled with fruit shrivel appeared by 4 d of storage after vibration. However, the symptom in control fruit was not observed until 8 d of storage. It could be concluded that the simulated transport vibration caused intracellular damage in fruit tissues, which accelerated the water loss and shriveling process.

Keywords: /Water loss/ /Cell damage/ /Kiwifruit/ /Shrivel/ /Simulated transport vibration/

## MANGO

**Ntsoane, M. L., Luca, A., Zude-Sasse, M., Sivakumar, D., & Mahajan, P. V. (2019). Impact of low oxygen storage on quality attributes including pigments and volatile compounds in 'Shelly' mango. *Scientia Horticulturae*, 250, 174–183. DOI: 10.1016/j.scienta.2019.02.041**

### Abstract

Optimal oxygen conditions in controlled atmosphere storage play an important role in maintaining quality and extending shelf life of mangoes, especially for long distance markets. The aim of the study was to investigate the low O<sub>2</sub> tolerance limit of 'Shelly' mango fruit based on quality attributes including pigments and accumulation of O<sub>2</sub> restricted volatile organic compounds (VOCs). Spectroscopy in the visible wavelength range was applied in diffuse reflectance mode as a non-destructive method for monitoring the pigment contents. Furthermore, the relationship between non-destructively measured pigment indices and pigment content was investigated. The spectral reflectance measurements predicted the pigment content in mango fruit ( $R^2 \geq 0.70$ ). However, experimental results showed that low O<sub>2</sub> had no impact on pigment contents. Soluble solids and individual sugars (sucrose, fructose, and glucose)

increased in all storage conditions. Significant differences were found in VOCs, 1% O<sub>2</sub> resulted in significant accumulation of anaerobic metabolites: ethanol, ethyl acetate, 3-hydroxy-2-butanone, ethyl butanoate, 1-butanol, 2, 3-butanediol, ethyl propanoate, 2, 3-butanediol, undecane. Sensory analysis indicated that the panelists rejected fruit stored at 1% O<sub>2</sub> due to unfavorable odour and taste. The results showed that 5% is the low O<sub>2</sub> limit for 'Shelly' mango, below which anaerobic metabolites accumulated compromising the acceptability of the fruit due to 'off-flavour'. However, storage conditions of 10% O<sub>2</sub> can already result in reduced fruit mass loss and respiration rate; maintained the fruit flesh firmness, soluble solids content, and individual sugars in 'Shelly' mango after 21 d of storage.

Keywords: /Controlled atmosphere storage/ /Low oxygen limit/ /Mango/ /Pigments/ /Volatile organic compounds/

## MANGOSTEEN

**Kaewsuksaeng, S., Tatmala, N., Shigyo, M., Tanaka, S., & Yamauchi, N. (2019). Application of electrostatic atomized water particle suppresses calyx discoloration in relation to postharvest quality of mangosteen (*Garcinia mangostana* L.). *Scientia Horticulturae*, 250, 380–387. DOI: 10.1016/j.scienta.2019.02.078**

### Abstract

Commercial exporting of mangosteen (*Garcinia mangostana* L.) is faced with rapid discoloration by degreening of calyx in relation to the loss of postharvest quality. Utilization of electrostatic atomized water particles (EAWPs) has been shown to reduce the chlorophyll (Chl) degradation of green calyces and postharvest quality during storage. Fruit were treated with EAWPs for 0, 10, 20, 30, 40, 50 and 60 min, and then kept in the dark at 20 °C and 90 ± 5% RH. Treatments with EAWPs for 40 min were found to be appropriate treatments to maintain green calyx freshness by suppressing color change in the calyx and peel of mangosteen fruits, and produced hue angle and a\* value higher than that of the control. This treatment efficiently delayed the reduction of Chl a and b contents, and Chl degrading enzyme activities in the calyx. Production of Chl derivatives including chlorophyllide a, pheophorbide a, 132-hydroxychlorophyll a and pheophytin a were detected during storage in the calyx of mangosteen treated with EAWPs for 40 min and were higher than that of the control. Hydrogen peroxide content in EAWPs-treated calyces was detected at a high level at day 0 of storage and was lower than that of the control. Total anthocyanin content, cyanidin-3-sophoroside and cyanidin-3-glucoside were lower in the treated peel than in the control. SEM observation revealed that treatment of mangosteen with EAWPs for 40 min may induce closing stomata, and reduced guard cells shriveling in the mangosteen calyx. The results obtained in this study suggested that treatment with EAWPs for 40 min could delay degradation of Chl by controlling its catabolites, inhibited Chl degrading enzyme activities, and positively affected the calyx and peel quality of mangosteen in storage.

Keywords: /Mangosteen/ /Electrostatic atomized water particles/ /Chlorophyll degradation/ /Postharvest quality/

## MELON

**Hatami, M., Kalantari, S., S.Itani, F., & Beaulieu, J. C. (2019). Storability, Quality Changes, and General Postharvest Behavior of Dudaim Melon Harvested at Two Maturity Stages. HortTechnology hortte, , 1-10. DOI: 10.21273/HORTTECH04057-18**

### Abstract

Dudaim melon (*Cucumis melo* Group Dudaim) is a unique edible melon for which few postharvest physiology studies have been conducted. To investigate the postharvest behavior of dudaim melon, two cultivars (Zangi-Abad and Kermanshah) were planted, tagged at anthesis, and harvested at two maturity stages: 21 and 28 d after anthesis (DAA). Harvested fruit were stored at 5 or 13 C for up to 3 weeks and various quality parameters including color, firmness, titratable acidity (TA), total soluble solids (TSS), weight loss, chilling injury (CI), ethylene production, protein content, glucose content, fructose content, sucrose content, and maltose content were assessed during storage. After 3 weeks of storage at 13 C, early-harvested fruit (21 DAA) had relatively similar color values ( $L^*$ , lightness;  $a^*$ , green–red tones;  $b^*$ , blue–yellow tones) and TA compared with late harvested fruit (28 DAA); however, some quality traits, such as TSS, were not similar. Ethylene content decreased initially after harvest and then started to increase during storage at 13 C. For most treatments, glucose and fructose contents decreased whereas sucrose and maltose contents increased with advancing maturity. Increased ethylene production, in concert with color development at 13 C, similar to ripe fruit, and the changing balance of measured mono- and disaccharide sugars in harvested fruit likely indicates ‘Kermanshah’ is climacteric. Results for ‘Zangi- Abad’ were not as definitive. Dudaim melon fruit can be harvested at an optimum stage of maturity, similar to known climacteric melon fruit, and then allowed to ripen at proper storage temperatures before consumption. Based on the results of this study, we recommend that harvest at 21 DAA and storage at a nonchilling temperature such as 13 C are the optimal stage and temperature for long storage purposes.

Keywords: /*Cucumis melo*/ /anthesis/ /storage/ /sugar/ /ethylene/

**Rivas-Garcia, T., Murillo-Amador, B., Nieto-Garibay, A., Rincon-Enriquez, G., Chiquito-Contreras, R. G., & Hernandez-Montiel, L. G. (2019). Enhanced biocontrol of fruit rot on muskmelon by combination treatment with marine *Debaryomyces hansenii* and *Stenotrophomonas rhizophila* and their potential modes of action. Postharvest Biology and Technology, 151, 61–67. DOI: 10.1016/j.postharvbio.2019.01.013**

### Abstract

Separately and in combination a marine yeast *Debaryomyces hansenii* and a marine bacterium *Stenotrophomonas rhizophila* were evaluated for their biocontrol potential against *Fusarium proliferatum* on muskmelon fruit. The results show that the mixture of yeast and bacterium in vitro reduced the growth of *F. proliferatum*, possibly due to either by direct parasitism, nutrient competition, lytic enzymes, biosurfactants and/or volatile organic compounds (VOCs). Disease incidence and lesion diameter caused by *F. proliferatum* on muskmelon was reduced significantly, especially when fruit was inoculated with the mixture of *D. hansenii* + *S. rhizophila*.

These results indicated that *D. hansenii*, *S. rhizophila* and their combination treatments were effective for the postharvest biocontrol of fruit rot on muskmelon.

Keywords: /Marine microorganisms/ /Muskmelon/ /Fruit rot/ /Antagonism/

## **MUSHROOM**

**Yang, W., Shi, C., Hu, Q., Wu, Y., Fang, D., Pei, F., & Mariga, A. M. (2019). Nanocomposite packaging regulate respiration and energy metabolism in *Flammulina velutipes*. *Postharvest Biology and Technology*, 151, 119–126. DOI: 10.1016/j.postharvbio.2019.02.003**

### **Abstract**

Energy metabolism is accompanied with postharvest senescence, deterioration and physiological disorder in *Flammulina velutipes*. In this study, nanocomposite packaging material (Nano-PM) inhibited rapid respiration thus preventing accumulation of reactive oxygen species (ROS). In comparison to the normal packaging material (Normal-PM) and no packaging (No-PM), Nano-PM elevated NADP and NADPH contents by increasing the key enzymes in pentose phosphate pathway (PPP), NADK and G6PDH activities, which was due to ROS removal. Moreover, the package enhanced mitochondrial ATPase activity. Regulation of PPP pathway and elevation of ATPase activity was the main reason for the maintenance of mitochondria membrane and structure integrity. Therefore, Nano-PM maintained sufficient ATP content and energy charge by protecting mitochondria structure and regulating electron transfer of mitochondrial respiratory. Overall, Nano-PM maintained energy metabolism by delaying apoptosis and swelling of mitochondria, thus, it alleviated postharvest senescence of *F. velutipes*.

Keywords: /*Flammulina velutipes*/ /Nanocomposite packaging/ /Mitochondria/ /Respiration metabolism/ /Energy charge/

## **PAPAYA**

**Façanha, R. V., Spricigo, P. C., Purgatto, E., & Jacomino, A. P. (2019). Combined application of ethylene and 1-methylcyclopropene on ripening and volatile compound production of “Golden” papaya. *Postharvest Biology and Technology*, 151, 160–169. DOI: 10.1016/j.postharvbio.2019.02.005**

### **Abstract**

Papaya (*Carica papaya* L.) fruit are consumed worldwide, but they are highly perishable. The effects of the application of 1-methylcyclopropene (1-MCP) with and without ethylene on 'Golden' papaya ripening and production of volatile compounds responsible for aroma. Fruit were treated with 2.5 µl L<sup>-1</sup> ethylene and/or 100 nL L<sup>-1</sup> of 1-MCP for 12 h as follows: I) control, II) ethylene, III) 1-MCP, IV) ethylene + 1-MCP (simultaneous), V) ethylene followed by application of 1-MCP at a 12 h interval and VI) ethylene + 1-MCP without any interval. Pulp

firmness, skin color, skin chlorophyll content, skin and pulp carotenoids, ethylene production, respiratory activity, internal ethylene concentration (IEC), pectin methyl esterase (PME) activity, 1-carboxylic acid-1-aminocyclopropane oxidase (ACC oxidase) activity and volatile compounds were measured. Fruit were stored at 22 °C, with analysis of volatile compounds performed until day 8 and all others until day 6. Fruit treated with only 1-MCP developed rubberized pulp. Fruit treated simultaneously with ethylene and 1-MCP reached desirable firmness for consumption by day 6. Co-application of 1-MCP + ethylene promoted chlorophyll degradation. A consistent increase in ethylene production in 1-MCP-treated fruit above those observed in control fruit and in fruit treated with ethylene only was observed. In relation to volatile compounds, linalool and its oxides were affected less by 1-MCP treatment, with or without ethylene, on days 2 and 6, and did not affect fruit flavor.

Keywords: /Carica papaya/ /1-MCP/ /Rubberized pulp/ /Ethylene/

## PEACH

**Huan, C., Xu, Y., An, X., Yu, M., Ma, R., Zheng, X., & Yu, Z. (2019). iTRAQ-based protein profiling of peach fruit during ripening and senescence under different temperatures. *Postharvest Biology and Technology*, 151, 88–97. DOI: 10.1016/j.postharvbio.2019.01.017**

Abstract:

Ripening and senescence of postharvest fruit under different storage conditions involve different physiological and biochemical processes, but there is still limited knowledge available at proteomic level. In this study, an iTRAQ-based proteomic study was carried out to investigate the protein changes involved in peach fruit ripening and senescence at room temperature (RT, 25 ± 1 °C) and low temperature (LT, 4 ± 1 °C), respectively. A total of 325 proteins were identified as differentially expressed proteins (DEPs) which were mainly related to carbohydrate and energy metabolism, lipid metabolism, amino acid metabolism, signal transduction and stress response and defence. The changes of DEPs indicated that LT storage could significantly affect conversion of starch to fructose and glucose, regulate antioxidant ability and suppress transduction of Ca<sup>2+</sup> signal, which might contribute to the extension of storage life in peach fruit. Meanwhile, long term LT storage could cause oxidative stress, cell wall degradation and flavor loss in peach fruit during the late stage of storage. In contrast, only limited metabolic processes could be affected in peach fruit during RT storage, including suppression of sucrose synthesis and fructose phosphorylation, as well as enhancement of ABA signal and oxidative stress.

Keywords: /Peach fruit/ /iTRAQ/ /Proteomics/ /Temperature/ /Ripening and senescence/

**Sun, Y., Lu, R., Lu, Y., Tu, K., & Pan, L. (2019). Detection of early decay in peaches by structured-illumination reflectance imaging. *Postharvest Biology and Technology*, 151, 68–78. DOI: 10.1016/j.postharvbio.2019.01.011**

Abstract

Peaches are susceptible to fungal infection after harvest, and detection of the symptom at early stage is critical to reducing economic loss for the industry, but is challenging because the symptom is not visible at the surface of infected fruit. This research was therefore aimed to develop a non-destructive and accurate method, based on structured-illumination reflectance imaging (SIRI), for detection of early fungal infection in peaches. Patterned spectral images for seven wavelengths between 690 nm and 810 nm were acquired from 600 peaches of different decayed levels, using a multispectral SIRI system, under sinusoidally-modulated illumination at the spatial frequencies of 60, 100 and 150 m<sup>-1</sup>. The resultant direct component (DC) images, which are equivalent to images acquired under uniform, diffuse illumination, could not reveal the slightly diseased symptom for peaches, but the symptom was visible from the alternating component (AC) images and ratio images calculated from the AC and DC images for the three frequencies. Watershed algorithm and partial least squares discriminant analysis were used for classification of diseased peaches based on the AC and ratio images, which achieved detection rates in the range of 65%–87%. Consistently better detections of diseased peaches were achieved with the AC images at the wavelength of 730 nm and the spatial frequency of 100 m<sup>-1</sup>. The pixel-based convolutional neural network for the AC images of 730 nm and 100 m<sup>-1</sup> frequency achieved an excellent detection rate of 98.6% for all peach samples, and it also demonstrated superior performance for detecting early decayed peaches with nonvisible disease infection symptom at a detection rate of 97.6%. For comparison, detection rates of diseased peaches by the three classification methods for the DC images were consistently lower. This study has shown that SIRI, coupled with an appropriate image classification method, can be effective for early disease detection of peaches.

Keywords: /Peach Disease/ /Early detection/ /Multispectral imaging/ /Structured illumination /Convolutional neural network/

## PEARS

**Li, M., Zhi, H., & Dong, Y. (2019). Textural property and cell wall metabolism of ‘Golden Bosc’ and ‘d’Anjou’ pears as influenced by oxygen regimes after long-term controlled atmosphere storage. *Postharvest Biology and Technology*, 151, 26–35. DOI: 10.1016/j.postharvbio.2019.01.010**

### Abstract

Controlled atmosphere (CA) allows long-term storage of European pears (*Pyrus communis* L.) without chemical treatment to deliver a natural melting (buttery and juicy) texture for consumers. However, the relationship between textural properties and cell wall metabolism as influenced by O<sub>2</sub> regimes has not been comprehensively determined. In this study, ‘Golden Bosc’ and ‘d’Anjou’ pears were stored in 21 (air), 2, 1, or 0.5% O<sub>2</sub> with < 0.5% CO<sub>2</sub> for up to 8 and 10 months at -1.1 °C plus 7 d of ripening at 20 °C, respectively. Melting texture development in both cultivars showed high correlations with the level of water-soluble polyuronides (WSP) and activity of β-galactosidase (β-GAL). Also, activities of pectin methylesterase (PME) and α-arabinofuranosidase (α-ARF) were associated with softening in ‘Golden Bosc’ pears. Concentrations of CDTA-soluble polyuronides (CSP) and WSP + CSP + sodium carbonate-soluble polyuronides (SSP), as well as ethylene production showed positive correlations to melting texture in ‘d’Anjou’ pears. Reducing O<sub>2</sub> concentrations from 21% to

2–1% and 1–0.5% in 'Golden Bosc' and 'd'Anjou' pears allowed pears to develop a desirable eating texture during ripening for up to 8 and 10 months, respectively, with a commercially acceptable levels of postharvest disorders. Use of 1–0.5% O<sub>2</sub> resulted in a melting texture in 'Golden Bosc' pears, but fruit developed more core browning when ripe. These results indicate that O<sub>2</sub> regimes regulate textural qualities by influencing WSP level and β-GAL activity

**Keywords:** /*Pyrus communis*/ /Controlled atmosphere/ /Melting texture/ /Cell wall polyuronides/ / Cell wall-modifying enzymes/

## RADDISH

**Rux, G., Gelewsky, R., Schlüter, O., & Herppich, W. B. (2019). High hydrostatic pressure effects on membrane-related quality parameters of fresh radish tubers. *Postharvest Biology and Technology*, 151, 1–9. DOI: 10.1016/j.postharvbio.2019.01.007**

### Abstract

The impacts of high hydrostatic pressure (HHP) treatments on metabolic functionality and quality of fruit and vegetables are still poorly understood. The effects of pressure intensity (100, 150 and 200 MPa) and holding time (5 and 10 min), and temperatures (20, 30 and 40 °C) during HHP treatment on fresh radish tubers has been studied. Colour, stiffness and turgor of the tubers were evaluated using colorimetry, texture analyses and direct turgor measurements with the cell pressure probe techniques. Comparison of turgor and stiffness losses, and colour changes, of skin and thin-walled parenchymatous inner radish tissue showed the effects of the various HHP treatment parameters on the permeability of biomembranes. HHP treatment resulted in a rapid reduction of cell turgor and, concomitantly of tuber stiffness, but also in a cellular redistribution of anthocyanins as indicated by colour changes. These responses were partially reversible up to 100 MPa applied pressure at 20–40 °C for 5–10 min, yielding a turgor threshold of 0.1 MPa. Beyond these limits, changes were irreversible, most probably due to the denaturation of membrane bound proteins such as ion channels and pumps. Overall, even short-term HHP treatments at room temperature are not suitable for sanitation by inactivating bacteria of perishable produce.

**Keywords:** /Non-thermal processing/ /Postharvest physiology/ /Postharvest processing/ /Pressure probe/ /Produce quality/ /Turgor/

## SPINACH

**Chhetri, V. S., Janes, M. E., King, J. M., Doerrler, W., & Adhikari, A. (2019). Effect of residual chlorine and organic acids on survival and attachment of *Escherichia coli* O157:H7 and *Listeria monocytogenes* on spinach leaves during storage. *LWT-Food Science and Technology*, 105, 298–305. DOI: 10.1016/j.lwt.2019.02.019**

## Abstract

The use of sanitizers during produce wash operation is a common practice, but little is known about the effect of residual sanitizers on minimizing food safety risks associated with post-sanitizing cross-contaminations. This study investigated the effect of residual chlorine and organic acids on the survival and the attachment of *E. coli* O157:H7 and *L. monocytogenes* on spinach leaves during refrigerated storage. The pathogens were spot inoculated on chlorine (100 ppm), lactic acid (0.5%) and acetic acid (0.5%) treated leaves, and their survival during refrigerated storage (4 °C) was examined. A significant reduction ( $P < 0.05$ ) in *E. coli* O157:H7 and *L. monocytogenes* populations was observed within 15 min of exposure on chlorine-treated leaves, with total reductions of 2.64 and 3.15 log CFU/cm<sup>2</sup> respectively after 48 h. On 0.5% lactic acid treated leaves, the reduction in *E. coli* O157:H7 and *L. monocytogenes* population was 3.07 log CFU/cm<sup>2</sup> (24 h) and 1.40 log CFU/cm<sup>2</sup> (48 h), respectively. The effect of residual sanitizers was significantly greater on loosely attached populations compared to strongly attached populations. These results indicate that the residual sanitizers present on vegetable leaves after sanitizers wash may have a role in reducing the risks associated with post-sanitizing cross-contamination.

Keywords: /Chlorine Organic acids/ /Fresh produce/ /Bacterial survival/ /Attachment/

**Song, Y. S., Stewart, D., Reineke, K., Wang, L., Ma, C., Lu, Y., . . . Tortorello, M. L. (2019). Effects of package atmosphere and storage conditions on minimizing risk of escherichia coli O157:H7 in packaged fresh baby spinach. *Journal of Food Protection*, 82(5), 844-853. DOI: 10.4315/0362-028XJFP-18-337**

## Abstract

Packaged fresh spinach has been associated with outbreaks of illness caused by *Escherichia coli* O157:H7. The purpose of this study was to assess the behavior of *E. coli* O157:H7 in packaged baby spinach in response to storage conditions of temperature and package atmosphere and including effects of inoculation level, spinach leaf damage (cut leaves), internalized or leaf surface contamination, exposure to hypochlorite sanitizer, and package size. Behavior of *E. coli* O157:H7 inoculated at 2 and 4 log CFU/g on spinach packaged in polymer bags composed of a two-layer laminate (polypropylene and polyethylene) and stored under atmospheres of 20% O<sub>2</sub>-3% CO<sub>2</sub> and 0% O<sub>2</sub>-15% CO<sub>2</sub> (aerobic and anaerobic, respectively) was assessed at 5, 7, 12, and 15°C for up to 14 days. Growth kinetics were calculated using DMFit software. Temperature decreases progressively diminished growth or survival of the pathogen, and an aerobic package atmosphere resulted in longer lag times (4 to 6 days) and lower population levels (0.2 to 1.4 log CFU/g) compared with the anaerobic atmosphere at 15°C. Internalized contamination, leaf cuts, or exposure to 100 ppm of hypochlorite did not result in changes in pathogen behavior compared with controls; however, a growth minimization trend consisting of longer lag times and lower population levels was repeatedly observed in the aerobic compared with the anaerobic package atmospheres. In contrast, growth of indigenous mesophiles and Enterobacteriaceae was unaffected by package atmosphere. Spinach stored at 5 to 7°C in two sizes (5 and 16 oz) of polyethylene terephthalate clamshell packages with ambient air atmospheres was more likely to progress to lower-oxygen conditions in 16-oz compared with 5-oz packages after 7 days of storage ( $P < 0.05$ ). Practices to maintain aerobic

conditions within the package, as well as storage of the package at low temperature, are ways to limit growth of *E. coli* O157:H7 in packaged spinach.

Keywords: /*Escherichia coli* O157:H7/ /Leafy greens/ /Modified atmosphere packaging/ /Spinach/

## STRAWBERRY

**Ghasemi-Varnamkhasi, M., Mohammad-Razdari, A., Yoosefian, S. H., Izadi, Z., & Rabiei, G. (2019). Selection of an optimized metal oxide semiconductor sensor (MOS) array for freshness characterization of strawberry in polymer packages using response surface method (RSM). *Postharvest Biology and Technology*, 151, 53–60. DOI: 10.1016/j.postharvbio.2019.01.016**

### Abstract

An eight metal oxide semiconductor sensor (MOS) based electronic nose (e-nose) has been used to characterize freshness of strawberry in different polymer package types. Pattern recognition methods such as principal component analysis (PCA), linear discriminant analysis (LDA), and support vector machine (SVM) were used to classify and investigate the effects of polymer packages on strawberry freshness. The packages were Ethylene Vinyl Alcohol (EVOH), Polypropylene (PPP), and Polyvinyl chloride (PVC). The response surface method (RSM) was considered for selection of optimized sensor array in terms of the contribution of each sensor in sample classification. Sample headspace patterns were examined on days 1, 8 and 16. The results revealed that PCA explains 84% of the variance between the data. The LDA classified samples with an accuracy of 86.4%. The SVM method with polynomial function could accurately recognize samples as C-SVM by 86.4% and 50.6% in training and validation, and as Nu-SVM by 85.2% and 55.6% in training and validation with a radial basis function, respectively. Finally, among the eight sensors used in the study, MQ8, MQ3, TGS813, MQ4, and MQ136 sensors were selected as optimal response sensors using RSM to reduce the cost of fabrication. Furthermore, optimal application sensors for each polymer package were identified using RSM.

Keywords: /Electronic nose/ /Strawberry/ / Response surface/ /Optimized sensors/