

**SELECTIVE DESSIMINATION OF INFORMATION (SDI)  
PDF REPRINTS AS OF APRIL 2013**

**GENERAL**

**HACCP**

Dimitrios P. Kafetzopoulos, Dimitrios, et.al. 2013. Measuring the effectiveness of the **HACCP** food safety management system. Food Control. 33: 505 – 513.

**Abstract**

The Hazard Analysis and Critical Control Point (HACCP) is a Food Safety Management System (FSMS) that is recognized in the international food safety community as a world wide guideline for controlling food borne safety hazards. Nevertheless, the availability of a diagnostic instrument to assess the performance and effectiveness of the FSMS is rather restricted; therefore, the food sector needs an instrument to measure the effectiveness of FSMS. Based on the HACCP objectives identified in the literature, in this research, HACCP effectiveness is defined as the degree of achieving its objectives. A measurement instrument is developed and then empirically validated through collecting preliminary data from 335 Greek food enterprises. After testing the assumptions of multivariate analysis, Exploratory Factor Analysis as well as first and second order Confirmatory Factor Analysis are applied. This study reveals the three-dimensional nature of the HACCP objectives (hazard identification, hazard assessment and hazard control). Further analysis of the data also reveals a valid latent factor reflecting the successful achievement of the HACCP objectives, namely “HACCP effectiveness”. This measurement instrument can be used by a food company as a self assessment tool and a benchmarking tool. In doing so, suitable strategies can be selected in order for a food company to allocate resources, increase HACCP effectiveness and improve its product safety.

**Keywords:** /HACCP/ /Food Safety/

**IRADIATION**

Cote, Sandra, et.al. 2013. Effect of **radiation** intensity on the outcome of postharvest UV-C treatments Postharvest Biol. & Technol. 83: 83 – 89.

**Abstract**

Studies on the use of UV-C radiation of fresh produce have focused on the selection of appropriate doses(energy per unit area) for different commodities, but little attention has been placed on the effect of radiation intensity (dose per unit time). In this study, tomatoes (*Solanum lycopersicum* cv. Elpida) and strawberries (*Fragaria × ananassa* cv. Camarosa), were harvested (breaker and 100% of surface red color respectively) and treated with 4 kJ m<sup>-2</sup>of UV-C, at low (3 W m<sup>-2</sup>) or high (33 W m<sup>-2</sup>) radiation intensities. Untreated fruits were used as controls. After the treatments and at different storage times

the incidence of postharvest rots and the changes in fruit physical and chemical properties were determined. UV-C treatments reduced decay, with the effects being more marked in fruit exposed to high intensities. Mold counts were unaffected by the treatments, suggesting that improved disease control did not result from greater germicide effect. In both fruit species exposure to UV-C radiation delayed ripening, evidenced as lower color development, pigment accumulation and softening. UV-C-treated fruit maintained better quality than the control. In strawberry, high intensity treatments were more effective to prevent deterioration than in tomato where the differences between UV-C treatments were subtler. Soluble solids, titratable acidity and ethanol soluble antioxidants were not affected regardless of the UV-C intensity. Consumer tests showed higher preference of fruit treated at high UV-C intensity. Results show that in addition to the applied dose, radiation intensity is a main factor determining the effectiveness of UV-C treatments and should not be over-sighted. For a given dose, increasing radiation intensity may in some cases maximize the benefits of UV-C on fruit quality, while significantly reducing the treatments time.

**Keywords:** /Irradiation/ /Postharvest/ /Quality/ /Tomato/ /Strawberry

## **LEAFY VEGETABLES**

Cheng, Liu Chen, Nynke Hofstra, Eelco Franz. 2013. Impacts of climate change on the microbial safety of pre-harvest **leafy green vegetables** as indicated by *Escherichia coli* O157 and *Salmonella* spp. *Int'l. J. Food Microbiol.* 163: 119 – 128.

### **Abstract**

The likelihood of leafy green vegetable (LGV) contamination and the associated pathogen growth and survival are strongly related to climatic conditions. Particularly temperature increase and precipitation pattern changes have a close relationship not only with the fate and transport of enteric bacteria, but also with their growth and survival. Using all relevant literature, this study reviews and synthesises major impacts of climate change (temperature increases and precipitation pattern changes) on contamination sources (manure, soil, surface water, sewage and wildlife) and pathways of food borne pathogens (focussing on *Escherichia coli* O157 and *Salmonella* spp.) on pre-harvested LGVs. Whether climate change increases their prevalence depends not only on the resulting local balance of the positive and negative impacts but also on the selected regional climate change scenarios. However, the contamination risks are likely to increase. This review shows the need for quantitative modelling approaches with scenario analyses and additional laboratory experiments. This study gives an extensive overview of the impacts of climate change on the contamination of pre-harvested LGVs and shows that climate change should not be ignored in food safety management and research.

**Keywords:** /Leafy Vegetables/ /Temperature/

## **FRUITS**

### **APRICOT**

Stan;ey, Jill, et.al. 2013. Effect of harvest maturity and cold storage on correlations between fruit properties during ripening of **apricot** (*Prunus armeniaca*). *Postharvest Biol. & Technol.* 82: 39 – 50.

## Abstract

Apricots (*Prunus armeniaca*) were held in air storage at 0 °C and ripened at 20 °C, or ripened at 20 °C straight after harvest, and changes in fruit quality quantified using postharvest and sensory evaluations. Maturity at harvest significantly affected flesh firmness and other quality factors. Mealiness and gel formation only developed in fruit that had been stored at low (0 °C) temperatures. Mealiness did not develop until firmness dropped below approximately 20 N, whereas gel formation began to develop when firmness was as high as 35 N. Development of mealiness and loss of juiciness were correlated; however, slight mealiness was perceived when fruit were still considered juicy. Specific cultivar-related differences were evident in the changes in firmness and development of gel formation during and after cold storage. Fruit were less liked by the sensory panel when firmness dropped below 20 N, as juiciness decreased and mealiness and gel formation increased. Cell wall studies showed changes in yields of water-soluble and CDTA (trans-1,2-cyclohexanediamine tetraacetic acid)-soluble pectin. In fruit ripened after cold storage, mealiness and gel formation was accompanied by an increase in water-soluble pectin and an increase in CDTA-soluble pectin, whereas in apricots ripened straight after harvest, water-soluble pectin increased but CDTA-soluble pectin slightly decreased. All fruit, regardless of maturity or having chilling disorders or not, fitted the same correlation between firmness and uronic acid content of water-soluble pectin, but no pattern was evident for CDTA-soluble pectin. We concluded that the increasing solubilisation of pectin was a major feature of fruit softening in apricot, whereas the differences in CDTA-soluble pectin may reflect differences in strength of cell adhesion.

**Keywords:** /Apricot/ /Fruit Softening/ /Mealiness/ /Fruit Quality/

## BANANA

Carneiro, Raphaella P., et.al. 2013. Development and method validation for determination of 128 pesticides in **bananas** by modified QuEChERS and UHPLCeMS/MS analysis. *Food Control*. **33**: 413 – 423.

## Abstract

A multi residue method for the quantification of 128 pesticides in banana is described. It involves the application of a modified QuEChERS procedure followed by UHPLCeMS/MS (Ultra High Performance Liquid Chromatography coupled to Tandem Mass Spectrometry) analysis. The method was validated according to the European Union SANCO/12495/2011 guidelines and Brazilian Manual of Analytical Quality Assurance. The validation levels were 10.0; 25.0; 50.0 and 100 mg kg<sup>-1</sup>. Acceptable values were obtained for the following parameters: linearity, limit of detection e LOD (5.00 mg kg<sup>-1</sup>) and limit of quantification e LOQ (10.0 mg kg<sup>-1</sup>), except for fenamiphos and mevinphos (LOD ¼ 7.5 mg kg<sup>-1</sup> and LOQ ¼ 25 mg kg<sup>-1</sup>), trueness (for the levels: 10.0, 25.0, 50.0 and 100 mg kg<sup>-1</sup> the recovery assays values were between 70 and 120%) except for methamidophos at 10 mg kg<sup>-1</sup> level (67.5%), intermediate precision (<20.0%) and measurement uncertainty tests (<50.0%). These results demonstrate the applicability of this method in the routine practice by the laboratories of Ministry of Agriculture, Livestock and Food Supply of Brazil that attend the National Control Plan for Residues and Contaminants (PNCRC).

**Keywords:** /Banana/ /Pesticides/

## BLUEBERRY

Leiva-Valenzuela, Gabriel A. 2013. Automatic detection of orientation and diseases in blueberries using image analysis to improve their postharvest storage quality. *Food Control*. 33: 166 – 173.

### Abstract

The production of the South American blueberry has increased by over 40% in the last decade. However, during storage and shipping, several problems can lead to rejections. This work proposes a pattern recognition method to automatically distinguish stem and calyx ends and detect damaged berries. First, blueberries were imaged under standard conditions to extract color and geometrical features. Second, five algorithms were tested to select the best features to be used in the subsequent evaluation of classification algorithms and cross-validation. The blueberries classes were control, fungally decayed, shrivelled, and mechanically damaged. The original 951 features extracted were reduced to 20 or fewer with sequential forward selection. The best classifiers were Support Vector Machine and Linear Discriminant Analysis. Using these classifiers made it possible to successfully distinguish the blueberries' orientation in 96.8% of the cases. By evaluating damages to fungally decayed, shrivelled, and mechanically damaged blueberries, the average performances of the classifiers were above 97%, 93.3%, and 86% respectively. All of the experiments were evaluated using external images with 95% confidence e 10-fold cross-validation. These results are promising because they will allow for the increase in export quality when implemented in production lines.

**Keywords:** /Blueberry/ / Postharvest Diseases/

Rivera, Sebastian A., Juan P. Zoffoli, Bernardo A. Latorre. 2013. Determination of optimal sulphur dioxide time and concentration product for postharvest control of gray mold of blueberry fruit. *Postharvest Biol. & Technol.* 83: 40 – 46.

### Abstract

Highbush blueberries (*Vaccinium* spp.) are a major export fruit crop of Chile which is stored at 0°C and transported to markets in Asia, Europe, and the USA, using more than 15 d of maritime transportation. Under these conditions, gray mold caused by *Botrytis cinerea* can produce important economic losses. The effectiveness of sulfur dioxide (SO<sub>2</sub>) concentration × time treatments on gray mold control was determined in the laboratory and validated prior to refrigerating the fruit, using pallet scale SO<sub>2</sub> fumigation treatment on the following blueberry cultivars: 'Brigitta', 'Legacy', 'Liberty' and 'O'Neal'. In inoculated 'Brigitta' and 'Liberty' blueberries, gray mold prevalence varied from 97.2% to 97.5% in non-treated fruit, and this value was reduced from 7.9% to 6.1% in blueberries that were exposed to a SO<sub>2</sub> concentration × time (Ct) product of 400 (μL L<sup>-1</sup>) h. The relationship between SO<sub>2</sub>Ct products and gray mold prevalence under laboratory conditions was best explained by exponential models, which had a determination coefficient (R<sup>2</sup>) that ranged from 0.88 to 0.96. The estimated EC<sub>90</sub> values varied between 245 and 400 (μL L<sup>-1</sup>) h, and the SO<sub>2</sub>Ct between 250 and 350 (μL L<sup>-1</sup>) h was validated using a pallet scale application treatment to obtain the best control and minimal variation. No visual phytotoxicity symptoms of SO<sub>2</sub> were observed with the Ct that was tested in this study. Therefore, SO<sub>2</sub> fumigation was demonstrated to be an effective and practical technology for reducing the risk of blueberry gray mold decay during storage, and further effort should be given to register the use of this product for blueberries in the main Chilean export markets.

**Keywords:** /Blueberry/ /Postharvest Control/ /Gray Mold/

## **KIWIFRUIT**

Yin, Xue-ren, et.al. 2013. Effects of acetylsalicylic acid on kiwifruit ethylene biosynthesis and signaling components. *Postharvest Biol. & Technol.* 83: 27 – 33.

### **Abstract**

The effects of acetylsalicylic acid (ASA) on kiwifruit (*Actinidia deliciosa* cvs Bruno and Hayward) ethylene biosynthesis and signaling were investigated. Exogenous application of ASA inhibited ethylene production in both whole fruit, and in vitro with flesh discs, and enzymes associated with ethylene biosynthesis (ACS and ACO). The effect of ASA treatment on kiwifruit softening was relatively weak. Combination treatments also had inhibitory effects on fruit ripening, with ASA + C<sub>2</sub>H<sub>4</sub> more effective than C<sub>2</sub>H<sub>4</sub> + ASA. In order to evaluate the effects of ASA on ethylene signaling, twenty-four ethylene signaling components (five ethylene receptors, two CTR1 like genes, four EIN3-like genes and thirteen ERF genes) were analyzed at the transcriptional level. The results indicated that ASA treatment generally inhibited ethylene-induced modulation of ethylene receptor genes, and had little effect on softening-related ethylene signaling components, which suggested that ASA inhibits fruit ripening mainly by interfering directly with ethylene biosynthesis and perception. In addition, the ethylene response factors AdERF1, AdERF3 and AdERF12 were characterized as ASA-responsive genes, and their roles in fruit stress response are also discussed.

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

## **LEMON**

Cerionia, L. 2013. Control of lemon postharvest diseases by low-toxicity salts combined with hydrogen peroxide and heat. *Postharvest Biol. & Technol.* 83: 17 – 21.

### **Abstract**

The effectiveness of potassium sorbate, sodium bicarbonate and potassium phosphite combined with heat and hydrogen peroxide in the presence of CuSO<sub>4</sub> to control major lemon postharvest diseases was investigated on artificially infected fruit. Green and blue molds, which both require wounds for infections to occur, were controlled by combination of hydrogen peroxide followed by inorganic salts, even when the temperature solutions were 25 °C. Control of sour rot was poor with salt solutions alone but significantly improved in treatments including hydrogen peroxide followed by potassium sorbate or sodium bicarbonate at 50 °C. Phomopsis stem-end rot was effectively controlled by potassium sorbate and potassium phosphite at 20 °C, and diplodia stem-end rot was partially controlled only by potassium sorbate. Applications of either potassium sorbate or a sequence of hydrogen peroxide followed by potassium phosphite were the most promising treatments, primarily because they controlled most of the diseases without the need to heat the solutions. These treatments controlled postharvest citrus diseases to useful levels and could be suitable alternative to conventional fungicides, or could be applied with them to improve their performance or to manage fungicide resistant isolates.

**Keywords:** /Lemon/ /Postharvest Diseases/ /Postharvest Diseases/ / Stem-end Rot/ /Green Mold/

## **LIME**

Bassan, Meire M. et.al. 2013. The harvesting system affects the quality and conservation of the 'Tahiti' acid lime . Scientia Hort. 155: 72 – 77.

### **Abstract**

The inadequate management of 'Tahiti' acid lime harvesting has led to quality loss and reduced profit-ability for producers and exporters. This study evaluated the quality and conservation of 'Tahiti' acid limes for export using four different harvesting systems. Fruit were harvested with scissors, by twisting, with the help of a metal basket and with a hook. After harvesting, the fruit were processed and stored at  $9 \pm 2$  °C and  $75 \pm 5\%$  relative humidity (RH) for 30 d, simulating the conditions of export in refrigerated containers. The fruit were then transferred to  $22 \pm 2$  °C and  $75 \pm 5\%$  RH for 30 d, according to the commercialization conditions for the fruit. Harvesting with scissors led to a greater conservation of fresh mass, color and peel chlorophyll content of fruit compared with the use of a hook for harvesting. The levels of soluble solids, titratable acidity and ascorbic acid were not influenced by the harvesting system. Fruit harvested with a hook had a higher percentage of oleocellosis and a 30% reduction in the marketable amount compared with fruit harvested by scissors. Mechanical injuries caused during harvest also led to changes in the flavor and aroma of the 'Tahiti' acid limes. The results suggest that the physical damage incurred during harvesting prevents the postharvest treatments of 'Tahiti' acid limes from providing the expected response with regard to the maintenance of fruit quality and conservation.

**Keywords:** /Lime/ /Harvesting/ /Quality/

## **PAPAYA**

Bautista-Baños, Silvia, et.al. 2013. A review of the management alternatives for controlling fungi on papaya fruit during the postharvest supply chain. Crop Protection. 49: 8 – 20.

### **Abstract**

Due to their flavor and nutritional characteristics, papaya fruit are consumed worldwide. As a tropical commodity, storage has serious limitations that result in their rapid deterioration and high incidence of rots during handling and storage. Postharvest handling of papaya differs according to destination. For export markets, there are well-defined postharvest steps established that include technologies that generally avoid disease incidence. For national markets, the postharvest chain is short but characterized by poor handling practices that can result in serious losses due to microorganisms. Anthracnose is considered the main postharvest disease, but development of other rots may also limit good fruit quality, as is the case with, among others, stem-end rots. Control of papaya rots for export markets are applied in accordance with import export regulations, while for the national market it has typically relied on synthetic fungicides; however, due to their already known 'side-effects' on humans and the environment, other alternatives alone or combined should be tested in integrated technologies. We reviewed the available literature on different control methods to reduce postharvest diseases during papaya storage, including those that reported on their effects on fruit quality. Wax combined with fungicides and heat is currently in use. Other methods, such as the application of irradiation, antagonistic microorganisms and natural compounds [e.g. chitosan and plant derivatives (extracts,

essential oils and isothiocyanates)], are still under evaluation, but have yielded promising initial results. The application of various organic salts and minerals and modified and controlled atmosphere technologies using ozone and volatiles such as 1- methycyclopropane are also under experimentation. We believe that research areas that include preharvest experimentation aimed at reducing postharvest diseases on papaya fruit should be taken into account. Finally, the integration of more than one control method will reduce the incidence of rots, and therefore improve and extend the storage life of this important commodity.

**Keywords:** /Papaya/ /Postharvest/ /Supply Chain/

Lima, J.R., et.al. 2013. Use of killer yeast in the management of postharvest **papaya** anthracnose  
Postharvest Biol. & Technol. 83: 58 – 64.

### **Abstract**

The efficiency of two killer yeast strains, *Wickerhamomyces anomalus* (strain 422) and *Meyerozyma guilliermondii* (strain 443), as biocontrol agents against *Colletotrichum gloeosporioides*, a postharvest anthracnose agent of papaya and other tropical fruit, was assessed. These strains were previously selected through in vitro assays, but in the present study, their in vivo action was assessed. In addition, the influence of phytopathogen inoculation time on the fruit in combination with the use of the biocontrol agent was also assessed. We assessed mycoparasitism as an antagonistic mechanism of action by scanning electron microscopy (SEM). In addition, two hydrolytic enzymes, chitinase and  $\alpha$ -1,3 glucanase, were assayed. Our results indicated that *W. anomalus* (strain 422) and *M. guilliermondii* (strain 443) reduced disease incidence by 24.62% and 20.68%, respectively, for up to 6 d after inoculation, when applied 3 h before the phytopathogen and incubated in a wet chamber (95% RH) at 28°C. The time of yeast inoculation had a significant effect on its antagonistic action. Application of the yeasts 12 or 24 h before the phytopathogen inoculation resulted in 13.75% and 30% of disease reductions for *W. anomalus* (strain 422) and 31.35% and 41.17% reductions for *M. guilliermondii* (strain 443), respectively. Electron micrographs confirmed mycoparasitism by showing the interaction of the yeasts with *C. gloeosporioides* hyphae, causing in some cases, a loss of turgor and yeast penetration of walls with marked concavity formation on hypha cellwalls.

**Keywords:** /Papaya/ /Anthracnose/ /Postharvest/

### **PEACH**

Guillén, Fabian. 2013. Aloe arborescens and Aloe vera gels as coatings in delaying postharvest ripening in each and **plum** fruit. Postharvest Biol. & Technol. 83: 54 – 57.

### **Abstract**

Recently harvested peaches and plums were coated with either Aloe vera or Aloe arborescens gels and allowed to ripen at 20°C for six days. Both coatings significantly delayed ethylene production, the effect being higher in plum which had the highest ethylene production rates. Changes in quality parameters related to peach and plum postharvest ripening, such as colour changes, reduction of acidity and increasing in ripening index (total soluble solids/total acidity ratio), were significantly delayed in coated fruit. In addition, both coatings significantly reduced weight loss, especially the *A. arborescens*

gel. Thus, *A. arborescens* gel could be even more effective than *A. vera* gel for use as an edible coating for preserving the quality of climacteric fruit.

**Keywords:** /Plum/ /Postharvest/ /Ripening/

Sisquella, M. et.al. 2013. Combination of peracetic acid and hot water treatment to control postharvest brown rot on peaches and nectarines. *Postharvest Biol. & Technol.* 81: 1 – 8.

### **Abstract**

Brown rot caused by *Monilinia* spp. is the most important postharvest disease of stone fruit. From pre-liminary studies, the combination of 0.25% hydrogen peroxide, 0.02% peracetic acid (PAA) and 0.075% acetic acid, corresponding to 300 mg L<sup>-1</sup> of PAA, was selected to control *Monilinia fructicola*. Brown rot control was similarly controlled when the same concentration of PAA was applied with a PAA-based commercial product. In order to reduce PAA concentration, combinations of different concentrations and temperatures were evaluated. A treatment of 200 mg L<sup>-1</sup> of PAA at 40 °C for 40 s was selected to control pre-existing and future infections, different inoculum concentrations of *M. fructicola* and to control brown rot on naturally infected fruit. Brown rot was completely controlled with the selected treatment when peaches and nectarines were inoculated 0 h before the treatment but it was not controlled when infection time was increased to 24, 48 and 72 h. Also, the treatment significantly controlled brown rot at all inoculum concentrations evaluated (10<sup>3</sup>, 10<sup>4</sup>, 10<sup>5</sup> and 10<sup>6</sup> conidia mL<sup>-1</sup>) in both peaches and nectarines, but no protection against future infections was observed. In naturally infected fruit, brown rot incidence was slightly but significantly reduced to 61 and 36% in 'Roig d'Albesa' and 'Placido' peaches, respectively, but not in nectarines. Immersion for 40 s in 200 mg L<sup>-1</sup> of PAA at 40 °C provides an alternative treatment to control only recent infections of *Monilinia* spp. whatever their concentration without generally affecting fruit quality.

**Keywords:** /Peach/ /Hot Water Treatment/

### **PEAR**

Sugar, David, Sally R. Basile. 2013. Integrated ethylene and temperature conditioning for induction of ripening capacity 'Anjou' and 'Comice' pears. *Postharvest Biol. & Technol.* 83: 9 – 16.

### **Abstract**

'Anjou' and 'Comice' pears from three harvest dates were conditioned to develop ripening capacity by exposure to 100 μL L<sup>-1</sup> ethylene at 20 °C for 0, 24, 48, or 72 h, followed by varying durations of temperature conditioning at -0.5 or 10 °C. Ripening capacity was tested by measuring fruit firmness after 7 d at 20 °C after completion of conditioning treatments. Fruit firmness was also measured after conditioning but before ripening, and was designated "shipping firmness", indicative of the potential for the fruit to withstand transport conditions without physical injury. Ripening capacity in both cultivars developed more rapidly with later harvest date, increasing duration of ethylene conditioning, and increasing duration of temperature conditioning. Ripening capacity developed much more rapidly at 10 °C than at -0.5 °C. Useful durations of temperature conditioning at 10 °C were limited by fruit softening below acceptable values of shipping firmness. However, sequential combinations of ethylene and temperature conditioning at both -0.5 and 10 °C were identified wherein post-conditioning shipping firmness was acceptable.

**Keywords:** /Pear/ /Ripening/ /Ethylene/

Wang, Yan, David Sugar. 2013. Internal browning disorder and fruit quality in modified atmosphere packaged 'Bartlett' pears during storage and transit. *Postharvest Biol. & Technol.* 83: 72 – 82.

### **Abstract**

Internal browning (IB) can be a serious problem with the use of modified atmosphere packaging (MAP) for 'Bartlett' pears (*Pyrus communis* L.) grown in the Pacific Northwest during storage and transit to distant markets. To investigate this disorder, 'Bartlett' pears harvested at commercial maturity were packed in a commercial MAP (MAPc), an experimental MAP (MAPe) and commercial perforated plastic bags (control) and stored in air at  $-1.1^{\circ}\text{C}$ . After 1 and 3 months of storage, samples of MAPc and control fruit were transferred to rooms at temperatures of 2, 4.5, 7.5, and  $10^{\circ}\text{C}$  for 3 weeks to simulate transit temperatures and the time required to reach distant markets. MAPc maintained an average internal atmosphere of 12.3%  $\text{O}_2$  + 5.6%  $\text{CO}_2$  and significantly extended 'Bartlett' pear storage life with high eating quality and without IB and other disorders for up to 4 months at  $-1.1^{\circ}\text{C}$ . The internal gas atmosphere of MAPe equilibrated at 2.2%  $\text{O}_2$  + 5.7%  $\text{CO}_2$ , which resulted in fruit with 25.5 and 62.3% IB after 3 and 4 months of storage, respectively. During simulated transit conditions of 2, 4.5, 7.5, and  $10^{\circ}\text{C}$ , the  $\text{CO}_2$  level in MAPc was maintained at 5.6–7.9%, while  $\text{O}_2$  was reduced dramatically to 10.5, 5.0, 2.5, and 1.0%, respectively. IB developed at 7.5 and  $10^{\circ}\text{C}$  but not at 2 and  $4.5^{\circ}\text{C}$ , regardless of pre-transit storage duration (1 and 3 months) at  $-1.1^{\circ}\text{C}$ . The longer the storage duration and the higher transit temperature, the higher the incidence and severity of IB. The MAP-related IB disorder observed in this study included two types of symptoms: classic pithy brown core and wet brown flesh. The MAPc storage gas atmospheres maintained fruit firmness, color and higher eating quality after ripening, eliminated senescent scald and core breakdown, suppressed the loss of ascorbic acid (AsA) and titratable acidity, and slowed the accumulation of malondialdehyde (MDA) during storage at  $-1.1^{\circ}\text{C}$  for up to 4 months or 3 months + 3 weeks at simulated transit temperatures of 2 and  $4.5^{\circ}\text{C}$ . In contrast, fruit held in MAP with low  $\text{O}_2$  levels (1.0–2.5%) developed IB that appeared to be associated with a reduction in AsA, accumulated MDA and exhibited an increase in membrane leakage. MAP inhibited ripening at high  $\text{CO}_2$  + high  $\text{O}_2$  but led to IB when the packaging material or elevated temperatures resulted in high  $\text{CO}_2$  + low  $\text{O}_2$  conditions. The incidence of IB closely correlated with lipid peroxidation and appeared to be related to fruit AsA concentration. The MAPc designed for pears appears to be suitable for 'Bartlett' fruit stored at  $-1.1^{\circ}\text{C}$  for up to 4 months or storage for 3 months and a transportation duration of up to 3 weeks at  $0$ – $4.5^{\circ}\text{C}$  during the early season and at  $0$ – $2^{\circ}\text{C}$  during the late packing season. These conditions yielded fruit of high eating quality and without IB or over-ripening upon arrival at distant markets.

**Keywords:** /Pear/ /Modified Atmosphere Packaging/ /Internal Browning/

### **STRAWBERRY**

Aday, Mehmet Seckin, et.al. 2013. An innovative technique for extending shelf life of strawberry: ultrasound. *LWT – Food Sci. & Technol.* 52: 93 – 101.

### **Abstract**

Ultrasound is one of the newest nonthermal methods to extend shelf life of fresh fruits during storage. The effectiveness of ultrasound depends on wave frequency, power and treatment time. The present study was designed to determine the effect of different ultrasound powers (30 W, 60 W, 90 W) and treatment times (5 min, 10 min) on quality of strawberry. Oxygen concentration inside packages of strawberries which treated with 30 W and 60 W ultrasound powers were higher than 90 W and control (CNT) groups. A sharp increase in CO<sub>2</sub> release rate was observed for the CNT and 90 W treatments during the storage. Attributes such as pH, total soluble solid content and color for the 30 W and 60 W treatments were better than CNT and 90 W treatments. Decay incidence analysis confirmed that all ultrasound treatments were effective to reduce mold growth. The 30 W and 60 W treatments maintained better textural properties compared with 90 W and CNT groups. FT-NIR analysis was used to quantify water and sugar content of strawberries. As a result, it was concluded that ultrasound power as high as 90 W resulted in detrimental effects on strawberry quality, while power levels between 30 W and 60 W had improved quality and can be used to extend shelf life of strawberry.

**Keywords:** /Strawberry/ /Shelf Life/ /Texture/

Agudelo-Laverde, Lina M. ,Crolina Schebor, María del Pilar Buera. 2013. Water content effect on the chromatic attributes of dehydrated strawberries during storage, as evaluated by image analysis. LWT – Food Sci. & Technol. 52: 157 – 162.

### Abstract

The changes of chromatic attributes due to different hydration degree, anthocyanins degradation and browning development were studied in dehydrated strawberries. Strawberry slices were freeze-dried, equilibrated at different relative humidities and stored at 45 °C. The changes of several functions of the CIELAB color space were analyzed using a computer vision system, employing segmented image analysis. Darkening promoted by browning reactions could be evaluated through the decrease of luminosity and increase of hue angle and yellow coordinate in the whitish sections of the samples. During humidification the anthocyanin degradation increased as increasing water content. Of the several color functions, only the red coordinate values of the reddish sections of the samples correlated with anthocyanin degradation, but at relative humidities values higher than 43%. Light diffusion in the dried material caused a lighter appearance up to 75% relative humidity, while browning reaction and pigment degradation were accelerated at this relative humidity. These effects were related with the appearance of mobile water populations in the material, as detected by <sup>1</sup>H NMR.

**Keywords:** /Strawberry/ /Storage/

Aday, Mehmet Seckin, et.al. 2013. An innovative technique for extending shelf life of strawberry: ultrasound. LWT – Food Sci. & Technol. 52: 93 – 101.

### Abstract

Ultrasound is one of the newest non thermal methods to extend shelf life of fresh fruits during storage. The effectiveness of ultrasound depends on wave frequency, power and treatment time. The present study was designed to determine the effect of different ultrasound powers (30 W, 60 W, 90 W) and treatment times (5 min, 10 min) on quality of strawberry. Oxygen concentration inside packages of strawberries which treated with 30 W and 60 W ultrasound powers were higher than 90 W and control (CNT) groups. A sharp increase in CO<sub>2</sub> release rate was observed for the CNT and 90 W treatments

during the storage. Attributes such as pH, total soluble solid content and color for the 30W and 60W treatments were better than CNT and 90 W treatments. Decay incidence analysis confirmed that all ultrasound treatments were effective to reduce mold growth. The 30 W and 60 W treatments maintained better textural properties compared with 90W and CNT groups. FT-NIR analysis was used to quantify water and sugar content of strawberries. As a result, it was concluded that ultrasound power as high as 90 W resulted in detrimental effects on strawberry quality, while power levels between 30 W and 60 W had improved quality and can be used to extend shelf life of strawberry.

**Keywords:** /Strawberry/ /Shelf Life/ /

Vandendriessche, T., et.al. 2013. Effect of ripening and inter-cultivar differences on **strawberry** quality. LWT – Food Sci. & Technol. 52: 62 – 70.

### **Abstract**

Strawberry breeding programs for strawberry (*Fragaria\_ ananassa* Duch.) focus on developing cultivars with enhanced flavor and improved levels of health-related compounds. To assist this trend, a number of techniques were integrated into a single instrumental platform for high-throughput quality analysis of new strawberry cultivars. This platform was used to monitor the intrinsic properties of strawberries during ripening and to identify differences in sensory quality among nine strawberry cultivars. Through multivariate statistical analysis, 1-penten-3-ol was identified as a marker for unripe strawberries, whereas esters as methyl butanoate, pentyl acetate and methyl hexanoate distinguish ripe strawberries. Furthermore, ripe strawberries were characterized by higher sugar levels and decreased acidity and firmness. Additionally, the high-throughput platform could successfully discriminate between the different tested cultivars.

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

Velickova, Elena, et.al. 2012. Impact of chitosan-beeswax edible coatings on the quality of fresh **strawberries** (*Fragaria ananassa* cv Camarosa) under commercial storage conditions. LWT – Food Sci. & Technol. 52: 80 – 92.

### **Abstract**

Chitosan-based edible coatings were used to prolong the shelf-life of strawberries stored at 20 °C and 85% RH. Strawberries were coated with four different coating formulations (chitosan as monolayer, three layer coating consisting of separate beeswax-chitosan-beeswax layers, three layer coating where chitosan was crosslinked with sodium tripolyphosphate, TPP, and composite). The effectiveness of the coatings was evaluated by the changes of several parameters: fungal infection, weight loss, respiration rate, skin and flesh color, firmness, pH value, titratable acidity, soluble solids content, reducing sugars content and sensory evaluation. The coatings, especially the three-layer coatings, significantly decreased the senescence and weight loss of the fruits. They modified the respiration rates of the strawberries and slowed down their metabolism as shown by the retention of the color and the texture of the tissue. Sensory evaluation of the coated strawberries showed that the chitosan and composite coatings gave better visual appearance and taste and were therefore more preferable by 90% of the judges than the three-layer coatings, even though the latter had higher protective effect of the overall quality of the strawberries.

**Keywords:** /Strawberry/ /Chitosan/ /Edible Coating/ /Storage/

Wang, Shiow , Haiyan Gao. 2013. Effect of chitosan-based edible coating on antioxidants, antioxidant Enzyme system, and postharvest fruit quality of strawberries (*Fragaria x ananassa* Duch.) LWT – Food Sci & Technol. 52: 71 – 79.

### Abstract

The severity of decay in strawberries stored at either 5 °C or 10 °C was significantly reduced and the shelf-life was extended by immersing fruits in chitosan solutions of 0.5, 1.0 and 1.5 g/100 mL for 5 min at 20 °C as compared to the control. Strawberries treated with chitosan also maintained better fruit quality with higher levels of phenolics, anthocyanins, flavonoids (ellagic acid, ellagic acid glucoside, p-coumaroyl glucose, quercetin 3-glucoside, quercetin 3-glucuronide, kaempferol 3-glucoside, kaempferol 3-glucuronide, cyanidin 3-glucoside, pelargonidin 3-glucoside, cyanidin 3-glucoside-succinate, and pelargonidin 3-glucoside-succinate), antioxidant enzyme activity [catalase (CAT), glutathione-peroxidase (GSH-POD), guaiacol peroxidase (G-POD), dehydroascorbate reductase (DHAR) and monodehydroascorbate reductase (MDAR)], and oxygen radical absorbance capacity for peroxy radicals (ROO<sub>·</sub>), hydroxyl radical radicals (·OH; HO<sub>2</sub>·) and 2,2-Di (4-tert-octylphenyl)-1-picrylhydrazyl (DPPH) than the untreated fruits. Chitosan treatments retarded the decrease of ascorbic acid (ASA) and reduced glutathione (GSH) content and b-1,3-glucanase activities compared to control. The high contents of antioxidants, antioxidant activity, ASA and GSH and high activity of b-1,3-glucanase in the treated strawberries reinforced the microbial defense mechanism of the fruit and accentuated the resistance against fungal invasion. Therefore, the application of chitosan coating could be favorable in extending shelf-life, maintaining quality and controlling decay of strawberries.

**Keywords:** / Strawberry/ /Chitosan/ /Antioxidants/

Zhang, Hongyin, et.al. 2013. Phytic acid enhances biocontrol efficacy of *Rhodotorula mucilaginosa* against postharvest gray mold spoilage and natural spoilage of strawberries. LWT – Food Sci. & Technol. 52: 110 – 115.

### Abstract

The control activity of *Rhodotorula mucilaginosa*, alone or in combination with phytic acid (PA) on gray mold spoilage and natural spoilage of strawberries was investigated. *R. mucilaginosa* as stand-alone treatment significantly reduced the disease incidence of gray mold spoilage of strawberries at 20 °C, and the combination of *R. mucilaginosa* and PA at the concentration of 4 mol/ml and 6 mol/ml were more effective than *R. mucilaginosa* alone treatment. In vitro test showed that PA at the concentration of 4 mol/ml and 6 mol/ml significantly enhanced the inhibition of the growth of *Botrytis cinerea* on PDA. PA at all the tested concentrations enhanced the growth of *R. mucilaginosa* in NYDB media. PA at the concentration of 4 mol/ml slightly increased the population growth of *R. mucilaginosa* in strawberry wounds at the first day at 20 °C, and slightly increased the population growth of *R. mucilaginosa* in fruit wounds at 4 °C at the whole storage time. The combination of *R. mucilaginosa* and PA at the concentration of 4 mol/ml was the most effective treatment in controlling the natural spoilage of strawberries following storage at 4 °C for 20 d followed by 20 °C for 5 d.

**Keywords:** / Strawberry/ /Postharvest/ /BioControl/

Zhang, Hongyin, et.al. 2013. Phytic acid enhances biocontrol efficacy of *Rhodotorula mucilaginosa* against postharvest gray mold spoilage and natural spoilage of strawberries. *LWT – Food Sci & Technol.* 52: 110 – 115.

The control activity of *Rhodotorula mucilaginosa*, alone or in combination with phytic acid (PA) on gray mold spoilage and natural spoilage of strawberries was investigated. *R. mucilaginosa* as stand-alone treatment significantly reduced the disease incidence of gray mold spoilage of strawberries at 20 °C, and the combination of *R. mucilaginosa* and PA at the concentration of 4 mol/ml and 6 mol/ml were more effective than *R. mucilaginosa* alone treatment. In vitro test showed that PA at the concentration of 4 mol/ml and 6 mol/ml significantly enhanced the inhibition of the growth of *Botrytis cinerea* on PDA. PA at all the tested concentrations enhanced the growth of *R. mucilaginosa* in NYDB media. PA at the concentration of 4 mol/ml slightly increased the population growth of *R. mucilaginosa* in strawberry wounds at the first day at 20 degree C, and slightly increased the population growth of *R. mucilaginosa* in fruit wounds at 4 degree C at the whole storage time. The combination of *R. mucilaginosa* and PA at the concentration of 4 mol/ml was the most effective treatment in controlling the natural spoilage of strawberries following storage at 4 degree C for 20 d followed by 20 degree C for 5 d.

**Keywords:** /Strawberry/ /Postharvest/ /Gray Mold/

## TABLE GRAPE

Giuseppina Paola Parpinello, Giuseppina Paola, et. al. 2013. Relationship between sensory and NIR spectroscopy in consumer preference of table grape (cv Italia). *Postharvest Biol. & Technol.* 83: 47 – 53.

## Abstract

A combination of near infrared spectroscopy (NIR) instrumental measurements and sensory analysis was investigated to predict solids soluble content (SSC, assessed as Brix) and to classify preference in table grape cv Italia. SSC was monitored in each berry of whole bunches in order to evaluate intra-bunch distribution and variability. NIR spectra were recorded in the spectral region 12,000–4000 cm<sup>-1</sup> (833–2500 nm) using a set of 682 berries. The Partial Least Square (PLS) model based on cross-validation provided acceptable value for the main statistical parameters (coefficient of determination of cross-validation,  $r^2$ : 0.85; standard error of cross-validation, SECV: 1.08; residual predictive deviation, RPD:2.6) and was confirmed by external validation performed with 115 independent berries (coefficient of determination of prediction,  $rp^2$ : 0.82; standard error of prediction, SEP: 0.83). For consumer testing, the selected PLS model was used to predict the Brix value in 400 berries and Discriminant Analysis (DA) was then carried out to classify berries in terms of preference by relating NIR data to consumer judgment. The three defined preference clusters of berries were fully classified obtaining 100% membership. In cross-validation the value decreased especially for class 1 (78.5%) and 3 (75%) whereas class 2 obtained comparable values (98.7%). According to our results, NIR technology appears to be a promising technique for predicting SSC and obtaining information with regard to consumer preference in 'Italia' table grape for application of efficient and low cost on-line instruments in the fruit industry.

## **WATERMELON**

Abbaszadeh, Rouzbeh, et.al. . 2013. Evaluation of watermelons texture using their vibration responses. Biosystem Eng. 115: 102 - 105.

### **Abstract**

Flesh texture quality is an important attribute for watermelons that can be used as a ripeness indicator for sorting fruits. A non-destructive method is employed here, based on vibrations response, to assess the consumer opinion about watermelon (Crimson Sweet) tissue. The responses of samples to vibration excitation were recorded by laser Doppler vibrometry (LDV). The amplitude and phase as two spectrums of frequency response function were extracted over a wide frequency range. Following non-destructive tests, the watermelons were sensory evaluated. The samples were graded in a range of ripeness by panel members in terms of texture acceptability. Stepwise multiple linear regression (SMLR) and partial least squares regression (PLSR) were applied to extracted vibration spectrums to construct prediction models of watermelon flesh quality. The results showed that performance of SMLR models on phase spectrum was better than others. The determination coefficients (R<sup>2</sup>) of the calibration and cross validation models were 0.9998 and 0.9986 respectively. This study demonstrated the feasibility of mentioned method for predicting the quality of watermelons in industrial grading systems.

**Keywords:** /Watermelon/ /Vibration/

## **MANDARIN**

Gomez-Sanchisa, J. et.al. 2013. Hyperspectral LCTF-based system for classification of decay in mandarins caused by *Penicillium digitatum* and *Penicillium italicum* using the most relevant bands and non-linear classifiers. Postharvest Biol. & Technol. 82: 76 – 86.

Green mold (*Penicillium digitatum*) and blue mold (*Penicillium italicum*) are important sources of posthar-vest decay affecting the commercialization of mandarins. These fungi infections produce enormous economic losses in mandarin production if early detection is not carried out. Nowadays, this detection is performed manually in dark chambers, where the fruit is illuminated by ultraviolet light to produce fluorescence, which is potentially dangerous for humans. This paper documents a new methodology based on hyperspectral imaging and advanced machine-learning techniques (artificial neural networks and classification and regression trees) for the segmentation and classification of images of citrus free of damage and affected by green mold and blue mold. Feature selection methods are used in order to reduce the dimensionality of the hyperspectral images and determine the 10 most relevant. Neural Networks were used to segment the hyperspectral images. Results achieved using classifiers based on decision trees show an accuracy of around 93% in the problem of decay classification.

**Keywords:** /Mandarin/ / Fruit inspection/

Oberland, David. 2013. **Mandarin** flavor and aroma volatile composition are strongly influenced by holding temperature. *Postharvest Biol. & Technol.* 82: 6 – 14.

### **Abstract**

Mandarin flavor quality often declines during storage but the respective contributions to the flavor dis-order of warm versus cold temperature during storage were unknown. To determine this ‘W. Murcott Afourer’ mandarins were stored for either 6 weeks at a continuous 5 °C or held at 20 °C for either 1 or 2 weeks following 0, 2 or 4 weeks of 5 °C storage. Sensory quality as measured by likeability was maintained throughout the 6 week storage when the fruit were kept at 5 °C, but rapidly declined upon moving fruit to 20 °C. Flavor loss increased as the duration of cold storage prior to the warm temperature holding period was lengthened. The beneficial effect of maintaining mandarins in cold storage was also observed in three of the five other varieties where there was flavor quality loss during storage at a warmer temperature. Soluble solids concentration (SSC) and titratable acidity (TA) were relatively unchanged by holding at 20 °C, but aroma volatiles, with alcohols and ethyl esters being of the greatest importance, were greatly enhanced in concentration and are the likely cause of the off-flavor. The increases in aroma volatile concentration were apparent within one day of holding the fruit at 20 °C, indicating the need to carefully control postharvest storage temperatures. A comparison of 5, 10 and 20 °C holding indicated that it is only at 20 °C that aroma volatiles contributing to off-flavor accumulated. This study suggests that it may be possible in many mandarin varieties to prevent losses in flavor quality by maintaining the fruit at a cold temperature (5–10 °C) following packing and until the time of consumption.

**Keywords:** /Mandarin/ /Temperature/

Li, Jiangbo, et.al. 2013. Automatic detection of common surface defects on **oranges** using combined lighting transform and image ratio methods. *Postharvest Biol. & Technol.* 82: 59 - 69.

### **Abstract**

Automatic detection of fruit peel defects by a computer vision system is difficult due to the challenges of acquiring images from the surface of spherical fruit and the visual similarity between the stem-ends and the true defects. In this study, oranges with wind scarring, thrips scarring, scale infestation, dehiscent fruit, anthracnose, copper burn, canker spot and normal surface were researched. A lighting transform method based on a low pass Butterworth filter with a cut off frequency  $D0 = 7$  was first developed to convert the non-uniform intensity distribution on spherical oranges into a uniform intensity distribution over the whole fruit surface. However, the stem-ends were easily confused with defective areas. In order to solve this problem, different color components (R, G and B) and their combinations were analyzed. It was found that a ratio method and R and G component combination coupled with a big area and elongated region removal algorithm (BER) could be used to differentiate stem-ends from defects effectively. Finally, a processing and classification algorithm based on a simple thresholding method was proposed. The result with 98.9% overall detection rate for the 720 independent sample images indicated that the proposed algorithm was effective in differentiation of normal and defective oranges. The method, however, could not discriminate between different types of defects.

**Keywords:** /Oranges/

## **VEGETABLES**

### **BROCCOLI**

Garitta, Lorena, Guillermo Hough, Alicia Chaves. 2013. Sensory analysis of **broccoli** over time: consumer defined critical attributes and evaluation of digital photographs in comparison to real product appearance. *Food Qual. & Prefer.* 29 : 48 – 52.

#### **Abstract**

The objectives of the present work were: (a) define the critical attribute of broccoli from a consumers' perspective and (b) for broccoli compare the trained panel sensory evaluation of real products versus the sensory evaluation of the corresponding digital photographs. A panel of broccoli consumers evaluated appearance, aroma and flavor acceptability of broccoli with different storage times. Appearance acceptability was the only attribute where there were significant differences between storage times. Thus appearance was the critical attribute as evaluated by consumers. A panel of assessors measured the appearance of broccoli samples with different storage times using the quality scoring method (QSM). A month after having measured the real product the same assessors measured the appearance of digital photographs of the same samples using the QSM. Analysis of variance showed that there were no significant differences between evaluations of the real broccoli and the corresponding photograph.

**Keywords:** / Broccoli/ /Quality/

### **LETTUCE**

Barros, Margarita, Mikal E. Saltveit . 2013. Microbial growth in fresh-cut **lettuce e** increases when wound-induced phenolic accumulation is suppressed. *Postharvest Biol. & Technol.* 83: 34 – 39.

#### **Abstract**

Wounding lettuce (*Lactuca sativa* L. *Longifolia*) leaf mid-rib tissue initiates physiological responses that include increased synthesis and accumulation of phenolic compounds. Chlorogenic acid is the predomi-nant wound-induced phenolic compound that accumulates in excised lettuce leaf tissue held at 10 °C for 2 days. The growth of five bacterial isolates associated with lettuce decay (*Erwinia carotovora*, *Erwinia chrisanthemi*, *Pseudomonas putida*, *Pseudomonas fluorescens*, or *Pseudomonas syringae*) on TSA (tryptic soy agar) media was not markedly reduced by concentrations of chlorogenic acid identical to those found in wounded lettuce. Growth of *E. carotovora* and *P. fluorescens* was stimulated when prepared with TSA media containing homogenized non-wounded lettuce mid-rib tissue, while the increase was much less when the media was prepared with 5 mm thick mid-rib tissue segments that were held for 2 days at 10 °C after excision. Inhibiting the wound-induced increase in phenolic content with a 1-hexanol or heat-shock treatment allowed *E. carotovora* to grow on media prepared with excised tissue that had been held at 10 °C for 2 days at significantly higher rates than on media prepared with non-treated excised tissue. Hexanol is thought to interfere with the synthesis and/or propagation of the wound signal, so delaying its application to excised mid-rib tissue reduces its effectiveness. Delaying application of the inhibitor for 4 h, allowed increased accumulation of wound-induced phenolic

compounds in 2 day old lettuce tissue that resulted in a concomitant reduction in the growth of *E. carotovora* on media prepared with this tissue. Neither the hexanol nor the heat-shock treatment themselves made the excised lettuce tissue a better substrate for microbial growth. It appears that treatments that suppress wound-induced increases in antimicrobial phenolic compounds reduce the ability of excised lettuce tissue to suppress the growth of bacteria associated with lettuce decay by limiting the production and accumulation of these antimicrobial compounds. A critical distinction is made between whether a treatment renders the tissue more susceptible to microbial growth, or whether a treatment prevents the wound-induced increase in disease resistance that limits microbial growth. If all treatments that reduce tissue browning by interfering with the wound-induced accumulation of phenolic compounds also inadvertently make the tissue more susceptible to microbial growth, then research should be directed to prevent the production of brown pigments from the wound-induced accumulated phenolic compounds, rather than devising treatments that reduce their accumulation.

**Keywords:** /Lettuce/ /Fresh Cut/

Pereira, E. L., A. Rodrigues, E. Ramalbos. 2013. Influence of working conditions and practices on fresh-cut lettuce salads quality. *Food Control*. 33: 406 – 412.

### **Abstract**

The main aim of the present work was to study the influence of working conditions and practices of food handlers on physico-chemical and microbiological quality of fresh-cut lettuce salads produced in a catering unit. Twenty one visits were performed, checking all steps from lettuce reception until fresh-cut lettuce salad preparation. Even though the catering unit has implemented an HACCP plan, some non-conformities were detected on personal hygiene practices of the food handlers that should be corrected. Regarding green salad preparation two sanitizing treatments, diluted solutions of acetic acid (vinegar) and chlorine-based tablets, were applied. However, the former treatment should not be used because it did not guarantee food safety of the final product. On the other hand, the recommendations of chlorine-based tablets' supplier must be followed strictly. Regarding chlorine species, only free chlorine was detected. Furthermore, no free chlorine and chloramines were detected in the final product. In conclusion, this work allowed us to establish several practical recommendations to improve the efficacy of the washing sanitizing steps followed on the preparation of fresh-cut lettuce salads.

**Keywords:** /Lettuce/ /Fresh Cut/ /Quality/

### **ONIONS**

Yoo, Kil, Sun, Eun Jin Lee, Bhimanagouda S. Patil. 2013. Changes in quercetin glucoside concentrations of onion bulbs by scales, during storage, and in sprouting leaves exposed to UV. *Postharvest Biol. & Technol.* 83: 65 – 71.

### **Abstract**

Onion is an excellent source of quercetin (Q), which is known to have various health benefits. In this study, we investigated the distribution of quercetin glucoside (QG) compounds among dry skins, semi-dry skins, and fresh onion scales; changes in the concentrations of QG compounds in onion bulbs stored at various temperatures for five months; and changes in QG concentrations in the etiolated leaves

irradiated by ultraviolet (UV) or visible light. Among scales of a bulb, total quercetin (TQ) concentrations were greatest in the outer-most scales (dry skins) and were gradually reduced toward the inner fresh scales on a fresh weight basis. However, on an area basis, TQ content peaked in the first fresh scale and was lower in the dry skins or the inner fresh scales. The QG content in the bulbs stored in a controlled atmosphere (CA) did not change significantly, while the concentrations in bulbs stored at 30°C increased by about 50% and then returned to the initial levels. We observed increases of quercetin-3,4\_-diglucoside (Q3,4\_G), accompanied by a reduction of quercetin-4\_-glucoside (Q4\_G), at 30 and 24°C storage, suggesting a relationship between QG concentration and storage temperature or metabolic changes. However, it was not clear if there was a net synthesis of the TQ compounds at the 30 and 24°C storage. In the sprouting leaves under the different lights, Q4\_G and Q3,4\_G concentrations increased the most when exposed to UV light and, to a lesser extent, when exposed to visible light; however, even the samples in the dark condition showed as light increase in QG compounds. We did not observe the synthesis of QG in the white onion leaves. Our results confirm that the synthesis of QG compounds is enhanced by UV light and, to a lesser extent, by visible light.

**Keywords:** /Onion/ /Storage/ /Sprouting/

## **TOMATO**

Jarquín-Enríquez, L., et.al. 2013. Lycopene content and color index of tomatoes are affected by the greenhouse cover. *Scientia Hort.* 155: 43 – 48.

### **Abstract**

The use of plastic or glass covers in greenhouses increases fruit yield and quality by controlling their environment. Color as well as lycopene content is the most important factors in the visual and nutraceutical quality of tomatoes, and they are factors affected by temperature and light inside the greenhouse. The objective of this study was to compare color development and lycopene accumulation in tomato fruits cv. 'Geronimo' at different maturity stages, grown in greenhouses covered with two types of covers (double-layer polyethylene K50 Clear + K50 IR/AC or flat glass 4 mm thick coated with a 15% CaCO<sub>3</sub> solution) in different periods of production. At 21, 25 and 29 weeks after transplanting, 24 clusters of tomatoes were labeled per experimental unit and three weeks after labeling, tomato fruits were harvested, classified by maturity, and analyzed for color index ( $a^*/b^*$ ) and lycopene content. External and internal temperatures and light data were recorded through a meteorological station system with auto-matic control. Our results suggested that the season of production, temperature and lighting conditions in the greenhouse, affected the lycopene biosynthesis process. Lycopene content increased as the photoperiod was expanded and at the 32nd week, was higher in fruits collected in greenhouses with double layer of polyethylene (414  $\mu\text{g g}^{-1}$  freeze-dried fruit) than that in fruits grown under a cover with flat glass coated with CaCO<sub>3</sub> (241  $\mu\text{g g}^{-1}$  freeze-dried fruit). The application of 15% CaCO<sub>3</sub> solution helped to control the temperature but limited the lycopene biosynthesis. Tomato fruits that received greater amounts of light accumulated more lycopene and had the highest color index (1.22) which shows that it is possible that the accumulation of more lycopene is correlated to the transmittance of the cover. The temperature control through bleaching, washing and shading techniques could be improved if the light intensity needed to improve the fruit color development and lycopene accumulation is considered.

**Keywords:** /Tomato/ /Solanum lycopersicum/ /Color Index/

## **ORNAMENTALS**

### **EUSTOMA**

Ochiaia, Masaki, Shogo Matsumotoa, Kunio Yamada. 2013. Methyl jasmonate treatment promotes flower opening of cut Eustoma by inducing cell wall loosening proteins in petals. Postharvest Biol. & Technol. 82: 1 – 5.

#### **Abstract**

Establishing the technique for controlling the rate of cut flower opening is important to maintain appropriate cut flower supplies to meet consumer demand. Cut flowers of *Eustoma grandiflorum* (Raf.) Shinn. were held in a vase solution containing ( $\pm$ )-abscisic acid (ABA), 6-benzylaminopurine (BA), gibberellic acid-3 (GA), methyl jasmonate (MeJA) or 1-naphthaleneacetic acid (NAA) at 100  $\mu$ M. MeJA accelerated flower opening. Only the timing of flowering was earlier, and there was no change in maximum flower diameter at the fully open stage. Expansin and xyloglucan endotransglycosylase/hydrolase (XTH), regarded as cell wall loosening proteins, participate in petal growth from bud stage to the fully open stage in *Eustoma*. MeJA also accelerated the expression of EgEXPA2, EgEXPA3 and EgXTH1 mRNA and the accumulation of expansin and XTH protein in petals. Meanwhile, the acceleration of both flower opening and expression of these genes was not observed by ABA, BA or GA treatment. It was proposed that early flower opening by JA treatment resulted from petal cell wall loosening by accelerated expression of expansin and XTH.

**Keywords:** /*Eustoma*/ /Flower Opening/ /Methyl Jasmonate/

### **ROSE**

Liao, Wei-Baiao, Mei-Ling Zhang, Ji-Hua Yu. 2013. Role of nitric oxide in delaying senescence of cut rose flowers and its interaction with ethylene. *Scientia Hort.* 155: 30 – 38.

#### **Abstract**

Recent studies showed that nitric oxide (NO) functions as an essential endogenous plant signal molecule. In this study, the regulatory role of NO during the flower senescence of cut rose (*Rosa hybrida* L. 'Kardinal') was surveyed. Exogenous application of the NO donor sodium nitroprusside (SNP) could increase vase life and maximum flower diameter and its effects were dose and time dependent. Treatments with 200  $\mu$ M of SNP for 24 h obtained the maximum vase life and flower diameter. NO scavengers 2-(4-carboxy-2-phenyl)-4, 4, 5, 5-tetramethylimidazole-1-oxyl-3-oxide (cPTIO) or methylene blue (MB-1) and NO synthase (NOS) inhibitors N-nitro-L-arginine methyl ester (L-NAME) or S,S'-1,3-phenylene-bis(1,2-ethanediy)l-bis-isothiourea (PBITU) reversed the positive effects of exogenous NO. Meanwhile, cPTIO, MB-1, L-NAME, or PBITU alone significantly decreased the vase life, indicating that endogenous NO may play specific roles in cut flower senescence. Exogenous NO decreased 1-aminocyclopropane-1-carboxylate oxidase (ACO) activity and ethylene production, and cPTIO was able to prevent the negative effects of NO. This implies that NO may act as an antagonist to ethylene in the senescence of cut rose flowers. Ethylene inhibitors 1-methylcyclopropene (1-MCP) improved vase life and maximum flower diameter, but the promotive effects of 1-MCP could be partially reversed by cPTIO, MB-1, or L-NAME, suggesting that endogenous NO in cut rose flowers may play a

crucial role in the cut rose flowers senescence regulated by ethylene. Additionally, 1-MCP treatments increased NOS activity and endogenous NO production, while depressing ACO activity and ethylene production in cut rose. Thus, NO might decrease ethylene output by inhibiting ACO activity in cut rose flowers, thereby vase life being increased. Altogether, the results suggest that NO may function as a signal molecule involved in the senescence of cut rose regulated by ethylene.

**Keywords:** /Rose/ /Senescence/

## **TUBERS AND ROOTCROPS**

### **POTATO**

David Gómez-Castillo, David et.al. 2013. Effects of essential oils on sprout suppression and quality of **potato** cultivars. *Postharvest Biol. & Technol.* 82: 15 – 21.

The replacement of synthetic chemical compounds used as potato sprout inhibitors with naturally occurring compounds has been studied in potato varieties used in the processing industry. Sprout suppressant capacity of caraway (*Carum carvi*, L.), peppermint (*Mentha piperita*, L.), coriander (*Coriandrum sativum*, L.) and eucalyptus (*Eucalyptus globulus*, Labill.) essential oils was studied and compared to the sprout suppressant capacity of chlorpropham (CIPC). For the particular conditions of this study, which used high concentrations, peppermint and coriander essential oils were the most effective sprout inhibitors with inhibition rates of more from 65 to 95% respect to their control. The use of these essential oils also prevented phytopathogenic damage. Analytical quality parameters, such as moisture content and total soluble solids, were not affected by treatment with any of the aromatic essential oils. Sensory analysis revealed no difference in appearance and taste between potatoes treated with essential oils and untreated tubers.

**Keywords:** /Potato/ /Quality/