

**SELECTIVE DESSIMINATION OF INFORMATION (SDI)  
PDF REPRINTS as of February 2013**

**GENERAL**

**FRESH PRODUCE**

Boxstael, Van, S. et.al. 2013. Food safety in **fresh produce** bacterial pathogens, viruses and pesticide residues indicated as major concerns by stakeholders in the fresh produce chain. [Food Control. 32: 190 - 197.](#)

**Abstract**

In January 2011, a workshop was organized by the EU FP7 Veg-i-Trade project to capture opinions of stakeholders on food safety issues in the global fresh produce supply chain. Food safety experts from various stakeholder types in the farm-to-fork chain were represented: farmer related organizations (n ¼ 6), fresh produce processing and trading companies (n ¼ 17), retail (n ¼ 3), consumer organizations (n ¼ 2), competent authorities (n ¼ 7) and lastly research institutes and universities (n ¼ 19). The experts who originated mainly from European countries (92.6%) were grouped in nine discussion groups per type of stakeholder and asked to rank food safety issues via a scoring approach according to perceived importance from their stakeholder type point of view. Also information sources for opinion making, appropriate food safety control measures and perceived contextual factors increasingly challenging governance of food safety in fresh produce were ranked according to perceived importance. Although some differences were noted between opinions of the different stakeholders, there was in general an agreement on the main priorities in food safety of fresh produce. Bacterial pathogens were overall considered to be the most important food safety issue for fresh produce, followed by foodborne viruses, pesticide residues and mycotoxins. Alert systems such as the European Commission's Rapid Alert System for Food and Feed (RASFF) were considered as the most important source of information of food safety issues, followed by reports of international organizations (e.g. WHO, EFSA), legislative documents (e.g. EU legislation), national reports (e.g. on monitoring hazards, foodborne outbreaks) and exchange of information between people (informal contacts). Concerning the control measures, the application of good agricultural practices (GAP) was identified to be the most important control measure to assure the safety of fresh produce, followed by the application of good hygienic practices (GHP) and the certification of food safety management systems (FSMS). Increasing international trade and globalization were overall expected to have a large impact on food safety in fresh produce. Other contextual factors perceived to be important were the food safety policies by governments and the (lack of) food safety knowledge by consumers and other stakeholders of the fresh produce supply chain. Although the various stakeholder groups may conceive issues differently from their proper position in the fresh produce supply chain, no deep disagreements emerged. This type of workshop enhances interaction and risk communication between stakeholders and contributes to a better understanding of each other's concerns, constraints and interests to deal with the food safety of the increasingly complex and globalized fresh produce supply chain.

**Keywords:** /Fresh Produce/ /Food Safety/

## **1- METHYLCYCLOPROPENE**

Nock, Jacqueline F. Christopher B. Watkins. 2013. Repeated treatment of apple with **1-methylcyclopropene** (1-MCP) prior to controlled atmosphere storage. *Postharvest Biol. & Technol.* 79: 73 - 79.

### **Abstract**

The effect of multiple 1-MCP treatments prior to the establishment of controlled atmosphere (CA) storage on the quality of 'McIntosh' and 'Empire' apples [*Malus × sylvestris* (L.) Mill. var. *domestica* (Borkh.) Mansf.] was investigated. Fruit were harvested on three occasions over a 1 week period, and at each harvest cooled overnight and 1-MCP applied the following day. Fruit from the first or second harvests were treated again or for the first time when fruit from each successive harvest was treated. CA conditions were established after the last 1-MCP treatment and fruit were stored for up to 8 months. Delays in 1-MCP application generally resulted in progressively higher internal ethylene concentrations (IECs) at the time of treatment and lower firmness both at the time of treatment and after storage. Multiple 1-MCP applications kept IECs low and maintained firmness compared with single applications that were applied after 4 d. For 'McIntosh', external CO<sub>2</sub> injury was more prevalent after storage if fruit were treated without delays after harvest for earlier harvests while later harvests were less affected. For 'Empire', flesh browning was more prevalent in fruit from later harvests and 1-MCP treated fruit had higher levels than untreated fruit. Either early 1-MCP treatment or multiple treatments reduced senescent breakdown in 'McIntosh', and core browning and greasiness in 'Empire'.

**Keywords:** / 1- Methylcyclopene/ /Ethylene/ / Firmness/ /Storage/ /Physiological Disorders/

## **HORTICULTURAL COMMODITIES**

Amaro, Ana L. Domingos P.F. Almeida. 2013. Lysophosphatidylethanolamine effects on **horticultural commodities** a review. *Postharvest Biol. & Technol.* 78: 92 - 102.

### **Abstract**

Lysophosphatidylethanolamine (LPE) is a naturally occurring lipid with regulatory effects in senescence and ripening. When applied exogenously to horticultural crops, LPE affects growth, development, and postharvest longevity. The effects of exogenously applied LPE have been studied in a range of plant organs in more than a dozen horticultural species. The claimed horticultural benefits include delayed leaf senescence, stimulation of ripening in table grape, acceleration of color development and extension of shelf-life in cranberry and tomato, and increased vase life of cut flowers. Responses to LPE application are found to vary dramatically within horticultural commodity, developmental stage, and organ type. Effects on ethylene responses are contradictory. LPE inhibits phospholipase D and is reported to affect the activity of enzymes relevant for produce quality, such as phenylalanine ammonia lyase and acid invertase. The biochemical mode of action of LPE is poorly understood. In particular, a mechanism by which a plant growth regulator might delay senescence of plant organs and accelerate ripening-related changes is not obvious. The horticultural, physiological and biochemical effects of LPE are reviewed in an attempt to highlight the knowledge gaps regarding the putative regulatory role of exogenously applied LPE.

**Keywords:** /Horticultural Commodities/

## **INTERNAL BROWNING**

Vandendriessche, Thomas, et.al. 2013. High-throughout NMR based metabolic profiling of Braeburn apple in relation to **internal browning**. Postharvest Biol. & Technol. 18 - 24.

### **Abstract**

NMR is a valuable tool for metabolomics due to its short analysis time and reproducibility. However, this technique remains little used due to its high cost. Recently, cheaper NMR machines for high-throughput screening have been developed. In this study, NMR was used to study the effect of several pre- and postharvest factors on apple metabolite levels during air and controlled atmosphere storage, including metabolic changes related to the incidence of internal browning. The results show that the selected fertilizer treatments and fruit side (green versus red side) did not affect the metabolite levels. However, the different postharvest storage conditions (optimal CA and brown inducing CA) did result in significant changes in metabolite levels. In addition, differences (e.g., pyruvate, citrate, fumarate, alanine, chlorogenate, methanol, ethanol, acetaldehyde and acetoin) between brown and unaffected apples stored under the applied CA conditions could be demonstrated.

**Keywords:** /Internal Browning/ /Browning/ /Apple/

## **FRUITS**

### **BANANA**

Tang, Yang, et.al. 2013. Molecular characterization of PR and WRKY genes during SA and MeJA induced resistance against *Colletotrichum musae* in **banana** fruit. Postharvest Biol. & Technol. 79: 62 - 68.

### **Abstract**

In order to further elucidate the molecular mechanisms underlying induced resistance of banana fruit against *Colletotrichum musae*, causing anthracnose disease, the expression patterns of fifteen genes encoding for pathogenesis-related proteins (PRs), including three PR1, one PR2, three PR5, one PR10c, four chitinase and three chitinase-like genes, and two WRKY transcription factors (TFs) in banana fruit in relation to salicylic acid (SA) and methyl jasmonate (MeJA) induced resistance, was investigated. Application of SA and MeJA significantly reduced the anthracnose disease index and lesion diameter of banana fruit, along with enhanced accumulation of endogenous SA or JA contents, and higher expression levels of MaWRKYs, MaPR1-1, MaPR2, MaPR10c, MaCHI3, MaCHI4 and MaCHIL1. Moreover, yeast one-hybrid analysis showed that MaWRKYs could bind to the promoters of four SA and MeJA-inducible PR genes, MaPR1-1, MaPR2, MaPR10c and MaCHIL1. Taken together, our results suggest that the activation of banana PRs and WRKYs genes by SA and MeJA treatments, and WRKY TFs binding to PRs promoters, may be attributed at least or partially to SA- and MeJA-induced pathogen resistance. Our study expands our understanding of PR proteins and their transcriptional regulation in economic fruit crops in relation to induced pathogen resistance.

**Keywords:** /Banana/ /Induced Pathogen Resistance/

## CITRUS

Sukorini, Henik, Somsiri Sangchote, Netnapi Khewkhom. 2013. Control of postharvest green mold of citrus fruit with yeasts, medicinal plants and their combination. Postharvest Biol. & Technol. 79: 24 - 31.

### Abstract

The use of bio-fungicides and a plant extracts to control postharvest disease was investigated as an alter-native to chemical control. The combination of a promising plant extract and yeast were selected through in vitro and in vivo techniques. A combination of *Candida utilis* TISTR 5001 and *Eugenia caryophyllata* crude extract was the best combination to attain a reduction in disease incidence and disease severity of *Penicillium digitatum* on citrus fruit. Colonization was the lowest on fruit treated with the combination of *E. caryophyllata* crude extract and *C. utilis* TISTR 5001, and survival of *C. utilis* TISTR 5001 was the highest. The combination of *E. caryophyllata* crude extract and *C. utilis* TISTR 5001 significantly reduced the natural development of green mold of citrus fruit, and had no effect to fruit quality. The active compound of *E. caryophyllata* was found to be eugenol, based on HPLC and NMR (<sup>1</sup>H and <sup>13</sup>C). Hence, the results indicate that a combination of plant extracts and yeasts posses antifungal activity that can be exploited as an ideal treatment for future plant disease management.

**Keywords:** /Citrus/ /Green Mold/

## DRAGON FRUIT

Zahid, Nooesheen, et.al. 2013. Efficacy of ethanolic extract of propolis in maintaining postharvest quality of dragon fruit during storage. Postharvest Biol. & Technol. 70: 69 - 72.

### Abstract

Significant ( $P \leq 0.05$ ) differences were observed in dragon fruit quality when treated with different con-centrations of ethanolic extract of propolis (EEP) (0.25, 0.50, 0.75 and 1.0%) and stored at  $20 \pm 2$  °C and  $80 \pm 5\%$  relative humidity (RH) for 20 days. Fruit treated with 0.50% EEP showed the most promising results, while fruit treated with 0.75 and 1.0% EEP showed some phytotoxic effects even after 8 days of storage. The results of gas exchange analysis also proved the efficacy of 0.50% EEP concentration. Thus, it can be concluded from the present investigation that EEP at 0.50% concentration could be used to extend the storage life of dragon fruit without any negative effects on the quality.

**Keywords:** /Dragon Fruit/ /Antioxidant/ /Postharvest Quality/

## GRAPES

Vinokur, Yakov, et.al. 2013. A method for evlauting fruit abscission potential of grapes and cherry tomato clusters. Postharvest Biol. & Technol. 79: 20 - 23.

### Abstract

Abscission is an important postharvest factor for table grapes and cluster cherry tomatoes. There are methods to measure the individual fruit removal force but until now there has been no objective

method to study the abscission at a whole cluster level. The working principle of the instrument is that a cluster is attached to a rod which is allowed to fall freely for a pre-determined distance; as the rod stops, the momentum of the berries is converted to detachment force applied to the abscission zone of each berry. The abscission potential can be evaluated as a percentage of fruit detached from cluster under given conditions. The instrument was constructed for robust and adjustable experimental use. It is shown that the abscission percentage for both table grapes and cluster cherry tomatoes was proportional to the free-fall distance. By using the instrument, we showed that the abscission potential of cluster cherry tomatoes was low during the first 2 weeks of storage and that it increased thereafter. Storage of cluster cherry tomatoes at 7 °C resulted in significantly less abscission than at 12 °C, as assessed either by manual shaking or by using the instrument. Treatment of grapes with the cytokinin-like compound forchlorfenthuron at 4 mg L<sup>-1</sup> during the early stages of fruit development resulted in significant reduction in abscission potential. These results demonstrate that the method can be used as a reliable experimental tool for objective evaluation of abscission potential.

**Keywords:** /Table grapes/ /Grapes/ /Cherry Tomato/

## **KIWI FRUIT**

Burdon, J. et.al. 2013. Soluble solids accumulation and postharvest performance of Hayward kiwifruit. Postharvest Biol. & Technol. 80: 1 - 8.

### **Abstract**

A soluble solids content (SSC) of 6.2% has been used as a minimum harvest index for 'Hayward' kiwifruit for about 30 years. This paper describes a study that examines the pattern of soluble solids accumulation in 'Hayward' kiwifruit beyond the simple timing at which fruit reach 6.2% and investigates the relationship between soluble solids accumulation and postharvest performance assessed as softening and expression of chilling injury. This has been done using fruit from 10 orchards harvested at a range of SSC from 5 to 10% during one season. Soluble solids accumulation showed a general trend for a change from slow to more rapid accumulation during the season that could be described by a single logistic curve. The point at which the rate of soluble solids accumulation increased was more or less distinct for fruit from different orchards and occurred when fruit were at SSC between 6.3 and 7.4%. It is also possible that there is not a consistent change in soluble solids accumulation rate, with the rate being dependent on the environmental conditions over several days before measurement. There was a major change in softening pattern and low temperature breakdown susceptibility between fruit harvested at 6.4 and at 8.0% SSC. This change coincided with a change to faster soluble solids accumulation at harvest. It is concluded that the pattern, or rate, of soluble solids accumulation is likely to be a more robust indicator of the physiological state of the fruit, and therefore postharvest performance, than a single SSC value.

**Keywords:** /Kiwifruit/ /Storage/ /Softening/ /Chilling Injury/

## **MANDARIN**

Van Zyl, Gideon J. Paul H. fourie, Gerhardus C. Schutte. 2013. Spray deposition assessment and benchmarks for control of Alternaria brown spot on mandarin leaves with copper oxychloride. Crop Protection. 46: 80 – 87.

## Abstract

Inadequate disease control on citrus foliage and fruit is often attributed to insufficient fungicide spray deposition on target surfaces. This study describes a novel spray deposition assessment protocol and determines deposition benchmarks indicative of the biological effectiveness for better interpretation of spray deposition results. Suitability of a yellow fluorescent pigment as tracer for copper oxychloride deposition was demonstrated through its similar particle concentration and size. Spray deposition assessment of spray targets, which were sprayed with a mixture that included the fluorescent pigment, involved photomacrography of whole leaf or fruit surfaces, followed by digital image analyses. This protocol proved to be very accurate in determining the quantity and quality of deposition. To determine deposition benchmarks, detached young 'Nova' mandarin leaves were sprayed with copper oxychloride and fluorescent pigment at different concentrations (0.1e2 times the recommended concentration) and spray deposition assessed. Subsequently, leaves were spray inoculated with a spore suspension of *Alternaria alternata* [causal agent of Alternaria brown spot (ABS) of mandarins], moist-incubated for c. 48 h and symptom expression rated. A very good linear relationship was found between fungicide concentration, leaf area covered by fluorescent pigment particles (%FPC) ( $r = 0.879$ ) and Cu residue analysis ( $r = 0.992$ ). A von Bertalanffy growth curve best fitted the relation between ABS control and deposition quantity (%FPC) data (91% of the percentage variance accounted for) with a good correlation between observed and predicted values ( $r = 0.825$ ). Benchmarks for 50% and 75% disease control were calculated as 2.07 %FPC and 4.14 %FPC, respectively. These corresponded with Cu residue levels of 59.4 and 91.0 mg kg<sup>-1</sup>, respectively. These FPC benchmarks can be used to evaluate spray technology research, specifically for control of ABS and similar citrus fruit and foliar diseases.

**Keywords:** /Mandarin/ /Postharvest/

## PEACH

Insausti, Pedro, Santiago Gorjon. 2013. Floods affect physiological and growth variables of **peach** trees *Prunus persica* L. Batsch, as well as the postharvest behavior of fruits. *Scientia Hort.* 152: 56–60.

## Abstract

Flooding is a case of abiotic stress that can affect plant growth, yield and fruit quality of many fruit trees species. The peach tree is recognized as highly susceptible to this stress factor. The aim of this study was to investigate the effects of flood periods on some physiological variables directly related to the growth and development of different organs of the peach tree and to evaluate the response to flooding by the plant with respect to postharvest fruit ripening. Flood cycles of 12 h per day were applied for two months to 'Red Globe' peach plants, comparing them with other plants with no flooding. Physiological variables, growth and behavior of the fruits after harvesting were evaluated. Flooding affected negatively leaf conductance and water potential and significantly decreased the chlorophyll content of leaves compared to controls. The trees subjected to flooding had branches with lower diameter and length growth, as well as smaller fruits, than control trees. The fruits from flooded trees produced ethylene earlier after harvest and responded with a faster softening. The results of this study proved that stress due to flooding produces responses that not only affect the plant but also the fruits after harvest.

**Keywords:** /Peach/ /Firmness/ /Ethylene/

## **PINEAPPLE**

Finnegan, E. et.al. 2013. Modelling respiration in fresh-cut **pineapple** and prediction of gas permeability needs for optimal modified atmosphere packaging. *Postharvest Biol. & Technol.* 79: 47 - 53.

### **Abstract**

This study investigated the effects of intrinsic factors (origin, physiological age and seasonality) and extrinsic factors (cut-size, blade-sharpness and dipping treatments) on respiration rate ( $RCO_2$ ) of fresh-cut pineapple chunks. A mathematical model for respiration rate based on exponential decay was developed that showed a gradual decrease in rate with time. The model parameters ( $R_i$  and  $R_{eq}$ , initial respiration rate and equilibrium respiration rate, respectively) were found useful to compare respiration rates for the factors studied. The average values were  $8.52 \pm 4.68$  and  $2.64 \pm 0.68$  ml/kg h for  $R_i$  and  $R_{eq}$ , respectively.  $R_i$  was affected to a greater extent by physiological age and origin than by season. Cut size had a considerable effect on  $R_i$  and  $R_{eq}$ , with larger cut pieces having the lowest  $R_i$  and  $R_{eq}$  of 5.9 and 2.7 ml/kg h, respectively. In contrast, smallest cut pieces had highest  $R_i$  (7 ml/kg h) and  $R_{eq}$  (3.2 ml/kg h). Cutting the fruit with a razor sharp blade versus a blunt blade decreased the  $R_i$ , while only caused a slight reduction in  $R_{eq}$ . The target  $O_2$  and  $CO_2$  transmission rate required for optimal modified atmosphere packaging were 7300–12,500 and 13,900–23,500 ml/m<sup>2</sup> day atm covering variability in respiration rate due to intrinsic and extrinsic factors studied.

**Keywords:** /Pineapple/ /Modified Atmosphere/ /Packaging/ /Fresh produce/ /Respiration/

## **POMEGRANATE**

Caleb, Oluwafemi, J. et.al. Effect of modified atmosphere packaging and storage temperature on volatile composition and postharvest life of minimally processed **pomegranate** arils. *Postharvest Biol. & Technol.* 79: 54 – 61.

### **Abstract**

This study investigated the effects of passive modified atmosphere packaging (MAP), storage temperature (5, 10 and 15 °C) and duration of 14 days on the postharvest quality attributes, compositional change in flavour attributes and microbiological quality of minimally processed pomegranate arils (*Punica granatum* L.), cvs 'Acco' and 'Herskawitz'. Volatile compounds were extracted via headspace solid phase micro-extraction (HS-SPME) and analyzed by gas chromatography–mass spectrometry (GC–MS). A total of 17 and 18 volatiles were detected and identified in the headspace of pomegranate juices of 'Acco' and 'Her-skawitz', respectively. Based on the physicochemical attributes and microbial evaluation, the postharvest life of MA-packaged 'Acco' and 'Herskawitz' was limited to 10 days due to fungal growth  $\geq 2$  log CFU g<sup>-1</sup> at 5 °C. However, the concentration (%) and compositional changes in volatile compounds indicated that the flavour/aroma life (7 days) was shorter than the postharvest shelf-life based on appearance and other physicochemical (10 days) for both cultivars.

**Keywords:** /Pomegranate/ /Postharvest/ /Storage/

## **HERBS AND SPICES**

### **GREEN PEPPER**

Gu, Fenglin, et.al. 2012. Analysis of the blackening of **green pepper** piper nigrum Linnaeus berries. Food Chem. 138. 797 - 801.

#### **Abstract**

This paper investigates polyphenol oxidase (PPO) activity, reduced weight percentage after sun drying, and the changes in colour and appearance of green pepper (*Piper nigrum* Linnaeus) berries after blanching and sun drying. The results show that the degree of reduced weight percentage and browning in green pepper berries after blanching for 10 min is greater at 100 °C than at 90 and 80 °C. Moreover, the samples blanched at 100 °C for 10 min had the fastest water loss, but the lowest PPO activity. Thus, the PPO enzymatic oxidation of polyphenols might not be the only reason for the browning of green pepper berries. This result is significantly different from that of [Variyar, Pendharkar, Banerjee, and Bandyopadhyay\(1988\)](#) and therefore deserves further study.

**Keywords:** /Pepper (*Piper nigrum* Linnaeus)/Polyphenol oxidase (PPO)/ Blackening/

## **ORNAMENTALS**

### **CALLA**

Ahmad, Iftikhar, et.al. 2013. Water quality effects on postharvest performance of cut **calla**, hydrangea, and snapdragon Iftikhar Ahmada. Scientia Hort. 153: 26 – 33.

#### **Abstract**

Effects of water quality on water uptake, change in fresh weight, vase solution pH and electrical conductivity (EC) change, termination symptoms, and longevity of cut 'Nicole Yellow' calla (*Zantedeschia* L.), 'White Extra' hydrangea [*Hydrangea macrophylla* (Thunb.) Ser.], and 'Admiral Pink' snapdragon (*Antirrhinum majus* L.) were studied. Calla was tolerant of high water pH (8.1); vase life varied only from 9.2 d for acidic solutions (pH 3.2) to 10.1 d for solutions with intermediate pH (6.3). Calla had the longest vase life at an EC of 0.75 dS m<sup>-1</sup>, whereas addition of floral preservative (Floralife Professional, Floralife, Walterboro, SC at 10 ml L<sup>-1</sup>) was ineffective. Low solution pH (2.9–3.3), increasing EC (up to 2.5 dS m<sup>-1</sup>), and use of floral preservative increased vase life of hydrangea. Increasing EC increased vase life of hydrangea from a low of 7.3 d to a high of 15.4 d at 2.5 dS m<sup>-1</sup>, when floral preservative was used and from a low of 3.5 d to a high of 5.7 d at 4.0 dS m<sup>-1</sup> in distilled water. Vase solution pH of snapdragon had no significant effect on vase life or water uptake. Increasing EC increased vase life to a maximum of 14.8 d at 2.0 dS m<sup>-1</sup> with preservative and to 9.7 d at 3.0 dS m<sup>-1</sup> without preservative. Each species had differing responses to varying pH and EC levels; however, solution pH should be low, as high pH solutions either had no effect or reduced vase life, such as with hydrangea. EC of vase water for hydrangea and snapdragon should be approximately 2.0–2.5 dS m<sup>-1</sup>, when preservatives are used and 3.0–4.0 dS m<sup>-1</sup> without, which is higher than most recommendations. Addition of preservative to vase solutions extended vase life of hydrangea and snapdragon, but did not affect calla.

**Keywords:** /Calla/ /Cutflower/ /Longevity/

## LILIUM

Prisa, Domenico. gianluca Burchi, Wouter G. van Doorn. 2013. Effects of low temperature storage and sucrose pulsing on the vase life of Lilium cv. Brindisi inflorescences. *Postharvest Biol. & Technol.* 79: 39 - 36.

### Abstract

Lilium cv. Brindisi inflorescences were stored at 2.5 °C for 5, 10, 15 or 20 d, comparing dry storage with storage of the stem ends in water. Prior to storage, inflorescences were treated with 20 or 100 g L<sup>-1</sup> sucrose in water, for 20 h at 20 °C. After storage the inflorescences were individually placed in water at 20 °C. The floral buds were still closed at the end of cold storage. In experiments carried out in summer, the time to bud opening was hastened by storage at 2.5 °C in water, more so after a longer period of cold storage. The time to tepal senescence after cold storage in water decreased with the time of storage. The time to tepal abscission was about 1 day longer than the time to tepal senescence. Repeat experiments in late fall and winter additionally showed early leaf yellowing after cold storage. Compared to the experiments in summer, more desiccated floral buds were found in the fall. Pulse treatment with 100 g L<sup>-1</sup> sucrose prior to cold storage reduced the number of desiccated buds. However, leaf yellowing was aggravated by the 100 g L<sup>-1</sup> sucrose pulse treatment. Compared to cold storage in water, dry storage at 2.5 °C further hastened the time to bud opening and also further hastened tepal senescence and abscission. Dry storage also produced more buds that desiccated or opened poorly. Sucrose treatment (100 g L<sup>-1</sup>) alleviated the effects of dry storage on tepal senescence and bud desiccation. The data showed that lily cv. Brindisi inflorescences are prone to chilling injury, but can be stored, depending on the treatment, for 5–10 d, during most of the year.

**Keywords:** /Lilium/ /Chilling injury/ /Cold Storage/

## LOTUS

Imsabai, Wachiraya, et.al. 2013. Petal blackening and lack of bud opening in cut lotus flowers (*Nelumbo nucifera*) role of adverse water relations. *Postharvest Biol. & Technol.* 79: 32 - 38.

### Abstract

Lotus flowers (*Nelumbo nucifera* Gaertn.) are commercially sold as closed buds. When placed in water the buds fail to open and the outer petals show rapid blackening. We investigated whether this is due to adverse water relations. Placing a plastic bag over the flower head delayed petal blackening, indicating that it was induced by early water stress. This treatment did not result in bud opening. A rapid occlusion of the stem xylem was found. Four possible causes of this occlusion were investigated: air uptake into the xylem, microorganisms in the vase solution, a plant-induced effect, and exuded latex. Preventing the uptake of air into the stem ends did not affect water uptake. Inclusion in the vase water of antibacterial compounds, or antioxidants that inhibit the plant-induced xylem blockage in other species, similarly did not alleviate the xylem occlusion. Cut stems exuded copious latex, close to the opened xylem conduits. Latex exudation was prevented by cutting under water, allow the latex to flow out, and cut again in air, within 1 cm from the previous cut. This treatment did not promote water uptake of the cut stems. A pulse treatment with citric acid also reduced latex flow, but also did not

prevent the decrease in water uptake. Treatment with ethephon or GA3 delayed the xylem occlusion, which suggests that it is induced by the plant itself. Only GA3 delayed petal blackening. None of these treatments promoted flower opening. It is concluded that adverse water relations are a cause of early petal blackening in cut lotus, but is not a cause of the lack of bud opening. The adverse water relations are apparently due to a plant-induced xylem occlusion which is different from those studied thus far in other species.

Keywords: /Lotus/ / Nelumbo nucifera/ /Blackening/ /Latex/

## **TULIPS**

Mochizuki-Kawai, Hiroko, Keninchi Shibuya, Kazuo Ichimura. 2013. Programmed cell death begins earlier in the mesophyll cells of **tulip** petals than in the epidermal cells. Postharvest Biol. & Technol. 79: 9 - 12.

### **Abstract:**

Based on histological observations, the onset of programmed cell death (PCD) occurs earlier in the mesophyll cells of petals than in the epidermal cells, but few biochemical studies have addressed the onset of PCD in mesophyll cells. We sampled epidermal cells and, separately, mesophyll cells from tulip petals, and then used biochemical methods to examine the onset of PCD in the two different tissue types. DNA laddering and collapse of cells had begun in mesophyll cells before petals had visibly wilted, but DNA laddering was not evident in epidermal cells at that point. Changes in protein content and total proteinase activity during senescence also supported the conclusion that the onset of PCD occurred in mesophyll cells before it occurred in epidermal cells. This study is the first to use multiple biochemical methods of analysis, as well as microscopic observations, to demonstrate that PCD begins earlier in the mesophyll cells than in the epidermal cells of tulip petals.

Keywords: /Tulip/ /Senescence/ /Epidermis/

## **VEGETABLES**

### **BROCCOLI**

Takala, Perlette N. et.al. 2013. Antimicrobial effect and physicochemical properties of bioactive trilayer polycaprolactone methylcellulose based films on the growth of foodborne pathogens and total microbiota in fresh **broccoli**. JFE. 116. 648 - 655.

### **Abstract**

Bioactive trilayer films were prepared using methylcellulose (MC) and polycaprolactone (PCL). Two antimicrobial formulations named as A (organic acids, extract of rosmarinic acid and Asian essential oil (EO) mixture) and B (organic acids, extract of rosmarinic acid and Italian EO mixture) were added in MC films during casting and the trilayer composite films (PCL/MC/PCL) were fabricated using compression molding. These films were inserted into packages containing broccoli and the packages were kept at 4 °C during 12 days storage to determine the antimicrobial capacity of the films and the physico-chemical properties of the films. Bioactive films showed a significant reduction of Escherichia coli in broccoli from Day 4 and a total inhibition at Day 12. Similarly, these films showed a significant reduction of Salmonella

typhimurium from Day 2 and a total inhibition at Day 7. Moreover, the films controlled the growth of total aerobic microbiota (TAM) in broccoli up to 10 days. Encapsulation of antimicrobial compounds in films allowed decrease of barrier properties of films. Tensile strength of films was not affected by the presence of formulation B. These results demonstrated the potential application of trilayer antimicrobial on controlling food pathogens and total flora in pre-cut vegetables.

**Keywords:** /Broccoli/ /Antimicrobial Effect/ /Foodborne Pathogens/

## **CUCUMBER**

Wang, Yanping, et.al. 2013. The role of abscisic acid in regulating cucumber fruit development and ripening and its transitional regulation. *Plant Physiol. & Biochem.* 64: 70 - 79.

### **Abstract**

Cucumber (*Cucumis sativus* L.), a kind of fruit usually harvested at the immature green stage, belongs to non-climacteric fruit. To investigate the contribution of abscisic acid (ABA) to cucumber fruit development and ripening, variation in ABA level was investigated and a peak in ABA level was found in pulp before fruit get fully ripe. To clarify this point further, exogenous ABA was applied to cucumber fruits at two different development stages. Results showed that ABA application at the turning stage promotes cucumber fruit ripening, while application at the immature green stage had inconspicuous effects. In addition, with the purpose of understanding the transcriptional regulation of ABA, two partial cDNAs of CsNCED1 and CsNCED2 encoding 9-cis-epoxycarotenoid dioxygenase (NCED), a key enzyme in ABA biosynthetic pathway; one partial cDNA of CsCYP707A1 for 80-hydroxylase, a key enzyme in the oxidative catabolism of ABA and two partial cDNAs of CsBG1 and CsBG2 for  $\beta$ -glucosidase (BG) that hydrolyzes ABA glucose ester (ABA-GE) to release active ABA were cloned from cucumber. The DNA and deduced amino acid sequences of these obtained genes respectively showed high similarities to their homologous genes in other plants. Real-time PCR analysis revealed that ABA content may be regulated by its biosynthesis (CsNCEDs), catabolism (CsCYP707A1) and reactivation genes (CsBGs) at the transcriptional level during cucumber fruit development and ripening, in response to ABA application, dehydration and pollination, among which CsNCED1, CsCYP707A1 and CsBG1 were highly expressed in pulp and may play more important roles in regulating ABA metabolism.

**Keywords:** ABA metabolism/ Cucumber/ Fruit development and ripening/ Transcriptional regulation/

## **GREEN LEAFY VEGETABLES**

Hariprasad, P. et.al. 2012. Natural occurrence of aflatoxin in green leafy vegetables. *Food Chem.* 138. 1908 - 1913

### **Abstract**

Natural occurrence of aflatoxin (AF) in agricultural soils, green leafy vegetables (GLVs) and persistence in processed foods was investigated. In total 33 soil samples and 81 GLVs which belonged to 9 groups collected from nine vegetable-growing regions were studied. Seventy percent of soils and 69.2% GLVs were contaminated with AF ranging from 0.0 to 88 ppb. Root samples frequently had higher concentration of AFB1 in comparison with shoot samples. Under greenhouse conditions all the tested plants were found to take up AF. From xylem and phloem sap experiments it was clear that AF was

gaining entry into the plant system via water-conducting xylem tissue and was translocated to aerial plant parts, with subsequent entry into the phloem. Of the two cooking methods studied, pressure cooking of GLVs significantly reduced the AF level in comparison with ordinary boiling.

Keywords: /Green leafy vegetables/ /Aflatoxin/

Moore-Neibel, Katherine, et.al. 2013. Antimicrobial activity of oregano oil against antibiotic-resistant *Salmonella enterica* on organic **leafy greens** at varying exposure times and storage temperature FM. 34. 123 – 129.

### **Abstract**

The objective of this study was to evaluate the effectiveness of oregano oil on four organic leafy greens (Iceberg and Romaine lettuces and mature and baby spinaches) inoculated with *Salmonella* Newport as a function of treatment exposure times as well as storage temperatures. Leaf samples were washed, dip inoculated with *S. Newport* (6-log CFU/ml) and dried. Oregano oil was prepared at 0.1, 0.3, and 0.5% concentrations in sterile phosphate buffered saline (PBS). Inoculated leaves were immersed in the treatment solution for 1 or 2 min, and individually incubated at 4 or 8 °C. Samples were taken at day 0, 1, and 3 for enumeration of survivors. The results showed that oregano oil was effective against *S. Newport* at all concentrations. *S. Newport* showed reductions from the PBS control of 0.7e4.8 log CFU/g (Romaine lettuce), 0.8e4.8 log CFU/g (Iceberg lettuce), 0.8e4.9 log CFU/g (mature spinach), and 0.5e4.7 log CFU/g (baby spinach), respectively. The antibacterial activity also increased with exposure time. Leaf samples treated for 2 min generally showed greater reductions (by 1.4e3.2 log CFU/g), than those samples treated for 1 min; however, there was minimal difference in antimicrobial activity among samples stored under refrigeration and abuse temperatures. This study demonstrates the potential of oregano oil to inactivate *S. Newport* on organic leafy greens.

Keywords: *Salmonella*/ Antimicrobials/ Oregano oil/ Organic leafy greens/ Food safety/

### **LETTUCE**

Luna, Maria C. et.al. 2012. Optimizing water management to control respiration rate and reduce Browning and microbial load of fresh-cut romaine **lettuce**. *Postharvest Biol. & Technol.* 80: 9 – 17.

### **Abstract**

We studied the influence of both deficit and excess irrigation on the quality of fresh-cut romaine lettuce, the second most important type of lettuce after iceberg. The influence of different irrigation regimes on respiration rate, browning and microbial quality of fresh-cut romaine lettuce (*Lactuca sativa* L.) was studied in 6 different harvests during 3 consecutive years. The total amount of water supplied to the crop was calculated taking into account the irrigation water and rainfall. Six different irrigation regimes were established based on a standard irrigation regime (SIR): -35% SIR (<221 mm), -15% SIR (221–265 mm), SIR (266–320 mm), +15% SIR (321–370 mm), +35% SIR (371–430 mm) and +75% SIR (>430 mm). Quality characteristics of romaine heads as raw material for fresh-cut were significantly influenced by irrigation regimes. The lowest fresh weight was obtained when cultivated with the most severe deficit and excess of water. Microbial loads were higher in whole heads subjected to the highest irrigation regime (+75% SIR). These differences were also observed in fresh-cut romaine lettuce after

processing (d 0). However, after d 10 of storage, psychrotrophic aerobic bacteria increased around 3 log units without significant differences among irrigation regimes. Despite the high number of *Pseudomonas* bacteria in fresh-cut romaine lettuce, 6.2 log cfu g<sup>-1</sup> in the deficit irrigated samples (-35% SIR) and 7.8 log cfu g<sup>-1</sup> in the excess one (+75% SIR), no association with quality loss was observed at the end of storage. In fact, visual quality of the fresh-cut romaine lettuce did not differ among irrigation regimes because of the similar headspace gas composition, independently of the irrigation regime. However, when midribs were stored in air, cut edge browning was reduced in the less irrigated midribs despite the accumulation of phenolic compounds. PPO activity increased with the highest irrigation regime. Respiration rate of fresh-cut lettuce was significantly higher when lettuce was cultivated under extreme conditions, which corresponded to deficit irrigation (-35% SIR) or to excess of water (+35% SIR). In conclusion, adequate agricultural irrigation practices are needed to both guarantee the sustainability of the environment but also to assure the quality of the whole and fresh-cut produce. Because differences occur with distinct lettuce type, the optimization of water management is needed for each type of lettuce.

**Keywords:** /Lettuce/ /*Lactuca sativa* L./ /Shelf-life/ /Preharvest factors/ /Postharvest/

## SPINACH

Dong, Xiaoqing, et.al. 2013. Diffusivity of 1-methylcyclopropene in spinach and bok choi leaf tissue, disks of tomato and avocado fruit tissue, and whole tomato fruit. *Postharvest Biol. & Technol.* 78: 40 - 47.

## Abstract

Gaseous 1-methylcyclopropene (1-MCP) has been widely employed for delaying ripening and senescence of harvested fruit and vegetables; however, details on ingress of gaseous 1-MCP in plant tissues, which might contribute to differences in responsiveness of different horticultural commodities to 1-MCP, have not been reported. In this study, we used spinach and bok choi leaves, disks from tomato epidermis, stem-scar and avocado-exocarp tissues, and whole tomato fruit to examine ingress of gaseous 1-MCP. Using a dual-flask system, equilibration of 20  $\mu\text{L L}^{-1}$  (831  $\mu\text{mol m}^{-3}$ ) 1-MCP through leaf tissue was reached within 1–2 h, and paralleled 1-MCP transfer through glass-fiber filter paper. For disks derived from fruit tissues, changes in 1-MCP concentrations in the dual-flask system showed anomalous patterns, declining as much as 70% in source flasks with negligible accumulation in sink flasks. The pattern of 1-MCP distribution was markedly different from that of ethylene, which approached equal distribution with tomato stem-scar and avocado exocarp but not tomato epidermis tissues. 1-MCP ingress was further addressed by exposing whole tomato fruit to 20  $\mu\text{L L}^{-1}$  1-MCP followed by sampling of internal fruit atmosphere. Tomato fruit accumulated internal gaseous 1-MCP rapidly, reaching approximately 8–9  $\mu\text{L L}^{-1}$  within 3–6 h at 20 °C. Internal 1-MCP concentration ([1-MCP]) declined around 74 and 94% at 1 and 3 h after exposure, respectively. Ingress was similar at all ripening stages and reduced by 45% in fruit coated with commercial wax. Blocking 1-MCP ingress through stem- and blossom-scar tissues reduced accumulation by around 60%, indicating that ingress also occurs through epidermal tissue. Fruit preloaded with 1-MCP and immersed in water for 2 h retained about 45% of post-exposure gaseous [1-MCP], indicating that 1-MCP is not rapidly sorbed or metabolized by whole tomato fruit. Rapid ingress of gaseous 1-MCP was also observed in tomato fruit exposed to aqueous 1-MCP. Both accumulation and post-exposure decline in internal gaseous [1-MCP] are likely to vary among different fruit and vegetables in accordance with inherent sorption-capacity, surface properties (e.g., waxes, stoma), volume and continuity of gas-filled intercellular spaces, and tissue hydration.

**Keywords:** /Spinach/ /Tomato/ /Avocado/ /1-Methylcyclopropene/ /Ripening/ /Spinach

## **TOMATO**

Qualtucci, A. et.al. 2013. Biological control of tomato bacterial speck using punica granatum fruit peel extract. Crop Protection. 46: 18 - 22.

### **Abstract**

*Pseudomonas syringae* pv. *tomato*, the causal agent of tomato bacterial speck, is common in greenhouses and fields all over Italy. The antibacterial activity of ethanol extracts of *Punica granatum* (pomegranate) fruit peels on *P. syringae* pv. *tomato* was studied both in vitro and in vivo. The minimum in vitro inhibition value for peel extract of *P. granatum* on the *P. syringae* pv. *tomato* Pt 1301 strain (from Turkey) was obtained at a concentration of 0.5%. The in vivo antibacterial action of this natural substance lasted at least 15 days, permitting the replacement or reduction of the commonly used copper compounds. The active components of the pomegranate peel extracts were ellagic and gallic acids.

**Keywords:** /Tomato/ / Biocontrol/ /Organic Agriculture/

Srilaong, Buntong B. et.al. 2013. Reducing postharvest losses of tomato in traditional and modern supply chains. Int'l. Food Res. J. 233 - 238.

### **Abstract**

Traditional and modern supply chains for tomato in Cambodia were assessed and possible handling improvements were introduced. Traditional chain involved farmers and collectors in Kandal Province, and wholesalers and retailers in wet markets in the capital of Phnom Penh, about 35 km apart. In the modern chain, only one intermediary between farmers and supermarkets in Phnom Penh was involved; collector-wholesaler in Kandal Province or a development organization in Kampong Speu Province (65 km away from Phnom Penh) which consolidated farmers' produce through its packinghouse facility. Postharvest losses in the traditional and modern chains were about 23% and 22.5%, respectively, but the modern chain had more stringent quality requirements and offered higher prices than the traditional chain. Farmers' losses were mainly due to preharvest damage by insect pests and diseases and immaturity while losses during subsequent handling were due to physical damage, rotting, weight loss and/or over-ripening. Improved packaging, precooling and sanitizing treatments as individual handling improvements were tried in the traditional chain. Use of 20 kg capacity plastic crate with 50  $\mu\text{m}$ -thick low density polyethylene (LDPE) bagging and 20 kg capacity bamboo basket lined with newsprint reduced fruit damage at the wholesale and retail stages relative to the conventional packaging of using 20 kg capacity 50  $\mu\text{m}$ -thick high density PE (HDPE). More dramatic effect on weight loss reduction was obtained with both conventional HDPE and plastic crate-LDPE packaging methods. Precooling (5 min dip in 5°C water) and chlorine wash (2 min dip in 200 ppm chlorine solution) combined with LDPE packaging had no pronounced effect on the incidence of fruit damage but reduced weight loss at the retail stage by about two-fold compared to that of fruit conventionally packed in HDPE bag without precooling or chlorine treatment. For the modern chain, modified atmosphere packaging (MAP) comparing LDPE and 11  $\mu\text{m}$ -thick film overwrap was tried under simulated supermarket conditions (15°C). Fruit weight loss and ripening were inhibited relative to that at ambient

(24-33°C, 65-92% RH). MAP had no appreciable effect on weight loss at 15°C but further retarded ripening based on colorimetric  $a^*$  values (red color), soluble solids and citric acid contents. Film overwrap was more effective than LDPE. The results indicate that the handling techniques introduced could be applied in tomato supply chains to reduce postharvest losses.

**Keywords:** /Tomato/ /*Solanum lycopersicum* L/ /Supply Chain/ /Precooling/ /Packaging/

Vinokur, Yakov. et.al. 2013. A method for evaluating fruit abscission potential of grapes and cherry tomato clusters. *Postharvest Biol. & Technol.* 79: 20 - 23.

### **Abstract**

Abscission is an important postharvest factor for table grapes and cluster cherry tomatoes. There are methods to measure the individual fruit removal force but until now there has been no objective method to study the abscission at a whole cluster level. The working principle of the instrument is that a cluster is attached to a rod which is allowed to fall freely for a pre-determined distance; as the rod stops, the momentum of the berries is converted to detachment force applied to the abscission zone of each berry. The abscission potential can be evaluated as a percentage of fruit detached from cluster under given conditions. The instrument was constructed for robust and adjustable experimental use. It is shown that the abscission percentage for both table grapes and cluster cherry tomatoes was proportional to the free-fall distance. By using the instrument, we showed that the abscission potential of cluster cherry tomatoes was low during the first 2 weeks of storage and that it increased thereafter. Storage of cluster cherry tomatoes at 7 °C resulted in significantly less abscission than at 12 °C, as assessed either by manual shaking or by using the instrument. Treatment of grapes with the cytokinin-like compound forchlorfenuron at 4 mg L<sup>-1</sup> during the early stages of fruit development resulted in significant reduction in abscission potential. These results demonstrate that the method can be used as a reliable experimental tool for objective evaluation of abscission potential.

**Keywords:** Cluster cherry tomatoes/ Rachis/ shatter/ Berry drop/

Zhang, Xinhua, et.al. 2013. Arginase by heat treatment contributes to amelioration of chilling injury and activation of antioxidant enzymes in tomato fruit. *Postharvest Biol. & Technol.* 79: 1 - 8.

### **Abstract**

Treatment of tomato (*Solanum lycopersicum* L. cv. Messina) fruit with hot air (HA) at 38 °C enhanced the transcript levels of LeARG1 and LeARG2, the two genes encoding arginase, and arginase activity. The strongest induction of LeARG1 and LeARG2 transcripts was observed after fruit treated with 38 °C HA for 12 h, which also effectively alleviated chilling injury (CI) of tomato fruit, manifested as decreased CI index, electrolyte leakage and malondialdehyde content during cold storage. To investigate the potential role of arginase in HA-induced chilling tolerance, fruit were treated with HA, or arginase inhibitor N<sub>ω</sub>-hydroxy-nor-L-arginine (nor-NOHA) combined with HA and then stored at 2 °C for up to 28 d. The results showed that HA-induced arginase activity was strongly inhibited by pretreatment with nor-NOHA and the reduction of CI by HA was nearly abolished by the arginase inhibitor. In addition, HA treatment increased activities of superoxide dismutase, catalase and ascorbate peroxidase, inhibited peroxidase activities, and promoted the accumulation of arginine, proline and putrescine. These effects were partially counteracted by nor-NOHA except that arginine and putrescine accumulation was unaffected. Our results indicate that arginase induction may be partly involved in HA-induced chilling

tolerance in tomato fruit, possibly by a mechanism involving activation of antioxidant enzymes and an increase in proline levels.

**Keywords:** /Tomato/ /Chilling Injury/

## **TUBERS AND ROOTCROPS**

### **POTATO**

Al –Mughrab, Khalil, I. et.al. 2013. Efficacy of *Pseudomonas syringae* in the management of **potato** tuber diseases in storage. *Biological Control*. 64: 315 – 322.

#### **Abstract**

Silver scurf caused by *Helminthosporium solani* and dry rot caused by *Fusarium* spp. are tuber diseases of economic importance in potato-growing areas worldwide. Recently, the two pathogens have developed resistance to thiabendazole (TBZ), a post-harvest fungicide commonly used for their control. Therefore, alternative disease control strategies are needed. The present study assessed the efficacy of the biopesticides Bio-Save 10LP (*Pseudomonas syringae*-strain ESC-10; Ps10) and Bio-Save 11LP (*P. syringae*-strain ESC-11; Ps11) against silver scurf and dry rot. Approximately 30 isolates representing the genus *Fusarium* were obtained from symptomatic potato specimens with dry rot from New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PE) and Alberta (AB), Canada. Species isolated were *Fusarium sambucinum*, *Fusarium tumidum*, *Fusarium coeruleum*, *Fusarium culmorum*, and *Fusarium avenaceum*. *H. solani* isolated from AB, NB and PE was included in the study as the causal agent of silver scurf. The efficacy of *P. syringae* against *F. sambucinum* and *H. solani* was tested in vitro. Ps10 and Ps11 inhibited the growth of *H. solani* up to 68% (NB isolate) and 73% (PE isolate), respectively and the inhibition was more or less comparable with that of TBZ. *F. sambucinum* was not significantly inhibited by Ps10; however Ps11 AB, PE and NB isolates by 43%, 28% and 54%, respectively. Conversely, TBZ inhibited AB, PE and NB isolates of *Fusarium* spp. in vitro by 86%, 88% and 100%, respectively. TBZ in combination with either Ps10 or Ps11.

**Keywords:** /Potato/ /Storage/