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**GENERAL**

**BIOFILM**

Cossu, Andrea, et al. 2016. Antimicrobial effect of synergistic interaction between UV-A light and gallic acid against *Escherichia coli* O157:H7 in fresh produce wash water and **biofilm**. *Innov. Food Sci. Emerg.* 37: 44 - 52.

**Abstract**

A synergistic interaction between gallic acid (GA) and UV-A light (UV-A + GA) to inactivate *E. coli* O157:H7 in spinach wash water and in biofilm was evaluated. A 30-min exposure to UV-A light in presence of 10 mM GA had relevant biological effect in the inactivation of *E. coli* O157:H7 in suspension in the absence ( $>5 \log(\text{CFU}/\text{mL})$ ) and the presence of organic content ( $>3 \log(\text{CFU}/\text{mL})$  in 2000 mg O<sub>2</sub>/L COD (Chemical Oxygen Demand) organic load), and resulted in ~80% decrease in the metabolic activity of *E. coli* O157:H7 biofilm. GA solutions could be recycled through at least 3-cycles of UV-A treatment without a significant loss in antibacterial effect. Catalase reduced the extent of *E. coli* O157:H7 inactivation from the UV-A+ GA treatment suggesting that generation of hydrogen peroxide was partially responsible for the observed antimicrobial effect. The UV-A + GA treatment was also found to be effective in causing  $>3 \log(\text{CFU}/\text{mL})$  reductions in *E. coli* O157:H7 on the surface of spinach leaves. UV-A + GA treatment can serve as an effective intervention in the fresh produce sanitation. *Industrial relevance:* The results of this study show that a synergistic interaction between gallic acid (GA) and UVA (365 nm) light is an effective treatment for sanitation of fresh produce and water used to wash fresh produce. It was also found to be effective against the *E. coli* O157:H7 biofilm. The attractive attributes of this technology include a relatively low cost; specific, light-triggered activity; non-toxic nature and scalability. Thus, this technology has potential to replace conventional chemical sanitizer-based sanitation approaches.

**Keywords:** /Biofilm/ /Fresh Produce/

Lamas, A, et al. 2016. **Biofilm** formation, phenotypic production of cellulose and gene expression in *Salmonella enterica* decrease under anaerobic conditions. *Int'l. J. Food Microbiol.* 238: 63 - 67.

**Abstract**

*Salmonella enterica* subsp. *enterica* is one of the main food-borne pathogens. This microorganism combines an aerobic life outside the host with an anaerobic life within the host. One of the main concerns related to *S. enterica* is biofilm formation and cellulose production. In this study, biofilm formation, morphotype, cellulose production and transcription of biofilm and quorum sensing-related genes of 11 *S. enterica* strains were tested under three different conditions: aerobiosis, microaerobiosis, and anaerobiosis. The results showed an influence of oxygen levels on biofilm production. Biofilm formation was significantly higher ( $P < 0.05$ ) in aerobiosis than in microaerobiosis and anaerobiosis. Cellulose production and RDAR (red, dry, and rough) were expressed only in

aerobiosis. In microaerobiosis, the strains expressed the SAW(smooth and white) morphotype, while in anaerobiosis the colonies appeared small and red. The expression of genes involved in cellulose synthesis (*csgD* and *adrA*) and quorum sensing (*sdiA* and *luxS*) was reduced in microaerobiosis and anaerobiosis in all *S. enterica* strains tested. This gene expression levels were less reduced in *S. Typhimurium* and *S. Enteritidis* compared to the tested serotypes. There was a relationship between the expression of biofilm and quorum sensing-related genes. Thus, the results from this study indicate that biofilm formation and cellulose production are highly influenced by atmospheric conditions. This must be taken into account as contamination with these bacteria can occur during food processing under vacuum or modified atmospheres.

**Keywords:** /Biofilm/ / Food Safety/

### **COLD STORAGE**

Berry, Tarl M., et al. 2016. Multi parameter analysis of cooling efficiency of ventilated fruit cartons using CFD: impact of vent hole design and internal packaging. *Food Bioprocess Technol.* 9: 1481-1493.

#### **Abstract**

Forced-air cooling (FAC) efficiency of fruit packed in ventilated cartons can be considerably improved by revising vent hole design and tailoring these openings according to the internal packaging used. Current vent hole designs for fruit cartons, however, often result from trials and errors or are developed in order to improve a specific package functionality, such as fruit cooling rate. This study presents a novel multiparameter evaluation process for ventilated fruit packaging. This multi-parameter strategy evaluates cooling rate and cooling uniformity, airflow resistance and energy efficiency. Computational fluid dynamics is used to evaluate the impact of internal trays and four vent hole designs. One of the designs investigated is currently used in commercial export of apples, while the other three are new configurations proposed to improve fruit cooling efficiency. Results showed that the addition of trays to the existing commercially used Standard Vent hole design increased ventilation energy consumption by 31% compared to cartons without trays, but in the two newly proposed carton designs (Altvent and Multivent), the energy usage was reduced by 27 and 26 %, respectively, as airflow was distributed more evenly between the five fruit layers. The use of the new vent hole designs (Altvent and Multivent) compared to the Standard Vent design, also considerably improved cooling uniformity and energy efficiency during FAC, reducing cooling heterogeneity by 79 and 51 %, as well as energy consumption by 48 and 7 %, when packed with and without trays, respectively. By simultaneous evaluation of multiple parameters, this analysis approach thus unveiled the benefits and disadvantages of the new ventilated carton designs and can be used to further improve vent hole designs for specific cold chains.

**Keywords:** /Cold storage/ /Forced Air Cooling/ /Internal Packaging/

### **FOOD SAFETY**

Wilson, Norbert L.W., et al. 2017. Food waste: The role of date labels, package size, and product category. *Food Qual. Prefer.* 55: 35 - 44.

#### **Abstract**

The presence of food waste, and ways to reduce it, has generated significant debate among industry stakeholders, policy makers, and consumer groups around the world. Many have argued that the variety of date labels used by food manufacturers leads to confusion about food quality and food safety among consumers. Here, we develop a between-subject, laboratory experiment with different date labels (Best by, Fresh by, Sell by, and Use by) for products (ready-to-eat cereal, salad greens, and yogurt) of different sizes and dates to evaluate how date labels influence the value of premeditated food waste of subjects, or their willingness to waste (WTW). Subjects have different WTW over products, sizes, and dates; we expect that ambiguity avoidance may prompt differences in the WTW. The WTW is greatest in the “Use by” treatment, the date label which may be the least ambiguous and suggestive of food safety. The WTW is the lowest for the “Sell by” treatment, which may be the most ambiguous date label about safety or quality for the consumer. Results from the mixed-design, repeated measures ANOVA provide evidence that subjects have different WTW by date labels over products.

**Keywords:** /Food Safety/ /Consumer Preference/

### **FRESH CUT**

Fundo, Joana F., et al. 2016. NMR water transverse relaxation time approach to understand storage stability of **fresh-cut** ‘Rocha’ pear. LWT-Food Sci. Technol. 74: 280 - 285.

### **Abstract**

Fresh-cut fruit is an important segment in fruit market due to the increasing demand for healthy/ convenient foods. However, processing promotes a decrease in fruits stability with faster physiological and microbiological deteriorations. Food stability is strongly attributed to its molecular dynamics and “water availability”. Understanding changes in water location/mobility is of utmost importance, since water dynamics profoundly influences physico-chemical and microbiological quality of foods. Nuclear magnetic resonance spectroscopy (NMR) is a methodology used to study the food constituents' molecular dynamics. The aim of this study is to use NMR to evaluate changes in water mobility that occurred in fresh-cut pear tissues during storage, by measuring the transverse relaxation time ( $T_2$ ) parameter. Results showed the existence of three water classes in the cells after processing, with  $T_2$  values of 10 ms, 187 ms and 3s for cellular wall, cytoplasm and vacuole, respectively. Also, the obtained results demonstrated that  $T_2$  was affected by processing and storage. Moreover, a relationship between  $T_2$ , microstructure and the quality parameters was established.  $T_2$ , maximum value increased with pear hardness as well as water activity. On the contrary, a decrease in total colour difference (TCD) was found with  $T_2$ . Results demonstrate the usefulness of the application of NMR relaxometry in food studies.

**Keywords:** /Fresh Cut/ /Quality Parameters/ / Storage/

Gomez-Lopez, et al. 2017. A novel electrochemical device as a disinfection system to maintain water quality during washing of ready to eat fresh produce. Food Control. 71: 242 - 247.

### **Abstract**

Electrolyzed water (EW) is known by its bactericidal efficacy and capability to oxidize organic matter. The present research evaluated the efficacy of recently developed electrolytic cells able to

generate higher concentration of reactive oxygen species using lower power and salt concentration than conventional cells. This study tested the inactivation of *Escherichia coli* O157:H7, the organic matter depletion and trihalomethane (THM) generation by EW in process wash water under dynamic conditions. To achieve this, clean tap water was continuously added up to 60 min with artificial process water with high chemical oxygen demand (COD) inoculated with *E. coli* O157:H7, in experiments performed in a pilot plant that recirculated water through one electrolytic cell. Plate counts of *E. coli* O157:H7, COD, THMs, free, combined and total chlorine, pH, temperature and oxidation-reduction potential were determined. Results indicate that the novel electrolysis system combined with minimal addition of NaCl (0.05%) was able to suppress *E. coli* O157:H7 population build-up and decreased the COD accumulation in the process wash water. THM levels in the water were relatively high but its concentration in the washed product was marginal. Highly effective electrolysis has been proven to reduce the occurrence of foodborne diseases associated to cross-contamination in produce washers without having an accumulation of THMs in the washed product.

**Keywords:** /Fresh Cut/ /*Escherichia coli* O157:H7/

## **FRESH PRODUCE**

Cossu, Andrea, et al. 2016. Antimicrobial effect of synergistic interaction between UV-A light and gallic acid against *Escherichia coli* O157:H7 in **fresh produce** wash water and biofilm. *Innov. Food Sci. Emerg.* 37: 44 - 52.

### **Abstract**

A synergistic interaction between gallic acid (GA) and UV-A light (UV-A + GA) to inactivate *E. coli* O157:H7 in spinach wash water and in biofilm was evaluated. A 30-min exposure to UV-A light in presence of 10 mM GA had relevant biological effect in the inactivation of *E. coli* O157:H7 in suspension in the absence ( $>5 \log(\text{CFU}/\text{mL})$ ) and the presence of organic content ( $>3\text{-log}(\text{CFU}/\text{mL})$  in 2000 mg O<sub>2</sub>/L COD (Chemical Oxygen Demand) organic load), and resulted in ~80% decrease in the metabolic activity of *E. coli* O157:H7 biofilm. GA solutions could be recycled through at least 3-cycles of UV-A treatment without a significant loss in antibacterial effect. Catalase reduced the extent of *E. coli* O157:H7 inactivation from the UV-A+ GA treatment suggesting that generation of hydrogen peroxide was partially responsible for the observed antimicrobial effect. The UV-A + GA treatment was also found to be effective in causing  $>3 \log(\text{CFU}/\text{mL})$  reductions in *E. coli* O157:H7 on the surface of spinach leaves. UV-A + GA treatment can serve as an effective intervention in the fresh produce sanitation. *Industrial relevance:* The results of this study show that a synergistic interaction between gallic acid (GA) and UVA (365 nm) light is an effective treatment for sanitation of fresh produce and water used to wash fresh produce. It was also found to be effective against the *E. coli* O157:H7 biofilm. The attractive attributes of this technology include a relatively low cost; specific, light-triggered activity; non-toxic nature and scalability. Thus, this technology has potential to replace conventional chemical sanitizer-based sanitation approaches.

**Keywords:** /Fresh Produce/ /*Escherichia coli* O157:H7/ / Biofilm

De Bonis, Maria Valeria and Gianpaolo Ruocco. 2016. A heat and mass transfer perspective of microbial behavior modeling in a structured vegetable food. *J. Food Eng.* 190: 72 - 79.

### **Abstract**

A mathematical model predicting *Escherichia coli* O157:H7 behavior was developed, depending on the applied thermal regimes, using a whole iceberg lettuce as a structured model food. The 3-D, transient model is based on energy and biomass conservation complemented by primary and secondary predictive notations, allowing one to virtualize the combined effect of bacterial growth and migration, under any possible handling and storage conditions. Due to its flexibility and applicability, the model is a suitable tool to virtualize the bacterial contamination in fresh produce, from postharvest to consumer. Realistic cases such as external contamination or pathogen internalization are examined, following model validation. The complex combination of bacterial penetration and population level, for example, is highlighted which depends nonlinearly on bacterial diffusivity and operating temperature. While it is shown that, with variable thermal regimes, the total contamination level is practically equivalent if the cumulative thermal exposures are the same. The proposed procedure can be also applied to other food/microorganism pairs, provided that general data on microbial generation and diffusion are available.

**Keywords:** /Fresh Produce/ / Refrigerated Storage/ / Product Handling/

Khalil, Rowaida K.S. and Mohamed A.E. Goma. Prevalence and characterization of Shiga toxin-producing *Escherichia coli* (STEC) in fruits and vegetables sold at local street markets in Alexandria, Egypt. LWT-Food Sci. Technol. 74: 199 - 210.

### Abstract

This is the first report on the prevalence of Shiga toxin-producing *Escherichia coli* strains (STECs) in fresh produce sold at local street markets in Alexandria. A total of 945 samples were enumerated for total aerobic mesophilic bacteria (AMC) and *E. coli* (ECC). AMC ranged from  $<0.69 \times 10^5$  and  $<0.56 \times 10^4$  Log<sub>10</sub> CFU g<sup>-1</sup> in fruits and vegetables respectively. High flavonoid contents and anti-oxidant capacity inhibited *E. coli* growth in some types. 80% of samples were contaminated with *E. coli*, and 4.23% were tested *E. coli* O157:H7 positive biochemically and serologically. Multiplex PCR detected STEC O157:H7 in 20% (2.3%) of produce types, with virulence markers: *stx2*; 59% (13/22), *stx1*; 54.5% (12/22), *eaeA*; 45.45% (10/22), and *hlyA*; 18.18% (4/22). The most prevalent toxin genotype was that of STECs possessing *stx1-eaeA* (27.3%), *stx2-eaeA* (22.7%), and *stx1-stx2* (13.6%). Multidrug resistance was observed in 86.4% of the STECs, 46.4% of which were *stx2*-positive. Resistance of *eaeA*-positive STECs to fluoroquinolones constitute health threat to consumers, where resistance determinants can spread among non-pathogenic bacteria in the gastrointestinal tract due to plasmid mobility. Findings of this research call for immediate actions by the Egyptian Food Safety Agency to ensure constant supply of safer produce to local markets nationwide.

**Keywords:** /Fresh Produce/ /Microbiological Quality/

Snyder, Abigail B., Jennifer J. Perry and Ahmed E. Yousef. Developing and optimizing bacteriophage treatment to control enterohemorrhagic *Escherichia coli* on fresh produce. Int'l. J. Food Microbiol. 236: 90 - 97.

### Abstract

Bacteriophages are potentially useful in controlling foodborne pathogens on minimally processed products since phage application is a non-destructive treatment. The purpose of this study

was to evaluate the efficacy of a newly isolated environmental bacteriophage against enterohemorrhagic *Escherichia coli* on fresh produce, and optimize the treatment with consideration for potential application. Seven anti *E.coli* O157:H7 EDL933 bacteriophages were isolated from various sources; the most promising was isolated from municipal wastewater. This isolate (designated as *E. coli* phage OSY-SP) was propagated with the host, in a growth medium, to a titer of 10<sup>8</sup> PFU/ml. Before inoculation into fresh produce, *E. coli* phage OSY-SP was incubated with the host bacterium, spent medium was filter-sterilized, and the resulting crude lysate was used as a source of phage inocula for preliminary experiments. For optimized testing, phage in the crude lysate was purified by ultracentrifugation and re-suspension in phosphate-buffered saline. Efficacy of phage treatments was determined as a function of fresh produce type (cut green pepper or spinach leaves), treatment time (2 or 5 min rinsing), and temperature of holding treated produce (4 °C, 25°, or a combination of both temperatures). Cut green pepper was treated with UV light, to eliminate background microbiota, then spot-inoculated with *E. coli* O157:H7 EDL933 on cut edges, and the inoculum was allowed to dry. Because of its susceptibility to damage, baby spinach leaves were not subjected to a decontamination treatment. These leaves were inoculated with the green fluorescent protein-labeled *E. coli* O157:H7 B6–914 to facilitate inoculum enumeration in the presence of background microbiota. Phage suspension was applied to the inoculated fresh produce that was subsequently held for three days under variable storage conditions. The optimized phage treatment decreased the populations of pathogenic *E. coli* by 2.4–3.0 log CFU/g on cut green pepper (5-min rinse) and 3.4–3.5 log CFU/g on spinach leaves (2-min rinse), during 72 h storage. The majority of this decline was caused by the antimicrobial action of the phage. These findings suggest the utility of bacteriophage to selectively control pathogens on fresh produce.

**Keywords:** /Fresh Produce/ /Biocontrol/

## **INTEGRATED PEST MANAGEMENT**

Lamichhane, Jay Ram, et al. 2016. Networking of **integrated pest management**: A powerful approach to address common challenges in agriculture. *Crop Prot.* 89: 139 - 151.

### **Abstract**

Integrated pest management (IPM) is facing both external and internal challenges. External challenges include increasing needs to manage pests (pathogens, animal pests and weeds) due to climate change, evolution of pesticide resistance as well as virulence matching host resistance. The complexity of designing effective pest management strategies, which rely less heavily on the use of conventional pesticides, is another external challenge. Internal challenges include organizational aspects such as decreasing trend in budget allocated to IPM research, increasing scarcity of human expertise, lack of knowledge transfer into practice and the communication gap both at country level and between countries, and lack of multi-, inter- and transdisciplinary IPM research. There is an increasing awareness that trans-national networking is one means to overcome such challenges and to address common priorities in agriculture. A large number of stakeholders (researchers, policy makers, growers and industries) are involved in the sector of crop protection, which needs to be coordinated through effective communications and dynamic collaboration to make any IPM strategy successful. Here we discuss a decade-long IPM networking experiences in Europe emphasizing how IPM research, implementation and adoption in Europe may benefit from a broader level networking.

**Keywords:** /Integrated Pest Management/

## **PACKAGING**

Bovi, Grazielle G., et al. 2016. Transpiration and moisture evolution in **packaged** fresh horticultural produce and the role of integrated mathematical models: a review. *Biosystem Eng.* 150: 24-39.

### **Abstract**

Transpiration has various adverse effects on postharvest quality and the shelf-life of fresh fruit and vegetables (FFV). If not controlled, the water released through this process results in direct mass loss and moisture condensation inside packaged FFV. Condensation represents a threat to the product quality as water may accumulate on the product surface and/or packaging system, causing defects in external appearance and promoting growth of spoilage microorganisms. Thus, moisture regulation is extremely important for extending FFV shelf-life. This review focuses on transpiration phenomenon and moisture evolution in packaged fresh horticultural produce. It provides recent information on various moisture control strategies suitable for packaging of fresh horticultural produce. It also provides an evaluation on the role and application of integrative mathematical modelling in describing water relations of FFV for packaging design, as well as, an overview of models reported in literature.

**Keywords:** /Packaging/ /Fresh produce/

## **READY-TO-EAT**

Ajayeoba, Titilayo, et al. 2016. The potential of lemon juice-ogi steep liquor mixtures in the reduction of *Listeria monocytogenes* contamination of **ready-to-eat** vegetables. *LWT- Food Sci. Technol.* 74: 534-541.

### **Abstract**

This study evaluated the inhibitory effect of lemon juice ogi steep liquor mixtures (10e50% v/v) made from white and yellow maize, white and red sorghum and Pearl millet grains on three antibiotic resistant isolates (LM 29, 33 and 44) and a susceptible isolate (LM 50) of *Listeria monocytogenes*. The isolates were surface-inoculated onto ready-to eat-vegetables (cucumber-*Cucumis sativas*, cabbage-*Brassica oleracea*, carrot-*Daucus carota*, tomato-*Solanum lycopersicum*, lettuce-*Lactuca sativa*). The most effective concentration (50% v/v, lemon juice-white sorghum) of the mixtures was further used for bioassay of vegetables contaminated with isolate with the lowest zone of inhibition (LM 29) to the treatments at dipping times of 0e20 min. The major active compounds in the mixtures were also elucidated with Fourier Transform Infra-Red spectroscopy. There were significant differences ( $p \leq 0.05$ ) in the responses of the isolates to the treatments which varied with types of isolates, the cereal sources and contact times. There were reductions in the colonies of the isolates as the dip time increased and the isolates inoculated onto carrots; cucumbers and lettuce were completely inhibited at 10, 15 and 20 min treatment times. Alcohol and carboxylic acids were identified as the major active compounds responsible for reduction and inhibition of the isolates.

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

Faour-Klingbeil, Dima, Ewen C.D. Todd and Victor Kuri. 2016. Microbiological quality of **ready-to-eat** fresh vegetables and their link to food safety environment and handling practices in restaurants. LWT-Food Sci. Technol. 74: 224 -233.

### **Abstract**

The increased consumption of ready-to-eat salads outside homes as a result of a fast paced lifestyle, awareness on their nutritional attributes and enhanced processing technology is well documented. This study aimed to determine the microbiological quality of fresh-cut salads vegetables in small and medium sized foodservice establishments (SMEs) and to identify risk factors and handling practices through observational assessment in order to investigate if an association between microbiological quality and visual assessment (inspection) scores can be established. A total of 118 samples fresh-cut vegetable salads were collected from 50 inspected locations and analysed microbiologically, in addition to 49 swabs of knives and cutting boards. There was no statistically significant correlation between visual assessment scores and bacteriological counts on vegetables or cutting boards. Nonetheless, the consistent relationship between inspection ratings on cross contamination and cleaning components and *Listeria* spp. levels was statistically significant. This study demonstrated that overall visual assessment scores would not directly reflect the safety of salad vegetables and that the significance of microbiological assessment should be considered in relation to individual inspection components. It is necessary to place effective control measures on cleaning standards and risk of cross-contamination to improve the microbiological safety of fresh salad vegetables in SMEs.

**Keywords:** /Ready-to-eat // Microbiological Quality/

Mottola, Anna, et al. 2016. Occurrence of emerging food-borne pathogenic *Arcobacter* spp. Isolated from pre-cut (**ready-to-eat**) vegetables. Int'l. J. Food Microbiol. 236: 33 - 37.

### **Abstract**

Given that changes in consumer food behaviours have led to an increase in the demand for pre-cut ready-to-eat (RTE) vegetables, and that few data are currently available on the occurrence of *Arcobacter* spp. in such foods, the aim of the present study was to assess the occurrence of *Arcobacter* spp. that carry virulence-associated genes on pre-cut RTE vegetables, using cultural and molecular methods. *Arcobacter* was detected using biomolecular identification methods in 44/160 (27.5%) of the samples, of which 40/44 (90.9%) isolates corresponded to *A. butzleri* and 4/44 (9.1%) to *A. cryaerophilus*. Studying the incidence of 9 virulence-associated genes revealed the widespread distribution of these genes among the *Arcobacter* isolates tested. The results obtained in our research provided plenty of information on the health risks associated with the direct consumption of raw vegetables, and highlight the need to implement further studies at each level of the production chain, in order to obtain further information to help protect human health.

**Keywords:** /Ready to Eat/ /Food-Borne Pathogens/

## FRUITS

### AVOCADO

Rezende, Ana Carolina B., et al. 2016. Incidence and growth of *Salmonella enterica* on the peel and pulp of avocado (*Persea americana*) and custard apple (*Annona squamosa*). Int'l. J. Food Microbiol. 235: 10 - 16.

#### **Abstract**

The aim of this study was to assess the incidence and to estimate the growth kinetic parameters (maximum growth rate,  $\mu$ ; lag time,  $\lambda$ ; and maximum population,  $\kappa$ ) of *Salmonella* on the peel and pulp of avocado (*Persea americana* var. *americana*) and custard apple (*Annona squamosa* L.) as affected by temperature (10–30 °C). The incidence of *Salmonella* was assessed on the peel and pulp of the fruits (n=200 of each fruit), separately, totalizing 800 analyses. Only three samples of custard apple pulp were positive for *Salmonella enterica* and the three isolates recovered belonged to serotype S. Typhimurium. *Salmonella* was not recovered from avocado and custard apple peels and from avocado pulp. Generally, the substrate (pulp or peel) of growth did not affect  $\mu$  values of *S. enterica* (p N 0.05). Very similar  $\mu$  values were found for *S. enterica* inoculated in custard apple and avocado. *S. enterica* presented the highest  $\lambda$  in the peel of the fruits. The growth of *S. enterica* resulted in larger  $\lambda$  in custard apple in comparison to avocado. For example, the  $\lambda$  of *S. enterica* in the pulp of custard apple and avocado were 47.0±0.78 h and 10.0±3.78 h, respectively. The lowest values of  $\kappa$  were obtained at the lower storage temperature conditions (10 °C). For instance,  $\kappa$  values of 3.7 ± 0.06 log CFU/g and 2.9 ± 0.03 log CFU/g were obtained from the growth of *S. enterica* in avocado and custard apple pulps at 10 °C (p b 0.05), respectively. On the other hand, at 30 °C,  $\kappa$  values were 6.5 ± 0.25 log CFU/g and 6.5 ± 0.05 log CFU/g, respectively. Significantly higher  $\kappa$  were obtained from the growth of *S. enterica* in the pulp than in the peel of the fruits (p b 0.05). For instance, the growth of *S. enterica* in the pulp of avocado led to a  $\kappa$  value of 6.5±0.25 log CFU/g, while in the peel led to a  $\kappa$  value of 4.6±0.23 log CFU/g (p b 0.05). In general, growth kinetic parameters indicated that avocado comprises a better substrate than custard apple for the growth of *S. enterica*. The square root model fitted to the data obtained in this study and to the growth data available in the literature for other tropical low acid fruits indicated high variability in  $\mu$  and  $\lambda$  of *Salmonella*. The results obtained in this study show that whole low acid tropical fruits can harbor *Salmonella*, and that this foodborne pathogen can not only survive but also grow both on the peel and pulp of low acid tropical fruits, such as avocado and custard apple.

**Keywords:** /Avocado/ /Custard Apple/ /Tropical Fruits/

### BANANA

Nannyonga, Stella, et. al. 2016. Mathematical modelling of color, texture kinetics and sensory attributes characterization of ripening bananas for waste critical point determination. J. Food Eng. 190: 206 - 210.

#### **Abstract**

It is vital to correlate the instrumental and non-instrumental analyses of food products so as to determine the product waste critical point. Texture and color (instrumental) were determined by a universal testing machine (UTM) and colorimetry respectively to ascertain the kinetics of bananas during

ripening. While deterministic, descriptive and ranking sensory tests were employed for sensory attributes characterisation. Seven banana color ripening stages were used for color variation and three temperatures (16, 23 and 30 °C) were used to study the kinetics, L, a, b and  $\Delta E$  were calculated and axial puncture force, PF determined. Logistic model and first order reaction models were used. The sensory attributes results indicated banana waste critical point from stage 6 while instrumental analyses still indicated a model trend up to stage 7.

**Keywords:** /Banana/ /Ripening/ / Sensory Attributes/

Huang, Yaoxin, et al. 2017. Pulsed light inactivation of murine norovirus, Tulane virus, *Escherichia coli* O157:H7 and *Salmonella* in suspension and on **berry** surfaces. Food Microbiol. 207: 1 - 4.

### **Abstract**

Pulsed light (PL) inactivation of two human norovirus (HuNoV) surrogates, murine norovirus (MNV-1) and Tulane virus (TV), and two bacterial pathogens, *Escherichia coli* O157:H7 and *Salmonella* were evaluated. The viruses and bacteria were suspended in phosphate buffered saline (PBS) to final populations of  $\sim 6$  log PFU/mL and  $\sim 6$  log CFU/mL, respectively. Both viral and bacterial suspensions were then irradiated by PL for different durations and the reductions of each microorganisms were determined. MNV-1 and TV were significantly ( $P < 0.05$ ) more resistant to PL treatment than *Salmonella* and *E. coli* O157:H7 in PBS suspension. MNV-1, *Salmonella* and *E. coli* O157:H7 were also inoculated on strawberries and blueberries and the PL inactivation of each microorganism was determined. Lower inactivation of each microorganism was achieved on berry surfaces than in PBS suspension. This study shows that PL can induce rapid inactivation of MNV-1, TV, *Salmonella* and *E. coli* O157:H7 in clear suspension with viruses more resistant to PL treatment than bacteria. The efficacy of PL treatment is substantially influenced by food surface structure.

**Keywords:** /Berry/

### **BLUEBERRY**

Hu, Meng-Han, Qing-Li Dong and Bao-Lin Liu. 2015. Modelling postharvest quality of **blueberry** affected by biological variability using image and spectral data. J. Sci. Food Agric. 96(10): 3365 - 3373.

### **Abstract**

**BACKGROUND:** Hyperspectral reflectance and transmittance sensing as well as near-infrared (NIR) spectroscopy were investigated as non-destructive tools for estimating blueberry firmness, elastic modulus and soluble solid content (SSC). Least squares–support vector machine models were established from these three spectra based on samples from three cultivars viz. *Bluecrop*, *Duke* and *M2* and two harvest years viz. 2014 and 2015 for predicting blueberry postharvest quality. **RESULTS:** One-cultivar reflectance models (establishing model using one cultivar) derived better results than the corresponding transmittance and NIRmodels for predicting blueberry firmness with few cultivar effects. Two-cultivar NIRmodels (establishing model using two cultivars) proved to be suitable for estimating blueberry SSC with correlations over 0.83.  $R_p$  (RMSEp) values of the three-cultivar reflectance models (establishing model using 75% of three cultivars) were 0.73 (0.094) and 0.73 (0.186), respectively, for predicting blueberry firmness and elastic modulus. For SSC prediction, the three-cultivar NIRmodel was found to achieve an  $R_p$  (RMSEp) value of 0.85 (0.090). Adding *Bluecrop* samples harvested in 2014 could

enhance the three-cultivar model robustness for firmness and elastic modulus. **CONCLUSION:** The above results indicated the potential for using spatial and spectral techniques to develop robust models for predicting blueberry postharvest quality containing biological variability.

**Keywords:** /Blueberry/ /Postharvest/ /Quality/

Hu, Meng-Han, et al. 2016. Prediction of mechanical properties of **blueberry** using hyper spectral interactance imaging. *Postharvest Biol. Technol.* 115: 122 - 131.

### **Abstract**

The purpose of this investigation was to develop and validate a hyperspectral interactance imaging system to non-destructively estimate blueberry mechanical properties. Four texture profile analysis (TPA) and four puncture analysis (PA) parameters were predicted. A region growing based algorithm was used to segment the acquired interactance hypercubes and to assist in extracting mean spectra. Subsequently, the spectra were smoothed by Standard Normal Variate (SNV) and Savitzky-Golay first derivative (Der). Least squares support vector machines integrated with Monte Carlo uninformative variable elimination (MC-UVE) models were developed for mechanical parameters. Based on the MC-UVE selected wavelengths, the SNV model performed best for cohesiveness with Rp (Rc) value of 0.91 (0.91). The SNV models of springiness, resilience, max force strain and final force resulted in Rp (Rc) values of 0.84 (0.85), 0.86 (0.87), 0.65 (0.76) and 0.62 (0.72), respectively. Using Der spectra, the Rp (Rc) values were found to be 0.77 (0.86), 0.71 (0.73) and 0.58 (0.69) for hardness, maximum force and gradient, respectively. Generally, the overall performances of MC-UVE based models were similar to those with full spectra. The above results showed the potential of hyperspectral interactance imaging coupled with MC-UVE approach for predicting the mechanical properties of blueberry and the other small fruit.

**Keywords:** /Blueberry/ /Fruit Quality/

Hu, Meng-Han, Qing-Li Dong and Bao-Lin Liu. 2016. Classification and characterization of **blueberry** mechanical damage with time evolution using reflectance, transmittance and interactance imaging spectroscopy. *Comput. Electron. Agric.* 122: 19 - 28.

### **Abstract**

The aim of this work was to evaluate the performance of hyperspectral data coupled with chemometrics methods in characterizing and detecting the non-visible mechanical damage of blueberries with time evolution. Reflectance and transmittance as well as interactance hypercubes were automatically segmented by the region growing based algorithms. The maximum-normalized spectra were pretreated by the Standard Normal Variate algorithm, and subsequently the Competitive Adaptive Reweighted Sampling algorithm was applied to extract the damage-specific wavelengths. Based on confusion matrices and area under Receiver Operating Characteristics curves, transmittance showed relatively superior performance to reflectance and interactance. Application of new sample set subjected to impact tests with time evolution, results demonstrated that it was especially difficult to distinguish fresh damage in blueberry. At 2 days after impacted, several transmittance-based classifiers obtained satisfactory accuracies for classifying damaged (sound) blueberries: logistic regression 79.1% (85.7%), multilayer perceptron-back propagation 74.4% (92.1%) and logistic function tree 72.1% (95.2%).

Furthermore, the physical property preliminarily proved to be more pronounced than the absorbed impact energy for damage incidence and severity of blueberry via the use of multiple comparisons.

**Keywords:** /Blueberry/ / Mechanical Damage/

Wang,Chen and Xianjun Meng. 2016. Effect of  $^{60}\text{Co}$   $\gamma$ -irradiation on storage quality and cell wall ultra-structure of **blueberry** fruit during cold storage. *Innov. Food Sci. Emerg.* 38: 91 - 97.

### **Abstract**

In order to explore the influence rule of  $^{60}\text{Co}$   $\gamma$ -irradiation on preservation effect of blueberry fruit, this research used different doses to deal with "Bluecrop" blueberries. The experimental results indicated that: under the temperature of  $0\pm 0.5$  °C, the preservation effect of 0.5 kGy irradiation treatment on blueberry fruit was not obvious and 3.0 kGy irradiation treatment can accelerate the ageing process of blueberry fruit in late storage, so 1.0 kGy to 2.5 kGy irradiation treatment were considered to be a feasible method for reducing the fruit rot rate, maintaining fruit firmness and colour, and reducing the loss of nutrients in blueberry fruit during storage, among them, 2.5 kGy irradiation treatment had the best preservation effect on the blueberry fruit stored for 35 days, which fruit decay rate was the lowest (3.35%), fruit firmness was the highest (1.08 N), the degradation of nutrients was the most slowly, the pictures of cell-wall ultrastructure were relatively complete, and the storage period was effectively prolonged to 63 days. Industrial relevance: The appropriate doses of irradiation treatment are very efficient in reducing the decay rate, maintaining sensory and nutritional quality, and extending the storage period for blueberry fruit stored at  $0\pm 0.5$  °C.

**Keywords:** /Blueberry/ /Storage/ /Quality/

### **CANTALOUPE**

Ma, Qiumin, et al. 2016. Quality attributes and microbial survival on whole **cantaloupes** with antimicrobial coatings containing chitosan, lauric arginate, cinnamon oil and ethylene diaminetetra acetic acid. *Int'l. J. Food Microbiol.* 235. 103 - 108.

### **Abstract**

Cantaloupes are susceptible to microbiological contamination in pre- or postharvest environments. Novel intervention strategies, such as antimicrobial coatings, are needed to improve the microbiological safety of cantaloupes. The objective of this study was to prepare whole cantaloupes coated with mixtures containing chitosan, lauric arginate (LAE), cinnamon oil (CO), and ethylene diaminetetra acetic acid (EDTA) and determine survival characteristics of inoculated foodborne pathogens during storage as well as cantaloupe quality attributes. Chitosan coating with 0.1% LAE, 0.1% EDTA, and 1% CO was the most effective for inactivating foodborne pathogens inoculated on cantaloupes. This coating caused a  $N_3$  log CFU/cm<sup>2</sup> reduction of *Escherichia coli* O157:H7 and *Listeria monocytogenes* immediately after coating and reduced *Salmonella enterica* to below the detection limit during a 14-day storage. Total molds and yeasts also were reduced to the detection limit by the coating. The redness and yellowness of uncoated cantaloupes were significantly higher than coated ones from day 6. The firmness of uncoated cantaloupes and those coated with chitosan only was significantly lower than other treatments from day 10. No significant differences were found in total soluble solids content

or weight loss between coated and uncoated cantaloupes. Results showed the potential benefits of applying the coating mixtures to improve the quality and microbiological safety of cantaloupes.

**Keywords:** /Cantaloupe/ /Chitosan/ /Coating/

## **CHERRY**

Muzaffar, Sabeera, et al. 2016. Ultrasound treatment: effect on physicochemical, microbial and antioxidant properties of **cherry** (*Prunus avium*). J Food Sci. Technol. 53 (6): 2752 - 2759.

### **Abstract**

The cherry was treated with ultrasonic waves (33 kHz, 60 W) at different time intervals (10, 20, 30, 40, 60 min) and study was carried out to analyze the change in physico-chemical properties (TSS, pH, color, acidity and firmness), antioxidant potential and microbial load of the fruit during the storage period of 15 days at 4 °C. It was observed that ultrasound treatment (US) between 30 and 40 min showed better retention of color of the fruit during the storage period. The antioxidant assays (DPPH, ABTS and TPC) also increased significantly (P < 0.05) up to 40 min, however the firmness of the fruit was affected and it showed a significant decrease beyond 20 min of US treatment. The sample with 40 min US treatment showed significantly less microbial load than other samples. The 20–40 min US treatment time (33 kHz, 60 W) was suggested for preservation of cherry during the storage at 4 °C.

**Keywords:** /Cherry/ /Antioxidant /

Wahib, Wael, et al. 2017. Evolution of **cherries** texture in brine: Impact of harvest conditions during long-time storage. LWT- Food Sci. Technol. 75: 243 - 250.

### **Abstract**

Texture is a primary quality attribute of brined sweet cherries (*Prunus avium* L.) and its preservation is a major objective for candying industry. In order to identify the harvest factors influencing textural changes during long period brine storage, different itineraries were applied: harvest at two different maturity stages, treatment or not with ethephon, manual or mechanical harvest, removal or not of peduncles. The cherries were immersed in brine and examined over a 12-months period for firmness, calcium and total soluble solids diffusion and cytohistological remodelling. Mechanical harvesting, harvest at late maturity stage and storage with peduncle decreased firmness while ethephon treatment had no effect. However, only presence or absence of peduncles influenced salt and total soluble solids diffusion, suggesting that peduncle removal promotes osmotic exchanges. Brine storage led to a texture gain in the first two months in most cases compared to fresh cherries, as confirmed by a beneficial reshuffle at cytohistological level. This explains why it can allow storage of cherries for candying over the whole duration between two harvest seasons.

**Keywords:** /Cherries / /Firmness/ /Storage/

## CITRUS

Cronjé, Paul J.R., Lorenzo Zacarías and Fernando Alférez. 2017. Susceptibility to postharvest peel pitting in citrus fruits as related to albedo thickness, water loss and phospholipase activity. *Postharvest Biol. Technol.* 123: 77 - 82.

### **Abstract**

To study the influence of albedo thickness and phospholipase activity on the incidence of postharvest peel pitting (PP) in citrus fruit the tangor Ortanique, mandarin, with a thin albedo and tolerant to peel pitting were compared to that of the sensitive Navelate Navel orange with a thick albedo. Fruit from both cultivars was subjected to identical postharvest practices consisting of washing and/or waxing on a commercial packline and thereafter the fruit was stored for 3 weeks at 30% or 90% relative humidity (RH). For comparison, other fruit lots were washed manually and stored as above. Periodically, water loss, water, osmotic and turgor potentials were monitored and peel pitting incidence was evaluated. For both cultivars fruit weight loss was higher in packline than in manually processed, however, only 'Navelate Navel' orange fruit developed peel pitting with higher incidence in the packline treatments compared with manually processed fruit. In addition, wax coating exacerbated this effect leading to higher pitting of 'Navelate Navel' orange. Accordingly, water potential variations were more pronounced in wax coated fruit from 'Navelate Navel' orange as compared to 'Ortanique' mandarin. Furthermore, Phospholipase D and A2 (PLD and PLA2) activities were higher in the peel from the pitting susceptible cultivar, suggesting their activation by sharper changes in peel water potential. Collectively, results suggest that water movement through cell layers in a thick albedo is related to postharvest peel pitting and support the notion that inability to properly adjust water status in peel tissue after prolonged water stress results in cell collapse and tissue damage. Moreover, enhanced phospholipase activity appears to be also a response of peel tissues to conditions causing peel pitting.

**Keywords:** /Citrus/ /Postharvest/

Ma, Haijie, et al. 2016. The citrus postharvest pathogen *Penicillium digitatum* depends on the PdMpkB kinase for developmental and virulence functions. *Int'l. J. Food Microbiol.* 236: 167 - 176.

### **Abstract**

The postharvest pathogen *Penicillium digitatum* causes green mold decay on citrus fruit, resulting in severe economic losses. To explore possible factors involved in fungal pathogenesis, phenotypic characterization of the budding yeast Fus3/Kiss1 mitogen-activated protein (MAP) kinase homolog was carried out. The *P. digitatum* MAP kinase B coding gene, designated *PdMpkB*, was functionally inactivated via homologous recombination. The fungal strain ( $\Delta PdMpkB$ ) carrying a *PdMpkB* deletion demonstrated altered gene expression profiles, reduced growth and conidiogenesis, elevated resistance to osmotic stress, and failed to induce green mold decay on citrus fruit.  $\Delta PdMpkB$  was more resistant to CaCl<sub>2</sub>, NaCl and sorbitol than its progenitor strain, indicating a negative regulatory function of *PdMpkB* in osmotic stress adaptation. Fungal infection assays on citrus fruit revealed that  $\Delta PdMpkB$  proliferated poorly within host tissues, induced water-soaking lesions, failed to break through host cuticle layers and thus, failed to produce aerial hyphae and conidia. Introduction of a functional copy of *PdMpkB* into a null mutant restored all defective phenotypes. Transcriptome analysis revealed that inactivation of *PdMpkB* impacted expression of the genes associated with cell wall-degrading enzyme activities, carbohydrate and amino acid metabolisms, conidial formation, and numerous metabolic processes. Our

results define pivotal roles of the *PdMpkB*-mediated signaling pathway in developmental and pathological functions in the citrus postharvest pathogen *P. digitatum*.

**Keywords:** /Citrus/ /Fruit Decay/ /Green Mold/

Ncama, Khayelihle, et al. 2017. Application of Vis/NIR spectroscopy for predicting sweetness and flavour parameters of 'Valencia' orange (*Citrus sinensis*) and 'Star Ruby' grapefruit (*Citrus x paradisi* Macfad). J. Food Eng. 198: 86 - 94.

### Abstract

Sweetness and flavour are desirable attributes used for quality control and assurance of citrus fruit, which are largely determined by total soluble solids (TSS), titrable acidity (TA) and TSS: TA ratio. However, the accuracies of TSS, TA and TSS: TA as flavour indices have been recently criticised. BrimA (Brix minus acids), on the other hand, is an accurate organoleptic parameter that has been shown to be highly related to sweetness and flavour of citrus fruit. In this study, the ability of visible to near infrared spectroscopy (Vis/NIRS), in reflectance mode, to non-destructively quantify BrimA, TSS, TA and TSS: TA ratio of 'Valencia' orange and 'Star Ruby' grapefruit was evaluated. Vis/NIR spectral data was acquired using a laboratory bench-top monochromator NIR Systems. Reference measurements and spectral datasets were subjected to partial least square (PLS) regression analysis. The best prediction models were observed for BrimA of 'Valencia' oranges with the coefficient of determination ( $R^2$ ) = 0.958; root mean square error of prediction (RMSEP)  $\frac{1}{4}$  0.006 and residual predictive deviation (RPD) = 3.96, followed by TSS: TA ratio ( $R^2$  = 0.958; RMSEP = 0.605; RPD = 4.92). Good models for predicting flavor of grapefruit were also attained, with TSS having the best model ( $R^2$  = 0.896, RMSEP  $\frac{1}{4}$  0.308 and RPD = 2.94), followed by BrimA ( $R^2$  = 0.858; RMSEP = 0.429; RPD = 2.45). These results demonstrated the ability of Vis/ NIRS to non-destructively predict sweetness and flavour attributes of oranges and grapefruit. Vis/NIRS was recommended as a possible fast and accurate technique to be used for fruit discrimination based on flavour parameters during packing and for pricing of fruit in the market.

**Keywords:** /Citrus/ /Maturity/ /Quality/

Sheng, Ling, et.al. 2017. Exogenous c-aminobutyric acid treatment affects citrate and amino acid accumulation to improve fruit quality and storage performance of postharvest citrus fruit. Food Chem. 216: 38 – 145.

### Abstract

The loss of organic acids during postharvest storage is one of the major factors that reduces the fruit quality and economic value of citrus. Citrate is the most important organic acid in citrus fruits. Molecular evidence has proved that c-aminobutyric acid (GABA) shunt plays a key role in citrate metabolism. Here, we investigated the effects of exogenous GABA treatment on citrate metabolism and storage quality of postharvest citrus fruit. The content of citrate was significantly increased, which was primarily attributed to the inhibition of the expression of glutamate decarboxylase (GAD). Amino acids, including glutamate, alanine, serine, aspartate and proline, were also increased. Moreover, GABA treatment decreased the fruit rot rate. The activities of antioxidant enzymes and the content of energy source ATP were affected by the treatment. Our results indicate that GABA treatment is a very effective approach for postharvest quality maintenance and improvement of storage performance in citrus production.

**Keywords:** /Citrus/ /Storage/ /Fruit Quality/

Vilanova, Laura, et al. 2016. Relevance of the transcription factor *PdSte12* in *Penicillium digitatum* conidiation and virulence during citrus fruit infection. Int'l. J. Food Microbiol. 235: 93 - 102.

### **Abstract**

Green mould, resulting from *Penicillium digitatum*, is the most important postharvest disease of citrus. In a previous study, the *PdSte12* transcription factor gene was identified, and disruption mutants were obtained. In the present study, the  $\Delta PdSte12$  mutants generated through gene replacement showed significantly reduced virulence during citrus fruit infection. Virulence was affected not only in mature fruit but also in immature fruit, and disease severity was markedly reduced when the oranges were stored at 20 or 4 °C. In addition, the  $\Delta PdSte12$  mutants were defective in asexual reproduction, producing few conidia. The conidiophores of these mutants had longer metulae with fewer branches at the tip of the hyphae. Gene expression analysis revealed that *PdSte12* might act as a negative regulator of several transporter-encoding genes and a positive regulator of two sterol demethylases, all of which are involved in fungicide resistance and fungal virulence. Moreover, *PdSte12* exhibited the negative regulation of another transcription factor *PdMut3*, putatively involved in fungal pathogenesis but with no effect on the MAPK SLT2 *P. digitatum* orthologue belonging to different transcription pathways relevant to cell integrity. These results indicate the *PdSte12* transcription factor is functionally conserved in *P. digitatum* for infection and asexual reproduction, similar to other Ste12 fungal plant pathogens.

**Keywords:** /Citrus/

### **GOOSEBERRY**

Nambiar, Sinjitha S., et al. 2016. Infusion of fructooligosaccharide in Indian gooseberry (*Emblica officinalis*) fruit using osmotic treatment and its effect on the antioxidant activity of the fruit. J Food Eng. 190: 139 - 146.

### **Abstract**

Osmotic dehydration is the most reliable method for the partial removal of water from fruits and vegetables because it is less energy intensive and retains the natural colour, texture and flavour of the food materials. The present work deals with the infusion of fructooligosaccharide (FOS) into Indian gooseberry (amla) fruit. The infusion of FOS was found to increase over a range of temperatures from 30 to 50 °C. The water loss and solid gain during the infusion process were higher at higher temperatures. Furthermore, the antioxidant activity and phenolic as well as flavonoid contents of the FOS osmotic dehydrated samples were also found to be significantly higher as compared to fresh fruits in both in vitro and cell line assays. The present study indicated that the osmotic treatment can be used as a method for the infusion of FOS in solid food matrix such as Indian gooseberry.

**Keywords:** /Gooseberry/

### **GRAPES**

Lorenzini, M., et al. 2016. Polymorphism and phylogenetic species delimitation in filamentous fungi from predominant mycobiota in withered grapes. Int'l. J. food Microbiol. 238: 96 - 62.

## Abstract

Filamentous fungi are the main pathogens of withered grapes destined for passito wine production. Knowledge of which species inhabit these post-harvest fruits and their pathogenicity is essential in order to develop strategies to control infection, but is still scarce. This study investigated the predominant mycobiota of withered grapes through a cultivation-dependent approach. Strain and species heterogeneity was evidenced on examining isolates collected over three consecutive years. Colony morphology and PCR-restriction fragment length polymorphism (PCR-RFLP) analysis revealed the occurrence of several phenotypes and haplotypes, respectively. Strains were phylogenetically analyzed based on sequence typing of different genes or regions (e.g. calmodulin,  $\beta$ -tubulin and internal transcribed spacer region). Beside the most common necrotrophic-saprophytic species of *Penicillium*, *Aspergillus*, *Alternaria* and *Botrytis* species responsible for fruit rot, other saprobic species were identified (e.g. *Trichoderma atroviride*, *Sarocladium terricola*, *Arthrinium arundinis* and *Diaporthe eres*) generally not associated with post-harvest fruit diseases. Species such as *Penicillium ubiquetum*, *Cladosporium pseudocladosporioides*, *Lichtheimia ramosa*, *Sarocladium terricola*, *Diaporthe nobilis*, *Bipolaris secalis*, *Paraconiothyrium fuckelii* and *Galactomyces reessii* that had never previously been isolated from grapevine or grape were also identified. Moreover, it was not possible to assign a species to some isolates, while some members of Didymosphaeriaceae and Didymellaceae remained unclassified even at genus level. This study provides insights into the diversity of the epiphytic fungi inhabiting withered grapes and evidences the importance of their identification to understand the causes of fruit diseases. Finally, phylogenetic species delimitation furnished data of interest to fungal taxonomy.

**Keywords:** /Grapes/ /Fungi/ /Post-harvest Pathogen/

## GUAVA

Mayorga-Martínez, Arturo A., et al. 2016. Non-destructive assessment of guava (*Psidium guajava* L.) maturity and firmness based on mechanical vibration response. Food Bioprocess Technol. 9: 1471 - 1480.

## Abstract

Storage potential and eating quality of guava (*Psidium guajava* L.) fruit depend on its maturity. Segregation of guava according to maturity and firmness measured using non-destructive technologies would help the industry to designate ripe fruit to immediate market and less ripe fruit for distant market (e.g., exportation). This research was conducted to evaluate the potential of experimental resonant frequency ( $f_e$ ) and elasticity index (EI) to estimate fruit firmness, which has been reported to be inversely correlated to its maturity. A maturity index ( $I_m$ ) was calculated as the ratio of total soluble solids/titratable acidity (TSS/TA). It was proved that TSS, TA, and  $I_m$  were significantly correlated ( $P < 0.05$ ) to skin firmness ( $F_s$ ), flesh firmness ( $F_f$ ), stiffness ( $S$ ), and analytical resonant frequency ( $\omega_n$ ), being  $S$  the attribute best fitted to  $I_m$  ( $R^2 = 0.77$ ). Since it was observed that  $f_e$  and EI were sensitive to changes in fruit firmness, both of them were explored as alternatives to predict  $F_s$ ,  $F_f$ ,  $S$ , and  $\omega_n$  of guava fruit. In some cases, EI improved the models to predict guava firmness traits (e.g.,  $F_s$  vs  $f_e$  had a coefficient of determination of  $R^2 = 0.58$ , whereas for  $F_s$  vs EI, it was  $R^2 = 0.62$ ). The best model occurred when plotting  $\omega_n$  vs  $f_e$  ( $R^2 = 0.86$ ), followed by  $S$  vs EI ( $R^2 = 0.84$ ), making these promising features for

the development of a new practical application using frequency response measurement as a non-destructive method to assess guava maturity.

**Keywords:** /Guava/ /*Psidium guajava* L. /

## **KIWIFRUIT**

Hertog, Maarten L.A.T.M., et al. 2016. A mechanistic model to describe the effects of time, temperature and exogenous ethylene levels on softening of **kiwifruit**. *Postharvest Biol. Technol.* 121: 143-150.

### **Abstract**

Early harvested kiwifruit (*Actinidia deliciosa* (A Chev) Liang et Ferguson cv 'Hayward'), from 14 growers and two seasons were stored under a wide range of storage temperatures (0–10 °C) and exogenous ethylene levels (0–200 mL L<sup>-1</sup>) followed by an ethylene free shelf life period at 0–20 °C. Firmness levels were monitored using a non-destructive compression technique. A mechanistic model, based on a simplified representation of the physiology underlying fruit softening, explained 97% of the observed variation. The kinetic model parameters appeared to be generic for the 14 grower lines studied. Differences between the grower lines could be explained based on differences in the initial firmness levels and the initial amounts of active enzyme system present. The model was validated with independent experimental data on the softening of 70 batches of main harvest kiwifruit stored at 0 °C, with more than 99% of the variation explained for each of the 70 grower lines. A further validation was done using literature data on shipping of "Kiwistart" fruit under dynamic temperature and ethylene conditions.

**Keywords:** /Kiwifruit/ /Ethylene/Softening/ /Ripening/ /Temperature/

## **LITCHI**

Ali, Sajid, Ahmad Sattar Khan and Aman Ullah Malik. 2016. Postharvest L-cysteine application delayed pericarp browning, suppressed lipid peroxidation and maintained antioxidative activities of **litchi** fruit. *Postharvest Biol Technol.* 121: 135 - 142.

### **Abstract**

Efficacy of L-cysteine as an anti-browning agent was investigated on 'Gola' litchi fruit. Fruit were treated with its different concentrations (0.0, 0.25, 0.50, 0.75 and 1.0%) and stored at 5 ±1 °C with 90±5% relative humidity (RH) for 28 d. Among the used concentrations, 0.25% treatment was most effective. L-cysteine (0.25%) treated-fruit showed significantly reduced weight loss, disease incidence, disease severity, browning index, membrane leakage and malondialdehyde (MDA) contents. Application of L-cysteine (0.25%) to litchi fruit maintained acidic pericarp pH, exhibited higher total anthocyanins, 2,2-Diphenyl-1- picryl-hydrazyl (DPPH) radical-scavenging-activity and total phenolic contents (TPC) along with reduced activities of peroxidase (POD) and polyphenol oxidase (PPO) enzymes. L-cysteine (0.25%) treatment also maintained substantially higher soluble solid contents (SSC), titratable acidity (TA), ascorbic acid contents and activities of catalase (CAT) and superoxide dismutase (SOD) enzymes. In conclusion, pre-storage L-cysteine (0.25%) application to litchi fruit exhibited reduced pericarp browning index and maintained antioxidative system for 28 d.

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

## **MANGO**

Anusuya, Pothuraja, et al. 2016. Pre-harvest sprays of hexanal formulation for extending retention and shelf-life of **mango** (*Mangifera indica* L.) fruits. Scientia Hort. 211: 231 - 240.

### **Abstract**

Field experiments were conducted to study the response of mango (var. Alphonso and Banganapalli) to pre-harvest sprays of a nanoemulsion of hexanal (Enhanced Freshness Formulation) in extending retention and shelf-life of fruits. Hexanal, a naturally occurring plant derived compound is known to inhibit phospholipase-D and facilitates extension of shelf-life of fruits during storage. Pre-harvest sprays of EFF(1.6 mM) on 30 and 15 days before harvest were done and the observations on fruit retention, incidence of post-harvest diseases and net fruit yield were recorded. After harvest, the fruits were kept under ambient ( $25 \pm 2^\circ\text{C}$ ; 70–75% RH) and cold ( $14 \pm 2^\circ\text{C}$ ; 85–90% RH) storage conditions and the physiological and biochemical parameters were measured regularly till the end of the shelf-life. The data clearly indicated that pre-harvest sprays of EFF significantly reduced the post-harvest diseases such as anthracnose, stem end rot and other infestations which minimized the post-harvest losses while increasing the net fruit yield by 4–5 kg per tree. The sprayed trees retained the fruits in the tree by 3–4 weeks longer than control. Further, the fruits harvested from the sprayed trees remained fresh for a longer period of time under both ambient (24–25 days) and cold (36–40 days) storage conditions in comparison to their respective controls (16–18 days; 20–22 days). The physiological loss in weight was registered lower while other quality attributes such as firmness, total sugars, acidity of treated fruits were higher than their respective controls regardless of storage conditions. Overall, the results suggested that pre-harvest sprays of EFF assisted in retention of fruits for 3–4 weeks longer in the orchard itself besides extending shelf-life under storage conditions without the loss of quality of fruits.

**Keywords:** Mango / / Fruit Quality/ /Post-harvest Losses

Ngamchuachit, Panita, Elizabeth J Mitcham and Diane M Barrett. 2016. Spatial variance of physicochemical properties within mangos and the effect of initial ripeness stage on the quality of fresh-cut **mangos**. J. Sci. Food Agric. 96: 3613 - 3620.

### **Abstract**

**BACKGROUND:** This study aimed to assess the spatial variation in physicochemical properties within individual mangos, as well as to investigate the influence of initial ripeness level on physicochemical characteristics of fresh-cut mangos. Individual mangos were evaluated at 12 specific flesh positions in the inner and outer sides. Mango cubes of 1.5 cm prepared from three firmness stages were monitored for changes during 9 days of storage at  $5^\circ\text{C}$ . **RESULTS:** Mango fruit varied significantly in firmness and color based on spatial position, with the ripening direction from the inner flesh outward and from the stem end to blossom end. Limitations to fresh-cut mango quality were 'desiccation' (dried cut surface) and 'edge or tissue damage' (cut edge damage or brown and bruise-like appearance). Firmer texture and paler yellow of inner flesh were found in less mature mango fruit ( $P < 0.001$ ). The optimal ripeness stage for fresh-cut mango products was 45N, based on ease of handling, fresh appearance at the time of purchase and intermediate physicochemical properties (firmness, color and

SSC/TA ratio). **CONCLUSION:** Spatial variance and initial ripeness stage affect fresh-cut mango quality. Therefore, they must be considered by fresh-cut mango processors in order to attain optimal product quality.

**Keywords:** /Mango/ /Ripening/ /Quality/ /Fresh-Cut/

## **PEAR**

Hahn, Federico, et al. 2016. Optimal pressure and temperature parameters for prickly **pear** cauterization and infrared imaging detection for proper sealing. *J. Food Eng.* 191: 131 - 138.

### **Abstract**

Cactus pear (*Opuntia* sp.) is a highly perishable fruit that starts to deteriorate after several days of storage at room temperature. After two weeks at room temperature, 70% of the fruit shows signs of deterioration. Cactus pear quality for stored pears depends on harvest techniques and on practices for prolonging shelf life. A pneumatic cauterizing machine with a resistive heating element was used to seal cactus pears on their peduncle. More effective contact between the heater element and fruit was obtained after cutting the peduncle. Internal pulp temperature was measured with NTC thermistors and it was found that after heating at 200 °C for 30 s, pulp temperature increased to 60 °C. Surface temperature was measured with a thermal infrared camera. Cactus pear shelf life, water loss, firmness and ° Brix were evaluated using piston pressures of 50, 100, 150 and 200 kPa during 30 s at cauterizing temperatures of 150, 180, 200 and 240 °C. The best shelf life was obtained after pressing the fruit with 100 kPa during 30 s at a temperature of 200 °C. Thirty-seven days after being cauterized, fruits began to rot, and half of the fruit was not marketable after 63 days. Pulp firmness decreased by 81% after 60 storage days, and soluble solids increased by 105%. Pears that did not seal properly were detected using thermal imaging three days after cauterizing. Pears were sliced and cauterized again unless the rotting area was over 50% and firmness lower than 15 N cm<sup>-2</sup>.

**Keywords:** /Pear/ /Shelf Life/

Park, YoSup, ByulHaNa Lee and Hee-Seung Park. Observation of the anatomical causes of fruit softening during growth and storage periods in 'Wonhwang' oriental **pear** (*Pyrus pyrifolia*). *Scientia Hort.* 210: 250 - 257.

### **Abstract**

The objective of this study was to investigate the anatomical causes of the softening of Wonhwang oriental pear by digitizing changes in cell size and intercellular space (IS). We attempted to identify differences affected by growth stage, storage conditions, and harvest timing. Fruit softening was a process caused by changes in cell size, IS widening, and the breaking of cell wall concatenation. Fruits in the were softened primarily by cell expansion and subsequent widening of the IS. For fruits stored at room temperature, softening proceeded very rapidly; the reason underlying rapid softening appeared to be the empty spaces created by cell wall destruction. For fruits stored at low temperature, rapid softening caused by the destruction of cell walls was delayed, but the fruits softened continually due to IS widening. Furthermore, cell size exhibited a positive correlation with firmness, which caused IS widening and softening of the fruits due to cell contraction. Thus, decreased cell size and widened IS

caused softening under low-temperature conditions, and the relationship between softening and cell size was different than that observed during the growth stage.

**Keywords:** /Pear/ /Fruit Softening/ /Storage/

## **PERSIMMON**

Liu, Chi-En, et al. 2017. Effect of a high voltage electrostatic field (HVEF) on the shelf life of **persimmons** (*Diospyros kaki*). LWT- Food Sci. Technol. 75: 236 - 242.

### **Abstract**

This study investigated the effects of HVEF as a potential postharvest technology in persimmon cultivation (*Diospyros kaki*). We used an electric field strength of 600 kV/m and treated samples for different lengths of time (0, 30, 60, 90 or 120 min) before storing the fruit for 15 d. The results showed that HVEF can reduce the rate of weight loss by 1.0e3.4-fold, demonstrating not only that HVEF has the ability to delay tissue deterioration but that the effect increases with treatment time. HVEF also delays the rate of decreasing hardness by 1.0e1.3-fold, indicating that it may have the ability to inhibit the activity of tissue enzymes. HVEF further demonstrated the ability to suppress the rate of malondialdehyde (MDA) production by 1.46e11.22-fold; increasing the treatment time improved the efficacy of the inhibition. HVEF can also delay the decreasing rate of carbon dioxides yield by 1.0e2.3-fold, indicating that it has the ability to inhibit metabolism. This inhibition rate of carbon dioxides yield also results in a delay of organizational deterioration. Finally, HVEF inhibited pectinesterase activity and had no impact on the amount of total phenols.

**Keywords:** /Persimmons/ /Shelf Life/

Vazquez-Gutierrez, Jose Luis, et al. 2016.High hydrostatic pressure as a method to preserve fresh-cut Hachiya **persimmons**: a structural approach. Food Sci. Technol. Int'l. 0(0): 1 - 11.

### **Abstract**

The “Hachiya” persimmon is the most common astringent cultivar grown in California and it is rich in tannins and carotenoids. Changes in the microstructure and some physicochemical properties during high hydrostatic pressure processing (200–400 MPa, 3 min, 25 °C) and subsequent refrigerated storage were analyzed in this study in order to evaluate the suitability of this non-thermal technology for preservation of fresh-cut Hachiya persimmons. The effects of high-hydrostatic pressure treatment on the integrity and location of carotenoids and tannins during storage were also analyzed. Significant changes, in particular diffusion of soluble compounds which were released as a result of cell wall and membrane damage, were followed using confocal microscopy. The high-hydrostatic pressure process also induced changes in physicochemical properties, e.g. electrolyte leakage, texture, total soluble solids, pH and color, which were functions of the amount of applied hydrostatic pressure and may affect the consumer acceptance of the product. Nevertheless, the results indicate that the application of 200MPa could be a suitable preservation treatment for Hachiya persimmon. This treatment seems to improve carotenoid extractability and tannin polymerization, which could improve functionality and remove astringency of the fruit, respectively.

**Keywords:** /Persimmon/ /Shelf Life/

## **PINEAPPLE**

Luengwilai, Kietsuda, Diane M. Beckles and Jingtair Siriphanich. 2016. Postharvest internal browning of **pineapple** fruit originates at the phloem. *J. Plant Physiol.* 202: 121 - 133.

### **Abstract**

A typical symptom of postharvest chilling injury (PCI) in pineapple fruit (*Ananas comosus* (L.) Merr.) is internal browning (IB) near the fruit core. Since vascular bundles (VBs) are localized to this region, it was hypothesized that the VBs might be the site of IB. To test this, the anatomy and histochemistry of VBs during chilling stress in four pineapple cultivars with different levels of sensitivity to PCI were examined. Fruit were stored at 10 °C for up to three weeks to stimulate translucency symptoms (TS; the initiation of IB). After three weeks of chilling exposure, the cultivars 'MD2' showed 0%, 'Pattavia' and 'Savee' showed 10–16%, and 'Trad Sri Thong' showed 100% TS and IB symptom. Scanning electron microscopy and in situ histochemical staining techniques that detect enzymes and substrates commonly associated with IB initiation were used in parallel. The TS of pineapple fruit coincided with the collapse of the phloem tissue. The VBs in the tissue where IB was initiated (i.e., the flesh adjacent to the core or F/C) had the highest activity of polyphenol oxidase, hydrogen peroxide, and phenolic compounds. The IB-resistant 'MD2' genotype had fewer VBs, but a greater proportion of sclerenchyma fibers ( $P < 0.05$ ) than did the susceptible 'Trad Sri Thong'. Based on these data, the first report of pineapple IB occurrence in the phloem was proposed.

**Keywords:** /Pineapple/ /Postharvest/ /Chilling Injury/ / Black heart/

Yeoh, Wei Keat and Asgar Ali. 2017. Ultrasound treatment on phenolic metabolism and antioxidant capacity of fresh-cut **pineapple** during cold storage. *Food Chem.* 216: 247 - 253.

### **Abstract**

Ultrasound treatment at different power output (0, 25 and 29 W) and exposure time (10 and 15 min) was used to investigate its effect on the phenolic metabolism enzymes, total phenolic content and antioxidant capacity of fresh-cut pineapple. Following ultrasound treatment at 25 and 29 W, the activity of phenylalanine ammonia lyase (PAL) was increased significantly ( $P < 0.05$ ) by 2.0 and 1.9-fold, when compared to control. Meanwhile, both the activity of polyphenol oxidase (PPO) and polyphenol peroxidase (POD) in fresh-cut pineapple was significantly ( $P < 0.05$ ) lower than control upon subjected to ultrasound treatment. In the present study, induction of PAL was found to significantly ( $P < 0.001$ ) correlate with higher total phenolic content and thus higher antioxidant capacity in fresh-cut pineapple. Results suggest that hormetic dosage of ultrasound treatment can enhance the activity of PAL and total phenolic content and hence the total antioxidant capacity to encounter with oxidative stress.

**Keywords:** /Pineapple/ /Fresh Cut/ /Cold Storage/

## **PLUM**

Martínez-Romero, Domingo, et. al. 2017. The addition of rosehip oil to Aloe gels improves their properties as postharvest coatings for maintaining quality in plum. *Food Chem.* 217: 585 – 592.

## Abstract

The effect of Aloe vera gel (AV) and Aloe arborescens gel (AA) alone or in combination with rosehip oil (RO) at 2% on ethylene production, respiration rate, quality parameters, bioactive compounds and antioxidant activity during plum postharvest storage was studied. Coated plums showed a delay in ethylene production and respiration rate at 20 °C and during cold storage and subsequent shelf life, the main effect being observed for those fruits coated with AA + RO. Quality parameters such as softening, colour and maturity index was also delayed during storage by the use of the coatings, which led to a 2-fold increase in plum storability. Accumulation of bioactive compounds was also delayed although at the end of the experiment the content of bioactive compounds was higher than those found for control fruits at the estimated shelf life. The most effective coating for maintaining plum quality and bioactive compounds was AA + RO.

**Keywords:** /Plum/ /Fruit Quality/ /Storage/ /Anthocyanins/

You, Yaohua, et al. 2016. Selection of reliable reference genes for quantitative real-time PCR analysis in plum (*Prunus salicina* Lindl.) under different postharvest treatments. *Scientia Hort.* 210: 285-293.

## Abstract

The reverse transcription quantitative real-time polymerase chain reaction (qRT-PCR) technique has become one of the most widely used and reliable methods in gene expression studies. Successful application of qRT-PCR requires the accurate quantification of relative transcript levels, which strongly depends on the expression stability of the reference genes used as internal controls for data normalization. Plums (*Prunus salicina* Lindl.) are among the most numerous and commercial important fruit trees. In order to ensure the reliability of gene expression analyses using qRT-PCR in plum molecular biology research, 14 candidate reference genes were selected, and their relative expression levels were further measured by qRT-PCR using samples of plum peels obtained via different postharvest processes. Three statistical algorithms, geNorm, Norm Finder, and Best Keeper, were employed to assess the expression stability of each candidate gene. A comprehensive evaluation was generated by the overall analysis approach, RefFinder to infer the final rankings. The results showed that *CAC* was the most stably expressed candidate reference gene across all experimental conditions. *CAC* and *UNK* under the room temperature treatment, *CAC*, *ACT*, and *CLATH* under the cold treatment, and *CAC* and *ACT* under all treatments were suitable for accurate gene expression quantification. In addition, relative gene expression patterns of the plant anthocyanin biosynthesis-related structural gene *PsANS* were evaluated using selected housekeeping genes as internal controls under two treatments to further confirm the usefulness of the selected reference genes. These results indicated that the selection of systematically validated reference genes for specific experimental conditions is necessary to avoid misinterpretation of qRT-PCR data and to obtain accurate and reliable gene expression results.

**Keywords:** /Plum/ /Postharvest Treatments/

## POMEGRANATE

Mphahlele, Rebogile R., Olaniyi A. Fawole and Umezuruike Linus Opara. 2016. Influence of packaging system and long term storage on physiological attributes, biochemical quality, volatile composition and antioxidant properties of pomegranate fruit. *Scientia Hort.* 211: 140 - 151.

## Abstract

Commercially ripe pomegranate fruit were packed in ventilated carton with polyliner (referred to as passive modified atmosphere packaging, MAP), individual shrink wrap and open top carton (control) and stored under  $7 \pm 0.5^\circ\text{C}$  and  $92 \pm 2\%$  RH for 4 months. Incidence of physiological disorders and changes in biochemical properties, phenolic compounds, total phenolics, total flavonoids, total tannins, total anthocyanins, antioxidant activity and vitamin C were analysed monthly. The results showed that fruit stored under polyliner and individual shrink wrapped significantly minimized weight loss compared to control. Significantly higher fruit decay incidence was observed after 3 months, irrespective of package type. TSS content, citric acid, and L-malic concentrations decreased considerably in all packaging systems with increasing storage time. Fructose and glucose concentrations fluctuated during storage with the lowest value observed at the end of storage in fruit packed under polyliner and shrink wrapped packaging. Amongst phenolic compounds identified, catechin and rutin increased by 65.43% and 139.39%, respectively, in fruit packed inside polyliners and individual shrink wrap after 4 months of cold storage. Total phenolic and total tannin concentrations declined by 23.86 and 65.89% in fruit stored under poly-liner and individual shrink wrap packaging after 3 months of storage, respectively. Furthermore, total anthocyanin concentration was significantly higher in fruit packed in MAP (103.59 g L<sup>-1</sup> of cyanidin-3-glucoside of pomegranate) than individual shrink wrap (84.78 g L<sup>-1</sup>) after 4 months of storage. Volatile organic compounds including ethanol, alpha-pinene and beta-pinene accumulation increased significantly with prolonged storage regardless of packaging material used.

**Keywords:** /Pomegranate/ /Fruit Quality/ /Modified Atmosphere Packaging/ /Storage/

Ranjbar, Negar, et al. 2016. Impact of instant controlled pressure drop on phenolic compounds extraction from pomegranate peel. *Innov. Food Sci. Emerg.* 37: 177 - 183.

## Abstract

In this research work, instant controlled pressure drop process (ICPD) was used as a texturing pretreatment to enhance extraction efficiency of phenolic compounds from pomegranate peel. Response surface methodology (RSM) was used to optimize ICPD. Experiments were carried out at steam pressures from 1 to 3 bar, steam exposure time from 10 to 60 s and number of pressure drop cycles from 1 to 5. The textured samples were extracted by 60% (v/v) methanol solution and the best operating conditions for ICPD were determined to be at 3 bar, 60 s and 1 cycle. In comparison with un-textured samples, total phenolic content (TPC) and antioxidant activity as inhibition percent were increased from 38.77 to 46.02 mg GA/g dry basis, and from 62.10 to 74.12%, respectively. Scanning electron microscopy (SEM) of the treated peel illustrated remarkable modification in the texture. Results showed a linear relationship between TPC and antioxidant activity of the textured pomegranate peel. Industrial relevance: Increasing valuable compounds extraction efficiencies and achieving higher qualities are some of the most important goals in food industry. Extraction of total phenols and antioxidants from natural resources and using them in different food products formulations is an interesting research area. This paper shows an efficient way for texturing pomegranate peel to enhance extraction yield of total phenols and antioxidants.

**Keywords:** /Pomegranate/

Sayyari, Mohammad, et al. 2016. Salicyloyl chitosan alleviates chilling injury and maintains antioxidant capacity of pomegranate fruits during cold storage. *Scientia Hort.* 211: 110 - 117.

## Abstract

In this study, the effects of postharvest salicylic acid, chitosan and salicyloyl chitosan treatments on chilling injury and nutritional quality of pomegranate fruits during storage at 2°C for 5 months was investigated. Chilling injury symptoms in pomegranate fruits were manifested by external husk browning and internal segment browning. Alleviation impacts of salicyloyl chitosan treatment on pomegranate fruits chilling injury was higher than salicylic acid and chitosan treatments along, which results to delay external and internal browning and increases in electrolyte leakage. Also, pomegranate fruits treated with salicyloyl chitosan exhibited higher membrane unsaturated/saturated fatty acids (unSFA/SFA) ratio. Higher hydrophilic (H-TAA) and lipophilic (L-TAA) antioxidant capacity in pomegranate fruits treated with salicyloyl chitosan results from higher total phenols, anthocyanins and ascorbic acid accumulation. In addition to nutritional quality, pomegranate fruits treated with salicyloyl chitosan exhibited lower weight loss, respiration rate and ethylene production associated with higher firmness, total soluble solids, and titrable acidity as sensory quality. These results suggest that salicyloyl chitosan treatment can be used as promising strategy not only for alleviating chilling injury by maintaining membrane integrity results from higher unSFA/SFA ratio but also for enhancing antioxidant capacity by total phenols, anthocyanins and ascorbic acid accumulation.

**Keywords:** /Pomegranate/ /Anthocyanins/ /Chilling injury/

Thomidis, T. and A. Filotheou. 2016. Evaluation of five essential oils as bio-fungicides on the control of *Pilidiella granati* rot in pomegranate. Crop Protection. 89: 66 - 71.

## Abstract

With recent public attention focused on chemical residues in food, the managing of plant disease organisms without the use of conventional chemical fungicides or bactericides can sometimes be a challenge. The main aim of this study was the evaluation of the antifungal activity of the essential oils of *Ocimum basilicum*, *Origanum vulgare*, *Rosmarinus officinalis*, *Rosmarinus officinalis* 'Prostrates', *Salvia officinalis* and their major constituents (carvacrol, thymol, linalool, eucalyptol) against the fungus *Pilidiella granati*. The results showed that the essential oil vapour of *O. basilicum*, *S. officinalis*, *R. officinalis*, *Rosmarinus officinalis* 'Prostrates', *O. vulgare* had fungicidal activities against the mycelial growth and conidia germination of *P. granati*, the pathogen causing postharvest fruit rots in pomegranate. However, in vivo experiments, only the essential oils of *O. vulgare* and *O. basilicum* controlled this fungus effectively with the essential oil of *O. vulgare* to being more effective at the same rates. Analysis showed a high number of compounds in each essential oil, with carvacrol, eucalyptol, linalool and thymol predominating. Thymol and carvacrol primarily and linalool secondary showed antifungicidal activity against *P. granati*. These results represent an important step towards the goal using essential oils from *O. basilicum*, *S. officinalis*, *R. officinalis*, *R. officinalis* 'Prostrates', *O. vulgare* and their constituents carvacrol and thymol to control of the pathogen *P. granati* of pomegranate.

**Keywords:** /Pomegranate/ /Bio-Fungicides/

## STONE FRUIT

Grzegorzczuk, Monika, et al. 2017. Postharvest biocontrol ability of killer yeasts against *Monilinia fructigena* and *Monilinia fructicola* on stone fruit. Food Microbiol. 61: 93 - 101.

## Abstract

The antagonistic effects of *Debaryomyces hansenii* KI2a, *D. hansenii* MI1a and *Wickerhamomyces anomalus* BS91 were tested against *Monilinia fructigena* and *Monilinia fructicola* in in vitro and in vivo trials. All yeast strains demonstrated antifungal activity at different levels depending on species, strain and pathogen. *D. hansenii* KI2a and *W. anomalus* BS91 showed the highest biocontrol activity in vitro; the production of hydrolytic enzymes, killer toxins and volatile organic compounds (VOCs) were hypothesized as their main mechanisms of action against pathogens. *D. hansenii* KI2a and *W. anomalus* BS91 significantly reduced brown rot incidence and severity on peach and plum fruits artificially inoculated with *M. fructigena* and *M. fructicola*, especially when applied 24 h before pathogen inoculation. On the opposite, *D. hansenii* MI1a exhibited weak antagonistic activity towards *M. fructigena* on peach and plum fruits and was ineffective against *M. fructicola*. The noticeable ability of *W. anomalus* BS91 to control brown rot could be also correlated with its high capacity to colonize the wound tissue and to increase its population density. Accordingly, the antagonistic strains of *D. hansenii* and *W. anomalus* could be proposed as active ingredients for the development of biofungicides against *Monilinia* species that are responsible for considerable economic losses in stone fruit crops.

**Keywords:** /Stone Fruit/ /Brown Rot/

## STRAWBERRY

Caleb, Oluwafemi J., et al. 2016. Hot water dipping: Impact on postharvest quality, individual sugars, and bioactive compounds during storage of 'Sonata' **strawberry**. *Scientia Hort.* 210: 150 - 157.

## Abstract

Soluble sugars plays an important role in the ripening of strawberry fruit and whether hot water (HW) treatment has a significant impact on sugar content is yet unclear. This study investigated the impact of hot water treatment (35 and 45°C) and dipping duration of 5 or 10 min on the physicochemical quality, individual sugars, antioxidant activity and visual quality of freshly harvested 'Sonata' strawberries stored in open packaging trays at 4°C for 9 days and then transferred to 16°C for 3 days. Hot water treatment and duration had significant impact on measured quality attributes of strawberries ( $p < 0.05$ ). Hot water dip induced an initial sharp increase in transpiration rate (TR). Calculated TR for 'Sonata' strawberries ranged from 11.4 to 63.1  $\mu\text{g kg}^{-1}\text{s}^{-1}$  across all treatments during storage. An initial decline in color parameters chroma ( $61.3 \pm 6.7$ ) and hue angle ( $41.2 \pm 5.4$ ) was observed until day 6 and thereafter, they increased until the end of storage, across all treatments. A significant increase in total soluble solids and titratable acidity was observed. Concentration of sucrose declined sharply and significantly from 131.9 to 28.7  $\text{mmol L}^{-1}$  during the storage period, followed by glucose and fructose. Percentage relative concentration decrease in sucrose, glucose and fructose was in the range of 60–78%, 10–20%, and 1–10%, respectively, at the end of storage. At the end of storage, antioxidant capacity was better retained in samples dipped at 45°C for 5 and 10 min (14.3 and 14.5  $\mu\text{mol g}^{-1}$  Trolox Equivalent, respectively). Overall, HW-treatment of 45°C for 5 min had no detrimental effects and best maintained quality attributes of strawberries and prevented incidence of decay.

**Keywords:** /Strawberry/ /Cold storage/ / Postharvest Treatments/

Chai, Lu and Yuan-Yue Shen. 2016. FaABI4 is involved in strawberry fruit ripening. Scientia Hortic. 210: 34 - 40.

### **Abstract**

Abscisic acid (ABA) is regarded as an important regulator in non-climacteric fruit ripening, especially in strawberry fruit. FaABI4, as a critical downstream component of ABA signaling in plants, whether it is involved in strawberry ripening remains unclear. The octoploid strawberry (*Fragaria ananassa*, 'Beinongx-iang') fruits were used here to explore this question. Our results showed that FaABI4 expressed higher in leaves, followed in flowers and fruits, but less in roots and stems, and that coupled with the fruit ripening, its transcripts increased gradually, suggesting that *FaABI4* might play a role in the ripening. Using tobacco rattle virus-induced gene silencing (VIGS), downregulation of FaABI4 transcripts significantly delayed fruit ripening in consistent with changes of firmness, sugar and ABA contents, as well as transcripts of several ripening-related genes, including *CA4H*, *CHI*, *DFR*, *CHS*, *GAL6*, *PE5*, and *XYL2*. Interestingly, ABA, sucrose and glucose all induced *FaABI4* expression through fruit-disc incubation in vitro. In conclusion, our results demonstrate that *FaABI4* plays an important role in the regulation of strawberry fruit ripening, and its expression is induced by ABA, sucrose and glucose.

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

McPhie, Douglas and Hannah J. Burrack. 2016. Effects of microbial, organically acceptable, and reduced risk insecticides on *Anthonomus signatus* (Curculionidae: Coleoptera) in strawberries (*Fragaria x ananassa*). Crop Prot. 89: 255 - 258.

### **Abstract**

*Anthonomus signatus*, the strawberry bud weevil, is active in early spring coinciding with the bloom period of host plants and when managed and unmanaged pollinators are active. Female *A. signatus* cause injury to the host plant during egg laying when they deposit a single egg inside an unopened flower bud and then girdle or "clip" the bud at the pedicel. Past efforts to control *A. signatus* populations have relied on the use of broad spectrum insecticides. Fields are either treated at the first signs of damage, or precautionary treatments may be applied prophylactically in fields with a history of damage. Because *A. signatus* damage occurs during bloom, there is concern about the potential harm to pollinators caused by these treatments. In order to identify materials more compatible for use during bloom, the efficacy of reduced risk pesticides against *A. signatus* was tested in semi-field bioassays over two years. *Beauveria bassiana*, cyantraniliprole, novaluron, and pyrethrins were assessed in the first year, and none caused significant *A. signatus* mortality. Acetamiprid, flonicamid, and spinosad were compared in the second year, acetamiprid and spinosad had higher *A. signatus* mortality than an untreated control, and exposure to spinosad resulted in similar mortality to bifenthrin, an industry standard material.

**Keywords:** /Strawberry/ /Organic/

### **WATERMELON**

Mohd Ali, Maimunah, et al. 2017. Quality evaluation of watermelon using laser-induced backscattering imaging during storage. Postharvest Biol. Technol. 123: 51 - 59.

## Abstract

Non-destructive and optical-based technologies are rapidly being engaged as alternative techniques for monitoring quality changes in agricultural produce. In the present work, the feasibility of laser-induced backscattering imaging was investigated to predict the changes of firmness, soluble solids content (SSC), pH, and moisture of watermelon during storage. Backscattering images were obtained from Black Beauty and Red Seedless watermelons using a laser diode emitting at the wavelength of 658 nm. Different multivariate methods were evaluated on the backscattering parameters (BP) for monitoring the quality changes of watermelons at different storage days. A partial least squares (PLS) regression was applied to the BP extracted from the backscattering images to analyze the quality attributes of the two watermelon cultivars. Among all of the quality changes, the moisture prediction gave the highest coefficient of determination ( $R^2$ ) of 0.942 and root mean square error of prediction (RMSEP) of 0.492, respectively. Therefore, this study has demonstrated the capability of laser-induced backscattering imaging as a useful, rapid, and non-invasive optical technique for the evaluation of the quality of watermelons during storage.

**Keywords:** /Watermelon/ / Quality Evaluation/ / Storage/

Shiu,J.W.,et al. 2016. Correlation of descriptive analysis and instrumental puncture testing of watermelon Cultivars. J. Food Sci. 81: 1506 - 1514.

## Abstract

The textural properties of 5 seedless watermelon cultivars were assessed by descriptive analysis and the standard puncture test using a hollow probe with increased shearing properties. The use of descriptive analysis methodology was an effective means of quantifying watermelon sensory texture profiles for characterizing specific cultivars' characteristics. Of the 10 cultivars screened, 71% of the variation in the sensory attributes was measured using the 1st 2 principal components. Pairwise correlation of the hollow puncture probe and sensory parameters determined that initial slope, maximum force, and work after maximum force measurements all correlated well to the sensory attributes crisp and firm. These findings confirm that maximum force correlates well with not only firmness in watermelon, but crispness as well. The initial slope parameter also captures the sensory crispness of watermelon, but is not as practical to measure in the field as maximum force. The work after maximum force parameter is thought to reflect cellular arrangement and membrane integrity that in turn impact sensory firmness and crispness. Watermelon cultivar types were correctly predicted by puncture test measurements in heart tissue 87% of the time, although descriptive analysis was correct 54% of the time.

**Keywords:** /Watermelon/ /Texture/

## VEGETABLES

### BABY SPINACH

Shynkaryk, Mykola V., et al. 2016. Gaseous ozone treatment of baby spinach within the existing production chain for inactivation of *Escherichia coli* O157:H7. J. Food Eng. 191: 10 - 18.

## Abstract

Sanitization of fresh fruits and vegetables, particularly leafy greens, is limited by penetration of sanitizers to the location of internalized pathogens. It is necessary, therefore, to adapt sanitization operations to practices in the existing produce chain. In this work, we investigated experimentally in a pilot scale, various potential sanitization options using gaseous ozone during and post vacuum cooling on the inactivation of *Escherichia coli* O157:H7 ATCC 43889. It was found that vacuum cooling causes bacterial internalization, making them harder to reach by sanitizer. However, the application of ozone during the vacuum cooling step significantly reduced ( $p < 0.05$ ) population of viable internalized bacteria which otherwise remain unaffected by sodium hypochlorite and UV light surface treatments. The presence of free water inside the vessel available for evaporation during vacuum cooling was found to impact the microbial reduction during combined vacuum cooling and the gaseous ozone treatment. The efficacy of application of high ozone concentration ( $1.5 \text{ g/m}^3$ ) short term during the vacuum cooling step in combination with low ozone concentration ( $0.032 \text{ e}0.528 \text{ g/m}^3$ ) long term sanitization treatments (days) was evaluated. This combination of gaseous treatment was found more effective in microbial reduction compared to a single treatment with a strongly expressed synergistic effect. The post-treatment spinach quality evaluation, however showed an increasing degree of damage as the time of treatment increases even at low ozone concentrations.

**Keywords:** /Baby Spinach/ /Fresh Produce/

### **CARROTS**

Donis-Gonzalez, Irwin R., Daniel E. Guyer and Anthony Pease. 2016. Postharvest noninvasive assessment of undesirable fibrous tissue in fresh processing **carrots** using computer tomography images. *J. Food Eng.* 190: 154 - 166.

#### **Abstract**

This research was designed to develop and test an automatic image analysis method (algorithm) to classify CT images obtained from 1233 carrot (*Daucus carota* L.) sections (samples), collected during the 2013 and 2014 harvesting seasons. Classification accuracy was evaluated by comparing the classes obtained using eighteen CT images per carrot section to their undesirable fibrous tissue class, based on the industry-simulated invasive quality assessment (% of fiber). Class-0 represents fibrous-free samples, and class-1 denotes samples containing fibrous tissue. After CT image preprocessing, cropping, and segmentation, 3762 grayscale intensity and textural features were extracted from the eighteen CT images per sample. A 4-fold cross-validation linear discriminant classifier with a performance accuracy of 87.9% was developed using 95 relevant features, which were selected using a sequential forward selection algorithm with the Fisher discriminant objective function. This objective method is accurate in determining the presence of undesirable fibrous tissue in pre-processed carrots.

**Keywords:** /Carrots/ /Quality/

### **CUCUMBER**

Guo, Yanbiao, et al. 2016. *Salmonella enterica* serovar Choleraesuis on fresh-cut **cucumber** slices after reduction treatments. *Food Control.* 70: 20 - 25.

#### **Abstract**

Cucumber is a popular fruit around the world and has been implicated in *Salmonella* food poisonings. *S. Choleraesuis* is a serovar that can cause pig and human infections but was rarely examined in food safety context. To investigate *S. Choleraesuis* behavior on cucumber slices, it was inoculated, at 10<sup>4</sup> colony forming units (CFU)/mL, onto fresh-cut cucumber slices and subjected to reduction with either high hydrostatic pressurization (HHP), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), or *Peredibacter* sp. BD2GS treatment, its reduction and survival during 48 h storage at 4 °C and 25 °C were compared. Reduction tests revealed that 5% H<sub>2</sub>O<sub>2</sub> was most effective in killing *S. Choleraesuis*, with 97.5% reduction after 15 min action, compared to 90.7%, 87.7%, 29.2% and 60.2% reduction rates with HHP, 2.5% H<sub>2</sub>O<sub>2</sub>, high- and low-dose BD2GS treatments, respectively. At the end of storage, contrast to no changes at 4 °C, *S. Choleraesuis* counts rose significantly ( $p < 0.05$ ) at 25 °C. Compared to control that reached  $7.1 \pm 0.1$  log CFU/g, HHP, 5% and 2.5% H<sub>2</sub>O<sub>2</sub> attained  $6.3 \pm 0.1$ ,  $6.7 \pm 0.1$  and  $6.4 \pm 0.2$  log CFU/g correspondingly, whereas high- and low-dose BD2GS attained  $4.9 \pm 0.1$  and  $5.9 \pm 0.1$  log CFU/g respectively. A shared growth peak of between 9 h and 12 h was noted in all treatments except high-dose BD2GS where it occurred in the first 3 h. Results of this study revealed the effectiveness of 5% H<sub>2</sub>O<sub>2</sub> in the reduction of *S. Choleraesuis*, and demonstrated that if not stored properly, contaminated cucumber slices, though treated, can still have potentials to cause *S. Choleraesuis* outbreaks.

**Keywords:** /Cucumber/ /Fresh-Cut /

## **EGGPLANT**

Singh, Sudhir, et al. 2016. Carnauba wax-based edible coating enhances shelf-life and retains quality of eggplant (*Solanum melongena*) fruits. LWT- Food Sci. Technol. 74: 420 - 426.

### **Abstract**

Eggplant has limited shelf-life of only 3 days under ambient storage conditions. The functional quality of carnauba wax (CW) is assessed with various additives for shelf-life related attributes in eggplant during ambient storage ( $20 \pm 1$  °C and RH 52e54%) in both unpackaged and packaged in 35µ polypropylene pouches. Minimum decrease (8.56 N-6.92 N and 8.56 N-5.63 N) in firmness was recorded in Poly ethylene glycol (PEG) and 0.5% Sodium alginate (SA) in diluted (1:4) CW emulsion (T<sub>2</sub>) while maximum decrease (8.56 N-5.54 N and 8.56 N-3.57 N) in control (T<sub>4</sub>) packaged and unpackaged eggplants after 12 days of storage, respectively. Maximum antioxidant activity (67.63 and 51.52 µmol Trolox equivalent antioxidant capacity (TEAC)/100 g FW) was observed in T<sub>2</sub> treatment and minimum antioxidant activity (23.61 and 20.60 µmol TEAC/100 g FW) in control fruits in packaged and unpackaged respectively after 12 days. The minimum decrease (2.64-2.20 and 2.64-2.24) µmol tetraguaiacol (TG)/min/100 g FW) of peroxidase activity was recorded in T<sub>2</sub> treated fruits in packaged and unpackaged eggplant respectively and maximum decrease (2.64-1.37 and 2.64-1.63 µmol TG/min/100 g FW) was obtained in control unpackaged and packaged eggplant respectively after 12 days. Packaged eggplant treated with PEG and SA in CW emulsion remained acceptable up to 12 days.

**Keywords:** /Eggplant/ /Firmness/ /Shelf Life/

## LEAFY GREENS

Mishra, Abhinav, et al. 2017. Development of growth and survival models for *Salmonella* and *Listeria monocytogenes* during non-isothermal time-temperature profiles in leafy greens. Food Control. 71: 32 - 41.

### **Abstract**

Leafy greens contaminated with *Salmonella enterica* have been linked to large number of illnesses in many countries in recent years. *Listeria monocytogenes* is also a pathogen of concern for leafy greens because of its prevalence in the growing and processing environment and its ability to grow at refrigeration temperatures. Experimental data for the growth and survival of *S. enterica* and *L. monocytogenes* under different conditions and storage temperatures were retrieved from published studies. Predictive models were developed using the three-phase linear model as a primary growth model and square-root model to calculate specific growth rate ( $\ln \text{CFU g}^{-1} \text{h}^{-1}$ ) at different temperatures ( $^{\circ}\text{C}$ ). The square-root model for *S. enterica* was calculated as  $\mu = (0.020(\text{Temperature} + 0.57))^2$ . The square-root model for *L. monocytogenes* was fitted as  $\mu = (0.023(\text{Temperature} - 0.60))^2$ . The growth-survival model for *S. enterica* and growth model for *L. monocytogenes* were validated using several dynamic time-temperature profiles during the production and supply chain of leafy greens. The models from this study will be useful for future microbial risk assessments and predictions of behavior of *S. enterica* and *L. monocytogenes* in the leafy greens production and supply chain.

**Keywords:** /Leafy Greens/

## LETTUCE

Fayette, Joubert, et al. 2016. Organic compounds increase the efficacy of famoxadone + cymoxanil in the control of bacterial leaf spot of lettuce. Crop Protection. 89: 47 - 50.

### **Abstract**

Bacterial leaf spot of lettuce, induced by *Xanthomonas campestris* sp. *vitians*, constitutes a major disease on commercial lettuce (*Lactuca sativa*) production in south Florida. Under greenhouse conditions, resorcinol, two antioxidants, and various sugar alcohols such as mannitol, were evaluated alone, and in combination with Tanos<sup>®</sup> 50DF (25% a.i. of each component cymoxanil and famoxadone, E.I du Pont de Nemours and Company, Wilmington, DE) for control of bacterial leaf spot. Among the compounds evaluated, resorcinol (35-50% disease control) and mannitol (9-45%) were the most effective. In field trials, different mixtures containing propionic acid, mannitol, resorcinol, Tanos and or copper hydroxide (Kocide 3000<sup>®</sup>, 46.1%, 30% copper equivalent) were evaluated for the control of bacterial leaf spot of lettuce. Field data support a moderate impact of Tanos in disease reduction. Both greenhouse and field data support a synergistic interaction between Tanos and the compounds including copper, in disease reduction. The mixture Tanos + resorcinol, or copper/resorcinol, Tanos + copper provided better or similar disease control than copper alone. No phytotoxicity was observed in our trials. In an integrated management program for bacterial leaf spot of lettuce, Tanos may be useful in tank mixes with these compounds and copper.

**Keywords:** /Lettuce/ /Disease Control/

Min, Sea C., et al. 2016. Dielectric barrier discharge atmospheric cold plasma inhibits *Escherichia coli* O157:H7, *Salmonella*, *Listeria monocytogenes*, and Tulane virus in Romaine lettuce. *Int'l. J. Food Microbiol.* 237: 114 - 120.

### Abstract

The present study investigated the effects of dielectric barrier discharge atmospheric cold plasma (DACP) treatment on the inactivation of *Escherichia coli* O157:H7, *Salmonella*, *Listeria monocytogenes*, and Tulane virus (TV) on Romaine lettuce, assessing the influences of moisture vaporization, modified atmospheric packaging (MAP), and post-treatment storage on the inactivation of these pathogens. Romaine lettuce was inoculated with *E. coli* O157:H7, *Salmonella*, *L. monocytogenes* (~6 log CFU/g lettuce), or TV (~2 log PFU/g lettuce) and packaged in either a Petri dish (diameter: 150mm, height: 15mm) or a Nylon/polyethylene pouch (152 × 254mm) with and without moisture vaporization. Additionally, a subset of pouch-packaged leaves was flushed with O<sub>2</sub> at 5% or 10% (balance N<sub>2</sub>). All of the packaged lettuce samples were treated with DACP at 34.8 kV for 5 min and then analyzed either immediately or following post-treatment storage for 24 h at 4 °C to assess the inhibition of microorganisms. DACP treatment inhibited *E. coli* O157:H7, *Salmonella*, *L. monocytogenes*, and TV by 1.1 ± 0.4, 0.4 ± 0.3, 1.0 ± 0.5 log CFU/g, and 1.3 ± 0.1 log PFU/g, respectively, without environmental modifications of moisture or gas in the packages. The inhibition of the bacteria was not significantly affected by packaging type or moisture vaporization (p > 0.05) but a reduced-oxygen MAP gas composition attenuated the inhibition rates of *E. coli* O157:H7 and TV. *L. monocytogenes* continued to decline by an additional 0.6 log CFU/g in post-treatment cold storage for 24 h. Additionally, both rigid and flexible conventional plastic packages appear to be suitable for the in-package decontamination of lettuce with DACP.

**Keywords:** /Lettuce/ /*E. coli* O157:H7/

Ozturk, Ismet, et al. 2016. Decontamination of iceberg lettuce by some plant hydrosols. *LWT-Food Sci. Technol.* 74: 48 - 54.

### Abstract

Hydrosols are byproducts obtained by steam distillation of plant materials. In this study, six hydrosols obtained from thyme (*Thymus vulgaris* L.), summer savory (*Satureja hortensis* L.), rosemary (*Rosmarinus officinalis* L.), salvia (*Salvia officinalis* L.), sideritis (*Sideritis canariensis* L.), oregano (*Origanum onites* L.) and bay leaf (*Laurus nobilis* L.) were used for decontamination of fresh-cut iceberg lettuce inoculated with *Salmonella enterica* subsp. *enterica* serovar. Typhimurium, *Listeria monocytogenes* and *Escherichia coli* O157:H7. Volatile composition of the hydrosols and sensorial properties of hydrosol-treated lettuce were also investigated. Thyme and summer savory hydrosols achieved ~3-4 log reductions on all bacterial strains tested while significant (P < 0.05) reductions were obtained by all hydrosol treatments depending on the treatment time (0, 20, 40 or 60 min). Thymol and 1,8 cineole were the most abundant volatile constituents of the hydrosols, likely affecting their antibacterial activity. Hydrosol-treated samples especially with bay leaf and sideritis were generally accepted by the panelists. This study confirmed that plant hydrosols could be successfully used as sanitizing agents for fresh-cut lettuce to provide their microbiological safety without causing deep sensorial defects on the products.

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

Tudela, Juan A., et al. 2017. Growing season climates affect quality of fresh-cut **lettuce**. *Postharvest Biol. Technol.* 123: 60 - 68.

### **Abstract**

The objective of this study was to investigate if different growing season climates influenced the quality of fresh-cut lettuce. Different cultivars and harvests of iceberg and romaine lettuce grown over 26 months were processed and stored for 11 d in active modified atmosphere (MA) and then transferred to air for 24 h at 7°C. Pearson correlation coefficients were established between different climatic factors and subjective and objective parameters related to quality loss. Growing season mean temperature (GST) and growing cycle influenced the quality characteristics of fresh-cut lettuce but the correlations between GST and quality characteristics were always higher than for growing cycle in both types of lettuce, iceberg and romaine. Winter growing season caused low oxygen (O<sub>2</sub>) and more significantly high carbon dioxide (CO<sub>2</sub>) that reduced enzymatic browning although it conferred off-odors. Respiration rate was significantly influenced by GST but only in fresh-cut romaine. Interestingly, off-odors and fermentative metabolites such as ethanol and acetaldehyde were significantly reduced in those months of higher GST. However, cut edge browning was significantly promoted, indicated by the reduction in hue angle as GST increased. These results identified that the mean temperature during cultivation was the climate variable that contributed most to quality loss of fresh-cut lettuce. Due to the strong impact of growing season climate, some changes in raw material specifications, packaging design and days of shelf life are recommended in order to assure the quality of fresh-cut lettuce during the whole year.

**Keywords:** /Lettuce/ /Minimally Processed/ / Preharvest Factors/ / Postharvest Storage/ /Browning/

Van der Linden, Inge, et al. 2016. Minimal processing of iceberg **lettuce** has no substantial influence on the survival, attachment and internalization of *E. coli* O157 and *Salmonella*. *Int'l. J. Food Microbiol.* 238: 40 - 49.

### **Abstract**

The influence of a selection of minimal processing techniques (sanitizing wash prior to packaging, modified atmosphere, storage conditions under light or in the dark) was investigated in relation to the survival of, attachment to and internalization of enteric pathogens in fresh produce. Cut iceberg lettuce was chosen as a model for fresh produce, *Escherichia coli* O157:H7 (*E. coli* O157) and *Salmonella enterica* were chosen as pathogen models. Care was taken to simulate industrial post-harvest processing. A total of 50 ± 0.1 g of fresh-cut iceberg lettuce was packed in bags under near ambient atmospheric air with approximately 21% O<sub>2</sub> (NAA) conditions or equilibrium modified atmosphere with 3% O<sub>2</sub> (EMAP). Two lettuce pieces inoculated with *E. coli* O157 BRMSID 188 or *Salmonella* Typhimurium labeled with green fluorescent protein (GFP) were added to each package. The bags with cut lettuce were stored under either dark or light conditions for 2 days at 7 °C. The pathogens' capacity to attach to the lettuce surface and cut edge was evaluated 2 days after inoculation using conventional plating technique and the internalization of the bacteria was investigated and quantified using confocal microscopy. The effect of a sanitizing wash step (40 mg/L NaClO or 40 mg/L peracetic acid+1143 mg/L lactic acid) of the cut lettuce prior to packaging was evaluated as well. Our results indicate that both pathogens behaved similarly under the investigated conditions. Pathogen growth was

not observed, nor was there any substantial influence of the investigated atmospheric conditions or light/dark storage conditions on their attachment/internalization. The pathogens attached to and internalized via cut edges and wounds, from which they were able to penetrate into the parenchyma. Internalization through the stomata into the parenchyma was not observed, although some bacteria were found in the substomatal cavity. Washing the cut edges with sanitizing agents to reduce enteric pathogen numbers was not more effective than a rinse with pre-cooled tap water prior to packaging. Our results confirm that cut surfaces are the main risk for postharvest attachment and internalization of *E. coli* O157 and *Salmonella* during minimal processing and that storage and packaging conditions have no important effect.

**Keywords:** /Lettuce/ / Modified Atmosphere/ /Minimally Processed/

Zhang, Jufang and Hongshun Yang. 2017. Effects of potential organic compatible sanitisers on organic and conventional fresh-cut **lettuce** (*Lactuca sativa* Var. Crispa L). Food Control. 72: 20 - 26.

### **Abstract**

Potential organic compatible sanitisers including electrolysed water (EW, 4 mg/L free available chlorine (FAC)), citric acid (0.6%), H<sub>2</sub>O<sub>2</sub> (1%), and their combinations were applied on organic and conventional fresh-cut lettuce (*Lactuca sativa* Var crispa L.) to evaluate their effects on microbiological safety, physicochemical parameters and sensory analysis (including raw sample and boiled sample). The combination of 1% H<sub>2</sub>O<sub>2</sub> with 0.6% citric acid led to the highest reductions of microbial loads (2.26 log CFU/g for aerobic mesophilic count (AMC) and 1.28 log CFU/g for yeasts and moulds); however, it also caused the highest electrolyte leakage rate (3.11% vs. 0.91% for control). The combination of EW with 1% H<sub>2</sub>O<sub>2</sub> achieved 1.69 and 0.96 log CFU/g reductions for AMC and yeasts and moulds, respectively with electrolyte leakage rate of 1.41%. In terms of the content of polyphenolic compounds, firmness, colour and raw material sensory analysis, there were no significant differences among different treatments, and between organic and conventional counterparts. The results suggest that 1% H<sub>2</sub>O<sub>2</sub> combined with 4 mg/L EW is a promising approach for treating organic fresh-cut lettuce.

**Keywords:** /Lettuce/ /Organic lettuce/ /Microbial Safety/ /Quality Attributes/

### **SPINACH**

Abdullah, Muhammad Atif Randhawa, et al. 2016. Assessment of different washing treatments to mitigate imidacloprid and acetamaprid residues in **spinach**. J Sci. Food Agric. 96(11): 3749 - 3754.

### **Abstract**

**BACKGROUND:** Agricultural crops treated with pesticides retain toxic residues that can cause various health disorders upon consumption. The present research project was designed to assess pesticide residues in contaminated spinach (*Spinaciaoleracea*). The efficiency of chemical solutions (acetic acid, citric acid, hydrogen peroxide, sodium chloride and sodium carbonate) of different concentrations (% w/v) along with tap water for the dissolution of pesticide residues in spinach was studied. After various dipping treatments (T0–T22) of treated spinach, imidacloprid and acetamaprid residues were determined by high-performance liquid chromatography (HPLC). **RESULTS:** Among the solutions tested, the highest reductions in imidacloprid and acetamaprid residues respectively were

0.92±0.04 mg kg<sup>-1</sup> (83%) and 1.42±0.53 mg kg<sup>-1</sup> (87%) in treatment T6 (10% acetic acid), followed by 0.79±0.01 mg kg<sup>-1</sup> (69%) and 0.86±0.05 mg kg<sup>-1</sup> (71%) in treatment T11 (10% citric acid), while the lowest were 0.30±0.02 mg kg<sup>-1</sup> (27%) and 0.35±0.02 mg kg<sup>-1</sup> (29%) in treatment T20 (4% sodium carbonate). Moreover, treatment T1 (tap water) caused 0.27±0.00 mg kg<sup>-1</sup> (23%) and 0.38±0.05 mg kg<sup>-1</sup> (27%) elimination of imidacloprid and acetamaprid residues respectively. **CONCLUSION:** From these findings it is inferred that acetic acid and citric acid washing treatments can be used along with tap water to minimize pesticide residues in treated vegetables.

**Keywords:** /Spinach/ /Pesticides/ /Washing Treatments/

Agüero, M. Victoria, et al. 2016. Surface decontamination of **spinach** by intense pulsed light treatments: Impact on quality attributes. *Postharvest Biol. Technol.* 121: 118 - 125.

### Abstract

Intense pulsed light (IPL) treatments constitute an emerging non-thermal technology proposed to decontaminate food surfaces. In this study, the bactericidal effect of IPL against *Listeria innocua* and *Escherichia coli* inoculated on spinach leaves was evaluated and mathematically modeled. Also, the impact of IPL treatments (20 and 40 kJ m<sup>-2</sup>) on headspace gas composition, microbial quality, antioxidant properties and color of spinach was assessed immediately after treatment and during refrigerated storage. IPL treatments were effective for reducing the naturally-occurring microbial load on the raw material by 0.4–2.2 Log CFU g<sup>-1</sup>, depending on the applied fluence. IPL treatments also reduced the growth rates of microbial populations through storage. Changes in the package headspace composition were significantly affected by IPL treatments. In-package production of CO<sub>2</sub> increased at a higher rate than for untreated spinach leaves, while O<sub>2</sub> concentrations decreased. Total polyphenolic content and antioxidant capacity of spinach exhibited significant increases in the range of 5–10% and 32–34% for the samples treated with 20 or 40 kJ m<sup>-2</sup>, respectively. Despite these initial increases, treated spinach leaves presented an accelerated decrease in these quality indicators during refrigerated storage. At the end of storage, IPL-treated samples presented a slightly lower phytochemical quality but significant better microbial quality than control samples.

**Keywords:** /Spinach/ /Quality/

Watanabe, Takashi, et al. 2017. Effect of short time heating on the mechanical fracture and electrical impedance properties of **spinach** (*Spinacia oleracea* L.). *J Food Eng.* 194: 9 - 14.

### Abstract

We evaluated the mechanical properties and electrical impedance data of spinach after short time heating. The mechanical fracture properties of samples heated for 40 s significantly differed from those of the non-treated samples. A circular arc of the Cole-Cole plot obtained from the impedance data shrunk after heating for 10 s. Similarity of the circular arcs, i.e. non-uniformity in the electrical characteristics, changed after heating for 30 s. After heating, extracellular resistance values were decreased from 650 to 16 kΩ, and cell membrane capacitance values were decreased from 13 to 0.28 nF. These changes could be evaluated simply by using the length of the coordinate at the top of the circular arc from the origin, and these occurred earlier and were greater in magnitude than those in the fracture properties were. These electrical properties could be an index for the early detection of changes in the fracture properties of samples.

**Keywords:** /Spinach/ /Mechanical Properties/

Zhang, Zhiyun, et al. 2016. Evaluation of postharvest washing on removal of silver nano particles (AgNPs) from spinach Leaves. J Agric. Food Chem. 64: 6916 - 6922.

### **Abstract**

There is increasing use of silver nanoparticles (AgNPs) as pesticides for fruits and vegetables due to the particles' unique antimicrobial and insecticidal properties. However, residual AgNPs in harvested produce may transfer through the food chain and pose a potential risk to public health. The objective of this study is to determine whether postharvest washing can effectively remove AgNPs that had accumulated on fresh produce. Ten microliters of commercially available 40 nm citrate coated AgNPs (0.4 mg/L) was dropped to a (1 × 1 cm<sup>2</sup>) spot on spinach leaves, followed by washing with deionized water (DI water), Tsunami 100 (80 mg/L), or Clorox bleach (200 mg/L). Then, the AgNP removal efficiency of the three treatments was evaluated by surface-enhanced Raman spectroscopy (SERS), scanning electron microscopy (SEM)–energy dispersive spectrometry (EDS), and inductively coupled plasma mass spectrometry (ICP-MS). ICP-MS results showed that deionized water removed statistically insignificant amounts of total Ag (5%), whereas Tsunami 100 and Clorox bleach yielded 21 and 10% decreases in total Ag, respectively (P < 0.05). The increased removal efficiency resulted from AgNP dissolution and Ag<sup>+</sup> release upon contact with the oxidizing agents in Tsunami 100 (peroxyacetic acid, hydrogen peroxide) and Clorox bleach (sodium hypochlorite). According to the SERS results, the deionized water and Tsunami 100 treatments removed nonsignificant amounts of AgNPs. Clorox bleach decreased Ag NPs by >90% (P < 0.05); however, SEM-EDS images revealed the formation of large silver chloride (AgCl) crystals (162 ± 51 nm) on the leaf, which explained the low total Ag removal from ICP-MS. This study indicates current factory washing methods for fresh produce may not be effective in reducing AgNPs (by water and Tsunami 100) and total Ag (by all three means). This highlights the necessity to develop an efficient washing method for NP removal from food surfaces in the future.

**Keywords:** /Spinach/ /Silver Nanoparticles/ /Postharvest/

### **TOMATO**

Estiarte, N., et al. 2016. Effect of 1-methylcyclopropene on the development of black mold disease and its potential effect on alternariol and alternariol monomethyl ether biosynthesis on tomatoes infected with *Alternaria alternata*. Int'l. J.Food Microbiol. 236: 74 - 82.

### **Abstract**

Ethylene is a naturally produced plant regulator involved in several plant functions, such as regulation of fruit ripening. Inhibition of ethylene perception by using 1-methylcyclopropene (1-MCP) slows down the ripening of the fruit maintaining its quality and freshness. The use of 1-MCP is a commercial strategy commonly used in the food industry to extend the postharvest life of several fruits, including tomatoes. To assess how 1-MCP affected infection by *Alternaria alternata* on tomatoes, three different cultivars were artificially inoculated with 5 µL of an *A. alternata* conidial suspension (10<sup>5</sup> conidia/mL). Tomatoes were treated with 0.6 µL/L of 1-MCP for 24 h. Spiked but untreated tomatoes were considered controls. Then, fruit were stored 6 days at 10 °C and one more week at 20 °C to simulate shelf-life. Fungal growth development and mycotoxin production (alternariol, AOH and

alternariol monomethyl ether, AME) were assessed both on the first and on the second week. After the first 6 days at 10 °C, in just one variety the black mold disease was higher in the 1-MCP treated samples. However, after two weeks of storage, in all cases, tomatoes treated with 1-MCP showed more significant fungal growth disease. Regarding mycotoxin production, no large differences were observed among different treatments, which was corroborated with gene expression analysis of *pksJ*, a gene related to AOH and AME biosynthesis.

**Keywords:** /Spinach/ /Tomatoes/ / 1-Methylcyclopropene/

Gong, Chao, et al. 2017. Analysis of *Clonostachys rosea*-induced resistance to grey mould disease and identification of the key proteins induced in tomato fruit. *Postharvest Biol. Technol.* 123: 83 - 93.

### Abstract

Tomato grey mould disease, which is caused by *Botrytis cinerea*, is a serious threat to tomato postharvest handling and storage. *Clonostachys rosea* is an effective antagonistic fungus to *B. cinerea* and can prevent this disease in tomatoes. To elucidate the mechanism of *C. rosea*-induced resistance in tomato, fruit were subjected to four treatments: spraying with *B. cinerea*, spraying with *C. rosea*, inoculation with *C. rosea* after spraying with *B. cinerea*, and inoculation with *B. cinerea* after spraying with *C. rosea*. Compared to the control (water), increases in indole acetic acid (IAA), salicylic acid (SA) and NO levels and enhanced phenylalanine ammonia lyase (PAL) and polyphenol oxidase (PPO) activities were observed, whereas catalase (CAT) activity and abscisic acid (ABA) levels decreased, particularly in the *B. cinerea*-plus-*C. rosea*- and *C. rosea*-plus-*B. cinerea*-treated fruit. We identified 22 proteins differentially expressed in the treated fruit compared to the control fruit using two-dimensional electrophoresis (2-DE) and mass spectrometry. ATP synthase CF1 alpha subunit was identified as an abundant protein in fruit sprayed with *C. rosea*. This study advances our understanding of *C. rosea* biocontrol mechanisms in tomato fruit.

**Keywords:** /Tomato/ /Grey Mould/ /Botrytis Cinera/

Mireei, Seyed Ahmad, Samaneh Amini-Pozveh and Majid Nazeri. 2017. Selecting optimal wavelengths for detection of insect infested tomatoes based on SIMCA-aided CFS algorithm. *Postharvest Biol. Technol.* 123: 22 - 32.

### Abstract

Selection of effective wavelengths is a decisive step for online multispectral imaging systems. In this study, a new approach was utilized to distinguish the most informative wavelengths for detection of insect infestation in tomatoes within 400–1100 nm. Soft independent modeling of class analogy (SIMCA) was first conducted in the entire spectral region after applying different pretreatment procedures. Following satisfactory results obtained from 1st derivative preprocessing (accuracy of 90%), the most effective wavebands for detection of infestation were attained by discrimination power plot of SIMCA analysis. Transmission differences between all possible pairs of wavelengths ( $T(I1)-T(I2)$ ) in the obtained informative wavebands were then calculated to substitute the 1st derivative spectra. Afterward, correlation-based feature selection (CFS) algorithm was used to find the best pairs of wavelengths. To compare the performance of SIMCA-aided CFS procedure, CFS was also conducted on the raw spectral data. Seven spectral difference features and six wavelength features were found superior by CFS. To classify tomatoes, three different machine learning techniques including Bayesian networks (BNs),

artificial neural networks (ANNs), and support vector machines (SVMs) were implemented. The test set validation results of all machine learning techniques revealed that the spectral difference features outperformed the raw spectra features, indicating the superiority of SIMCA-aided CFS procedure for detection of optimal wavelengths. Among different machine learning techniques, the best performance obtained by ANN based on spectral difference features with a classification accuracy of 95.0%. The results of this study can be adapted for developing an online tomato sorting system for detection of infestations.

**Keywords:** /Tomato/

Sánchez-González, María J., et al. 2016. Salinity and ripening on/off the plant effects on lycopene synthesis and chlorophyll breakdown in hybrid Raf **tomato**. *Scientia Hort.* 211: 203 - 212.

### **Abstract**

The aim of this study was to describe the physiology of fruit colour in tomato as affected by salinity and ripening on and off the plant. Chlorophyll and lycopene levels were repeatedly measured in ninety Raf tomatoes over a period of eight days using remittance spectroscopy. Fruits were subjected to three salinity levels and were measured either on or off the plant. The physiology of tomato colour was described by a kinetic model centred on the role of STAY-GREEN proteins (SGR) that was calibrated simultaneously on chlorophyll and lycopene data with a percentage variance explained for of 91%. Lycopene precursor and transcript SGR levels were estimated considerably higher for on-plant than for off-plant ripened fruits which indicates ongoing expression while attached to the plant. There is less inhibition of the lycopene precursor by SGR in on plant ripened tomatoes which results in higher maximum lycopene levels and less chlorophyll breakdown causing residual chlorophyll levels. Effects of salinity treatments on chlorophyll breakdown and lycopene synthesis are small, but higher salinity levels strongly diminish fresh weight. Ripening on and off the plant strongly affects colour physiology of tomato fruit and is described well by the proposed model.

**Keywords:** /Tomato/ /Maturity/

Yang, Yang, et al. 2016. Inhibition of nitric oxide synthesis delayed mature-green **tomato** fruits ripening induced by inhibition of ethylene. *Scientia Hort.* 211: 95 - 101.

### **Abstract**

Ethylene is a key molecule to quality preservation during fruit ripening. The ethylene biosynthesis is regulated partly by nitric oxide (NO), a signal molecule involved in various physiological reactions. In order to investigate the effect of NO on key factors of ethylene biosynthesis, mature green tomatoes (*Solanum lycopersicum* Mill. cv. Lichun) were treated with the NO synthesis inhibitor L-Nitro-arginine methylester (L-NAME). The results showed that L-NAME decreased endogenous ethylene release and delayed the breaker stage of fruits. In the process, the activities of 1-aminocyclopropane-1-carboxylic acid synthase (ACS) and 1-aminocyclopropane-1-carboxylic acid oxide (ACO) were inhibited in accordance with the down-regulation of *SIACS2/4* and *SIACO1/3* genes. In addition, the expression of calcium-dependent protein kinase (CDPK) and mitogen-activated protein kinase (MAPK) genes, *SICDPK1/2* and *SIMAPK1/2/3*, was delayed or reduced. These results suggest that protein phosphorylation is involved in the ethylene biosynthesis reduction induced by L-NAME and that this lead to a delay in tomato fruit ripening.

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

## **HERBS AND SPICES**

### **PEPPER**

Ali, Asgar, et. al. 2016. Post-harvest development of anthracnose in **pepper** (*Capsicum* spp): etiology and management strategies. Crop Prot. 90: 132 - 141.

#### **Abstract**

Chilli anthracnose, caused by *Colletotrichum* spp, is one of the main causes for post-harvest decay of chilli. It can develop on the field, during long distant transport, cold storage and shelf-life. In conventional agriculture, the whole plant including the fruits, are sprayed with fungicides as a prerequisite for postharvest control of chilli anthracnose. Due to consumer concerns regarding the use of synthetic fungicides and the demand for safer storage methods, the use of synthetic fungicides is no longer allowed for the post-harvest control of chilli anthracnose. As a result, studies on alternative methods to control postharvest decay have been developed over the years along with the demand for safer storage methods. In this review, results published within the last decade have been summarized and alternative approaches to synthetic fungicides for post-harvest control of chilli anthracnose were discussed in detail. Overall, the use of natural antimicrobials, biocontrol agents, resistant cultivars and ozone shows promise as treatments that can be adopted on a commercial scale to control post-harvest chilli anthracnose caused by *Colletotrichum* species.

**Keywords:** /Pepper/ /Anthracnose/ / Chilli/ / Post-harvest Management/

### **WILD ROCKET**

Wieczynska, Justyna, et al. 2016. The use of antimicrobial sachets in the packaging of organic **wild rocket**: Impact on microorganisms and sensory quality. Postharvest Biol. Technol. 121: 126 - 134.

#### **Abstract**

Natural plant extracts from herbs and spices are regarded as safe products for the control of microorganisms. The aim of this work was to study the effects of natural antimicrobial compounds on the quality of packaged fresh organic wild rocket (*Diplotaxis tenuifolia* L.). The effects of eugenol, carvacrol, *trans*-anethole, *trans*-cinnamaldehyde, and  $\alpha$ -pinene were tested in vitro against rot and human pathogens. All of the compounds exhibited antimicrobial activity, except for  $\alpha$ -pinene. The efficacy of the antimicrobial compounds to control microorganisms, leaf color, spoilage volatiles, such as dimethyl disulfide, and sensory quality was tested in two *in vivo* experiments with sachets: a lab-scale jar experiment and a commercial-scale packaging experiment. In the jar experiment, eugenol showed higher antimicrobial activity than carvacrol against aerobic bacteria. All of the jars contained dimethyl disulfide in the headspace, but the sulfurous rotten odor was only detected in the control and eugenol samples, demonstrating that carvacrol, *trans*-anethole, and *trans*-cinnamaldehyde could mask the unpleasant odor of rotten wild rocket. In the packaging experiment, there was no clear effect of

eugenol, carvacrol or *trans*-anethole on the microbial load, but eugenol and *trans*-anethole masked the off-odor ratings of wild rocket. Evaluation of antimicrobial compounds for packaged fresh produce must include *in vitro* and *in vivo* testing because the benefits in real food systems may differ from those obtained in the laboratory.

**Keywords:** /Wild Rocket/ /Organic/

## ORNAMAMENTALS

### CARNATION

Pun, Umed Kumar, et al. 2016. Effect of sucrose on sensitivity to ethylene and enzyme activities and gene expression involved in ethylene biosynthesis in cut carnations. Postharvest Biol . Technol. 121: 151 - 158.

#### **Abstract**

Application of sugars extends the vase life of many cut flowers. The role of applied sucrose in petal senescence of cut carnations (*Dianthus caryophyllus* cv. Barbara) was investigated. Petal senescence was significantly delayed by 5% sucrose treatment. Although glucose, fructose, and sucrose concentrations decreased in the petals of control flowers with time, these concentrations increased on sucrose treatment. To investigate the effect of sucrose on sensitivity to ethylene, flowers were pre-treated with aminoethoxyvinyl glycine (AVG) to avoid the effect of ethylene biosynthesis and placed in a sucrose solution for 0 and 5 days. Flowers were then exposed to ethylene at 0.2, 0.6, and 2  $\mu\text{L L}^{-1}$ . Sucrose treatment did not delay petal senescence by ethylene exposure on day 0, suggesting that the effect of sucrose on the sensitivity to ethylene is negligible. Petal wilting was not accelerated by ethylene exposure at 0.2, 0.6, and 2  $\mu\text{L L}^{-1}$  without sucrose treatment on day 5, but sucrose treatment did not delay petal wilting, implying that sucrose treatment maintains sensitivity to ethylene in the aged flowers. Sucrose treatment delayed climacteric-like increase in the ethylene production of petals and gynoecium. 1- Aminocyclopropane-1-carboxylate (ACC) synthase (ACS) and ACC oxidase (ACO) activity in petals increased during senescence, and sucrose treatment delayed the increase in ACS activity and suppressed the increase in ACO activity. The transcript levels of the ACS gene *DcACS1* and the ACO gene *DcACO1* in petals increased during flower senescence, and sucrose treatment delayed the increase in the transcript levels of *DcACS1* and suppressed the increase in the transcript levels of *DcACO1*. These results suggest that delay in petal senescence by sucrose treatment is due to maintenance of sugar level in the petals, which delays a climacteric-like increase in ethylene production. The delay in ethylene production is associated with ACS and ACO activities regulated mainly at the transcriptional level.

**Keywords:** /Carnation/ /Cut-flower/ /Vase-Life/

### GLADIOLUS

Dwivedi, Sharad K., et al. 2016. Effect of sodium nitroprusside on differential activity of antioxidants and expression of SAGs in relation to vase life of gladiolus cut flowers. Scientia Hortic. 210: 158-165.

#### **Abstract**

All cut flowers are destined to die, and the challenge for postharvest researchers is to slow the processes controlling flower death to enable cut flowers to reach distant markets with a display life. An experiment was carried out to study the effect of nitric oxide (NO), provided through sodium nitroprusside (SNP; 100 ppm L<sup>-1</sup>) on physiology and vase life of cut flowers of *Gladiolus grandiflora* variety "Snow Princess". The vase solution having SNP showed significant increment in cumulative uptake of vase solution by flower spikes as compared to control and improved vase life. The level of lipid peroxidation, lipoxygenase (LOX) and protease activity was lower while the activity of superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX) and membrane stability was improved in SNP treated florist/spike. Moreover, the expression of senescence associated genes (SAGs) viz., *GgCYP1* was downregulated, while, *GgDAD1* expression was up-regulated in SNP treated spikes. Finding of the study suggested that the application of SNP increases vase life by increasing the scavenging mechanism of reactive oxygen species (ROS) in terms of antioxidants activity, membrane stability and down-regulation of *GgCYP1* expression in gladiolus cutflowers.

**Keywords:** /Gladiolus/ /Vase Life/

## **PHALAEOPSIS**

Favero, Bruno Trevenzoli, et al. 2016. Efficiency of 1-methylcyclopropene (1-MCP) treatment after ethylene exposure of mini-*Phalaenopsis*. Scientia Hort. 211: 53 - 59.

### **Abstract**

*Phalaenopsis* orchids are popular around the world, but sensitive to the phytohormone ethylene. Ethylene can cause flower wilting, drop of buds and flowers. 1-Methylcyclopropene (1-MCP) is an ethylene receptor inhibitor and effective when applied to plants before or at the same time as exposure to ethylene. In the current study, the timing of 1-MCP postharvest treatment in relation to ethylene exposure was investigated in two different mini *Phalaenopsis* cultivars. The aim was to determine how long 1-MCP treatment can be delayed (postponed) after exposure to ethylene had been initiated in order to effectively avoid critical losses in plants. *Phalaenopsis* cultivars 'Allen' and 'Venice' were exposed to 100 nL L<sup>-1</sup> of ethylene for a week and 200 nL L<sup>-1</sup> of 1-MCP, was applied either at the same time or at time points spanning from 6 to 51 h, after ethylene treatment was initiated. After 42 h of ethylene exposure followed by 1-MCP treatment, 'Allen' and 'Venice' displayed 91.4% ± 3.8 and 28.9% ± 4.3 senesced flowers, respectively, but when 1-MCP was applied 24 h after ethylene exposure, the percentage of senesced flowers was similar to simultaneous start of ethylene and 1-MCP exposure. Colorimetric assessment appeared not to be a fruitful parameter to determine senescence although loss of gloss in flowers and buds toward the advance in time after ethylene exposure started was visually noted. Furthermore, percentage of water dropped to similar levels in 'Allen' when 1-MCP application was delayed to 42 h after initiation of ethylene exposure compared to plants solely treated with ethylene and electrolyte leakage started to increase to statistically different values compared to atmospheric air treated plants after 27 h of delay of 1-MCP application after ethylene exposure commenced, thus correlating to the increased senescence exhibited by this cultivar. Collectively, 24–27 h of ethylene exposure followed by 1-MCP treatment showed to be the threshold time span that 1-MCP application can be delayed to stop or even reverse the negative effects of ethylene exposure.

**Keywords:** /Phalaenopsis/ /Postharvest/ /Postproduction/ /Potted flower/ /Senescence/