

**SELECTIVE DISSEMINATION OF INFORMATION (SDI)  
PDF REPRINTS AS OF OCTOBER - NOVEMBER 2017**

**GENERAL**

**ACTIVE FILM**

Benbettaieb, N., et.al. 2018. Impact of functional properties and release kinetics on antioxidant activity of biopolymer active films and coatings. Food Chem 242: 369-377.

**Abstract**

This work deals with the study of the release kinetics of some natural antioxidants (ferulic acid, caffeic acid and tyrosol) from chitosan-fish gelatin edible films immersed ethanol at 96%, as well as the kinetics of their anti-oxidant activity using the DPPH assay. The aim was to determine how film functional properties influence the release kinetic and antioxidant activity. The addition of antioxidants to chitosan-fish gelatin matrix decreased the water vapour permeability by more than 30%. The tensile strength (TS) increased up to 50% after the incorporation of antioxidants. Some molecular interactions between polymer chains and antioxidants were confirmed by FTIR where spectra displayed a shift of the amide-III peak. Films containing caffeic acid or a caffeic-ferulic acid mixture exhibited the highest radical scavenging activity, leading to a 90% antioxidant activity at equilibrium but the release rate controlled the efficacy of the system.

**Keywords:** /Active Film/ /Active Packaging/ /Chitosan-fish Gelatin Film/

**CONSUMER PERCEPTION**

Loebnitz, N. and K.G. Grunert. 2018. The impact of abnormally shaped vegetables on consumers' risk perception. Food Qual Pref 62: 80-87.

**Abstract**

Genetically-modified (GM) food evokes high levels of fear and negative associations among consumers. This study predicts that people may associate naturally occurring vegetable shape-abnormalities with GM food, which increases their risk perception. With an experimental design in two studies, this research investigates the impact of abnormally-shaped vegetables on participants' risk perceptions related to vegetable items that vary in their degree of association with GM technology. The results reveal that knowledge can moderate the vegetable shapeabnormality–risk relationship, depending on its objectivity or subjectivity.

**Keywords:** /Consumer Perception/

**CUT FLOWERS**

Dole, J.M., et.al. 2017. Evaluating field-grown perennials as cut flowers. Acta Horti 1171: 59-66.

### Abstract

Perennials are an important part of field-grown cut flower operations and producers have many species and cultivars from which to choose. The Association of Specialty Cut Flower Growers in cooperation with North Carolina State University and perennial plant suppliers conducted a perennial trial program to evaluate 145 perennial species and cultivars. Five to eight commercial cut flower growers and North Carolina State University evaluated the plants as part of a 14-year study. Of the tested plants, 23 perennials produced more than 20 stems plant<sup>-1</sup>. Thirty-one perennials produced stems with an average length of less than 45 cm, which is the minimum length for commercial cut flower production. On the other hand, 16 perennials produced stems longer than 90 cm. In addition to providing production data, the trial sites also rated each perennial for market appreciation, likelihood of growing the perennial again, and ease of cultivation. Considering productivity of at least 5 stems plant<sup>-1</sup>, stem length of at least 45 cm, and high ratings, the overall top perennials were *Achillea* 'Fireland' and 'Terra Cotta', *Baptisia australis*, *Echinacea* 'Big Sky Summer Sky' and 'Comet', *Eupatorium maculatum* 'Carin', *Geum* 'Fireball', *Helenium autumnale* 'Helena Red Shades', *Hylotelephium* 'Matrona', *Heuchera* 'Florist's Choice' 'Paris', and 'Velvet Night', *Hypericum androsaemum* 'Albury Purple', *Monarda* 'Raspberry Wine', *Penstemon* 'Dark Towers' and 'Husker Red', *Persicaria amplexicaule* 'Firetail', *Phlox paniculata* 'Icecap', 'Miss Violet', and 'Red Eyes', *Physostegia* 'Summer Spires', *Rudbeckia subtomentosa* 'Henry Eilers', and *Veronica longifolia* 'Blauriensen'.

**Keywords:** /Cut Flowers/

### EDIBLE FILM

Mingming Guo, et.al. 2017. Antimicrobial edible coatings and films from micro-emulsions and their food applications. Int J Food Microbiol 263 9-16.

### Abstract

This study focused on the use of antimicrobial edible coatings and films from micro-emulsions to reduce populations of foodborne pathogens in foods. Corn-Bio-fiber gum (C-BFG) was used as an emulsifier with chitosan. Allyl isothiocyanate (AIT) and lauric arginate ester (LAE) served as antimicrobials. Micro-emulsions were obtained from a solution consisting of 1% chitosan, 0.5% C-BFG, and 1–4% AIT or LAE which was subject to high pressure homogenization (HPH) processing at 138 MPa for 3 cycles. Coatings and films produced from the micro-emulsions had micro-pores with sizes ranging from 100 to 300 nm and micro-channels that hold anti-microbials effectively and facilitate the release of antimicrobials from the center to the surface of the films or coatings, thus enhancing their antimicrobial efficacy. The coatings and films with 1% AIT reduced populations of *Listeria innocua* by over 5, 2, and 3 log CFU in culture medium (Tryptic soy broth, TSB), ready-to-eat meat, and strawberries, respectively. The coatings and films with 1% LAE reduced populations of *Escherichia coli* O157:H7 and *Salmonella* spp. by over 5 and 2 log CFU in TSB and strawberries, respectively. This study provides an innovative

approach for the development of effective antimicrobial materials to reduce food borne pathogenic contaminants on ready-to-eat meat, strawberries, or other food.

**Keywords:** /Edible Film/ /Packaging/

Thakur, R., et.al. 2017. Amylose-lipid complex as a measure of variations in physical, mechanical and barrier attributes of rice starch-  $\iota$ -carrageenan biodegradable **edible film**. Food Packag & Shelf Life 14: 108-115.

### **Abstract**

Improvements in the hygroscopic properties of starch based films are important to strengthen their mechanical properties. The effects of different hydrophobic components-butyric acid (BA, C4:0), lauric acid (LA, C12:0), palmitic acid (PA, C16:0), oleic acid (OA, C18:1), stearic acid (SA, C18:0) and sucrose fatty acid ester (FAEs) on the rice starch (RS)- $\iota$ -carrageenan ( $\iota$ -car) composite films were investigated. Scanning electron microscopy (SEM), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) in combination with amylose-lipid complexing index (CI) were used to characterise the changes in structure and properties of edible films. The SEM results showed that the surface of films became smoother after the incorporation of fatty acids. Carbon-chain length was a major determinant of CI formation which further influenced the attributes of RS- $\iota$ -car films. The addition of FAEs to RS- $\iota$ -car improved film thickness, permeability, transparency, tensile properties (TS) and could be used to tailor biodegradable edible films with enhanced properties and future fruit coating applications.

**Keywords:** /Edible Film/ /Packaging/

Zhilong Yu, et.al. 2017. Effect and mechanism of cellulose nanofibrils on the active functions of biopolymer-based nanocomposite **films**. Food Res Int 99: 166-172.

### **Abstract**

Cellulose nanofibrils (CNFs) are superfine cellulose fibrils with a nanoscale diameter and have gained increasing attention due to their great potential in the food industry. However, the applications of CNFs in active food packaging are still limited. The objectives of this study were to develop biopolymer-based edible nanocomposite films using CNFs, corn starch, and chitosan, and to investigate the effect and mechanisms of CNFs on the active functions and properties of the nanocomposite films. Important functional properties of the films were measured and the films were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and Zetasizer. The results demonstrate that CNFs increased the rigidity of the films due to more hydrogen bonds being induced by CNFs ( $\geq 60\%$ ). Incorporating a high content of CNFs ( $\geq 60\%$ ) in the film resulted in enhanced filling effect on the structure of the biopolymer films, which significantly improved the light barrier, oxygen barrier and water vapor barrier capacities. As CNF content increased to 100%, the film opacity increased by 59%, while the peroxide value of corn oil protected with edible films was reduced by 23%. Furthermore, the antimicrobial properties of the edible films with 80% and 100% CNFs were increased

by up to 2 log CFU/g on day 8 in a beef model, due to more positive charges in the films and improved blocking effects on oxygen. These results demonstrate that CNFs can effectively enhance the antimicrobial effect and barrier properties of biopolymer-based nanocomposite films and have great potential in applications of active packaging for food products.

**Keywords:** /Edible Film/ /Chitosan/

## FILM

Perez, L.J., et.al. 2017. Physical and antioxidant properties of **films** based on gelatin, gelatin-chitosan or gelatin-sodium caseinate blends loaded with nanoemulsified active compounds. J Food Eng 213: 47-53.

### Abstract

The aims of this study were the development and characterization of active films based on gelatin (G), gelatin-sodium caseinate (G-Cs) and gelatin-chitosan (G-Ch) blends, applying active compounds ( $\alpha$ -tocopherol, garlic essential oil and cinnamaldehyde) nanoemulsified in water (NACs). A microfluidization technique was used in the preparation of the O/W nanoemulsion. Following this, the emulsion system containing NACs was loaded into the film-forming solution. Films were prepared by the casting technique and thereafter characterized. Films based on the G-Ch blend plus NACs presented the lowest solubility and swelling and the highest hydrophobicity, as supported by the angle contact measurement. Analysis of the film microstructure obtained by SEM and FTIR exhibited a good compatibility among the G-Ch blend and showed that this matrix allowed a uniform distribution of the actives throughout the network. Films based on the G-Cs blend plus NACs showed the best antioxidant activity, highlighting its potential use as active packaging for shelf life extension of foodstuffs.

**Keywords:** /Films/ /Active Films/ /Edible Films/

## FOOD SUPPLY CHAIN

van Ruth S.M., et.al. 2018. Differences in fraud vulnerability in various **food supply chains** and their tiers. Food Control 84: 375-381.

### Abstract

Food fraud results from the interaction of motivated offenders with opportunities, and lack of control measures. The vulnerability to food fraud varies across chain actors (tiers) though, but insights on prime fraud drivers and enablers, as well as chain areas where vulnerabilities might exist are lacking. In the current study the fish, meat, milk, olive oil, organic bananas, and spice supply chains were assessed for their fraud vulnerabilities. The differences and similarities in vulnerabilities across the supply chains, as well as between groups of chain actors were evaluated using the SSAFE food fraud vulnerability assessment tool. Multiple correspondence analysis and agglomerative hierarchical clustering were applied for exploratory data analysis, and differences between chains and actors were

assessed by analysis of variance and post-hoc tests. Thirteen fraud factors related to opportunities and motivations scored high across all supply chains indicating their importance as fraud drivers and enablers. Control measures varied considerably across supply chains and actor groups, with technical (hard) controls generally being more in place than managerial (soft) controls. Approximately half of the fraud factors were impacted by the type of commodity chain, and one out of seven of the fraud factors by the actor group. From the current sample group overall fraud vulnerability appeared highest for the spice chain, which was followed by the olive oil, meat, fish, milk and organic banana chains. Among the actor groups, the wholesale/traders group appeared most vulnerable, followed by retailers and processors. The current results provide new insights in the fraud factors determining fraud vulnerability in various supply chains, and the (dis)similarities in fraud vulnerability across supply chains and actor groups which helps to combat future food fraud.

**Keywords:** /Food Supply Chain/ /Banana/ /Spices/

## **FRESH FRUITS AND VEGETABLES**

Romanazzi, G., et.al. 2017. Shelf life extension of fresh fruit and vegetables by chitosan treatment. Crit Rev Food Sci & Nutr 57(3): 579-601.

### **Abstract**

Among alternatives that are currently under investigation to replace the use of synthetic fungicides to control postharvest diseases in fresh produce and to extend their shelf life, chitosan application has shown promising disease control, at both preharvest and postharvest stages. Chitosan shows a dual mode of action, on the pathogen and on the plant, as it reduces the growth of decay-causing fungi and foodborne pathogens and induces resistance responses in the host tissues. Chitosan coating forms a semipermeable film on the surface of fruit and vegetables, thereby delaying the rate of respiration, decreasing weight loss, maintaining the overall quality, and prolonging the shelf life. Moreover, the coating can provide a substrate for incorporation of other functional food additives, such as minerals, vitamins, or other drugs or nutraceutical compounds that can be used to enhance the beneficial properties of fresh commodities, or in some cases the antimicrobial activity of chitosan. Chitosan coating has been approved as GRAS substance by USFDA, and its application is safe for the consumer and the environment. This review summarizes the most relevant and recent knowledge in the application of chitosan in postharvest disease control and maintenance of overall fruit and vegetable quality during postharvest storage.

**Keywords:** /Fresh Fruits and Vegetables/ /Shelf Life/ /Chitosan/

## **FRESH PRODUCE**

Cook, K.L., et.al. 2017. Using the agricultural environment to select better surrogates for foodborne pathogens associated with fresh produce. Int J Food Microbiol 262: 80-88.

### **Abstract**

Despite continuing efforts to reduce foodborne pathogen contamination of fresh produce, significant outbreaks continue to occur. Identification of appropriate surrogates for foodborne pathogens facilitates relevant research to identify reservoirs and amplifiers of these contaminants in production and processing environments. Therefore, the objective of this study was to identify environmental *Escherichia coli* isolates from manures (poultry, swine and dairy) and surface water sources with properties similar to those of the produce associated foodborne pathogens *E. coli* O157:H7 and *Salmonella enterica* serotype Typhimurium. The most similar environmental *E. coli* isolates were from poultry (n = 3) and surface water (n = 1) sources. The best environmental *E. coli* surrogates had cell surface characteristics (zeta potential, hydrophobicity and exopolysaccharide composition) that were similar (i.e., within 15%) to those of *S. Typhimurium* and/or formed biofilms more often when grown in low nutrient media prepared from lettuce lysates (24%) than when grown on high nutrient broth (7%). The rate of attachment of environmental isolates to lettuce leaves was also similar to that of *S. Typhimurium*. In contrast, *E. coli* O157:H7, a commonly used *E. coli* quality control strain and swine isolates behaved similarly; all were in the lowest 10% of isolates for biofilm formation and leaf attachment. These data suggest that the environment may provide a valuable resource for selection of surrogates for foodborne pathogens

**Keywords:** /Fresh Produce/

## **HYPOBARIC STORAGE**

Burg, S.P. and T.L. Davenport. 2017. Heat transfer, mass transport and horticultural commodity water loss during hypobaric storage. *Scientia Horti* 225: 561-566.

### **Abstract**

Freedom red roses stored in a hypobaric warehouse at 11.1 mmHg, 2 °C, lost 6.78% of their water in 35 days. Respiratory heat only evaporated enough water from the flowers to cause a 2.5% weight loss. The low storage pressure promoted capillary water condensation in the non-waxed cardboard boxes used for flower distribution, increasing the cardboard's weight by 20%. Radiation and convection transferred the heat of capillary water condensation from the cardboard to the roses, and evaporative cooling caused the extra water loss moving heat from the roses to the chamber air. A weight increase due to capillary water condensation did not occur in cardboard boxes at atmospheric pressure, 85–90% RH, or in waterproof plastic boxes at 11.1 mmHg, 99.8% RH. Horticultural commodities lose more water during controlled atmosphere (CA) or normal atmosphere storage (NA) than during hypobaric storage (LP) in waterproof boxes because more respiratory heat is produced in CA and NA. Non waxed cardboard boxes should not be used for hypobaric storage.

**Keywords:** /Hypobaric Storage/

## **MINIMALLY PROCESSED**

Ali, A., et.al. 2017. Advances in postharvest technologies to extend the storage life of **minimally processed** fruits and vegetables. Crit Rev Food Sci & Nutr DOI10.1080/10408398.2017.1339180

### **Abstract**

Minimally processed fresh produce is one of the fastest growing segments of the food industry due to consumer demand for fresh, healthy, and convenient foods. However, mechanical operations of cutting and peeling induce the liberation of cellular contents at the site of wounding that can promote the growth of pathogenic and spoilage microorganisms. In addition, rates of tissue senescence can be enhanced resulting in reduced storage life of fresh-cut fruits and vegetables. Chlorine has been widely adopted in the disinfection and washing procedures of fresh-cut produce due to its low cost and efficacy against a broad spectrum of microorganisms. Continuous replenishment of chlorine in high organic wash water can promote the formation of carcinogenic compounds such as trihalomethanes, which threaten human and environmental health. Alternative green and innovative chemical and physical postharvest treatments such as ozone, electrolyzed water, hydrogen peroxide, ultraviolet radiation, high pressure processing, and ultrasound can achieve similar reduction of microorganisms as chlorine without the production of harmful compounds or compromising the quality of fresh-cut produce.

**Keywords:** /Minimally Processed/ /Fresh Cut/ /Storage Life/

### **ORNAMENTAL CROPS**

Funnel, K.A., et.al. 2017. *Gentianella* species from New Zealand with potential as **ornamental crops**. Acta Horti 1171: 371-374.

### **Abstract**

The international ornamentals industry already benefits from recently developed ornamental plant products from New Zealand (NZ) such as begonia Bonfire™, limonium Sinzii™ and the gentian Showtime™ series. *Gentianella*, a genus closely related to *Gentiana*, has species endemic to geographic locations within NZ including the Chatham Islands to the east, the Sub-Antarctic islands to the south, and coastal and alpine regions of NZ's North and South Islands. Amongst the 30 species recognised as endemic to NZ, 78% have white flowers, but yellow, green, pink, red and purple flowers are also evident. More than 60% of species have a short stature with multiple flowering stems, making them suitable targets as potted or landscape plants, while the taller species may have potential as cut flowers. More than 80% of the species exist in alpine habitats, with others being coastal, suggesting a broad range of environmental tolerances across the genus. We intend to explore the genetic diversity available within the genus *Gentianella*, investigating opportunities to develop commercial use within this genus.

**Keywords:** /Ornamental Crops/

### **POSTHARVEST DISEASE**

Hongyin Zhang, et.al. 2017. Augmentation of biocontrol agents with physical methods against **postharvest diseases** of fruits and vegetables. Trends Food Sci & Technol 69: 36-45.

### **Abstract**

*Background:* The application of physical (thermal and non-thermal) treatments in combination with biocontrol agents for the control of postharvest fungi has achieved significant research attention. In order to make combined nonchemical agents commercially suitable for postharvest treatment of other commodities, there is the need to study their individual effects and then integrated effects to present them as economically viable, resilient and persistent.

*Scope and approach:* In this article, various physical treatment methods (thermal and non-thermal) have been used to enhance the bioefficacy of microbial agents against postharvest diseases of fruits and the possible mode of action were reviewed. Additionally, the interrelationship between fungal virulence, host response and environmental factors that influence infection rate and production of mycotoxin has also been highlighted.

*Key findings and conclusions:* Physical treatments act as disinfectants of surfaces of produce prior to application of antagonistic yeasts that provide persistent protective action over an extensive period. Physical methods by heat treatment tends to seal or cure openings on the produce in order to limit the sites for pathogen penetration and restriction of secondary infections by biofilm formation after application of antagonistic yeasts or bioactive compounds. Thus, this phenomenon slow down changes in fruits respiration and metabolic activity. Heat has the potential to up-regulate proteins in fruits, which correlates with defense response and redox metabolism; consequently, demonstrates a physiological adaptation to environmental stress. From literature, there is limited information on the effect of ohmic heat method combined with antagonistic on decay causing pathogens and shelf life of fruits. Furthermore, the employment of novel tools available in molecular biology will enable in-depth explanation of other physiological and biochemical pathways on which the treatment effects are supported.

**Keywords:** /Postharvest Disease/ /Fruits/ /Vegetables/

### **POSTHARVEST PHYSIOLOGY**

Pathak, N., et.al. 2017. Impacts of mixed fruit loading on **postharvest physiological** responses and quality of horticultural produce. Food Packag. & Shelf Life 14: 66-73.

### **Abstract**

Postharvest supply chain of fresh produce often involves close proximity of fruit with different ethylene sensitivities. Thus, the quality of fruit sensitive to ethylene may be affected due to the exogenous ethylene, produced by other commodities. This study was conducted to assess the impacts of a mixed fruit loading and storage on the physiological and qualitative attributes of fruits. Further on, the effectiveness of ethylene removal using conventional ethylene absorbent sachets as well as an in-house developed ultraviolet light based reactor in such mixed storage was also evaluated. High ethylene producer (apples) was stored along with non-treated green bananas and unripe kiwifruit (highly

sensitive to ethylene), at 15 °C for 10 days. Post-storage analysis showed that bananas and kiwifruits stored with apples had significantly elevated respiration and ethylene production rates compared to samples stored alone. Mix loading with apples resulted in a significant decline in tissue strength from 25.01 to 6.44 N for kiwifruits; and a significant increase in total soluble sugars from 2.7 to 21.09% for bananas at the end of storage. The use of ethylene absorbent as well as the reactor reduced ethylene concentration in the storage chamber and slowed down respiration rate in the fruits. However, to preserve fruit quality to a higher extent, further research into development of ethylene removal system with higher ethylene removal rate is suggested. The results obtained also highlight the need of proper separation of fresh produce (based on ethylene sensitivity) during transportation, storage and retail display.

**Keywords:** /Postharvest Physiology/ /Ethylene/ /Storage Life/ /Kiwifruit/

## **SUPPLY CHAIN**

Goransson, M., et.al. 2018. Shelf-life variations in pallet unit loads during perishable food supply chain distribution. Food Control 84: 552-560.

### **Abstract**

This paper presents an experimental study of the thermal inertia of a pallet loaded with returnable plastic crates containing primary packages of smoked ham. Based on this, food quality variations within the pallet were also investigated. Thermal time constants from 83 sensor locations were identified by studying the temperature changes when the pallet was exposed to instant temperature drops (16 °C - 2 °C) and temperature elevations (2 °C – 16 °C). The thermal time constants were used in microbiological prediction models to calculate the maximum difference in shelf life between packages at the two most extreme spots in the pallet unit load, when temperature elevated from 4 °C to a higher temperature (ranging from 4.5 °C to 12 °C), during different periods of time (ranging from 0.5 h to 200 h). The results showed a maximum difference in shelf life of approximately 1.8 days. The identified thermal time constants were also used to calculate the maximum difference in shelf life between packages at the two most extreme spots of a pallet unit load, in a real chilled food supply chain lasting for about 2.5 days. This resulted in a maximum difference of 0.1 days. The results imply that the location of a product in a pallet has a relatively low influence on the product shelf life. This means that a temperature sensor used for calculating the predicted shelf life of a product, can be placed relatively far from the product itself (e.g. on the secondary package or even on the pallet) without jeopardizing the reliability of the resulting shelf-life prediction. However, the results also emphasize the importance of continuous temperature monitoring along the entire chilled food supply chains.

**Keywords:** /Supply Chain/ /Shelf Life/

## **VEGETABLE CONSUMPTION**

Menozzi, D., et.al. 2017. Understanding and modelling vegetables consumption among young adults. LWT – Food Sci & Technol 85: 327-333.

### **Abstract**

Vegetables consumption is decreasing among young people in Italy. This paper aims to understand the main determinants of vegetables consumption among young adults to suggest possible intervention strategies to promote it. A cross-sectional study was conducted on a samples of Italian students (n = 751), using the theory of planned behaviour (TPB) as a conceptual framework. A structural equation modelling (SEM) was used to test the TPB predictors for eating at least two servings of vegetables per day next week, and multi-group analysis to assess the moderating effect of habits. The self-reported mean consumption was three servings of vegetables per day, but individuals reporting low habits consumed a lower number of servings and reported lower frequency of consumption. The TPB model explains 81% of intentions and 67% of behaviour variance. Intention significantly affects vegetable eating behaviour in participants with low habits, while for high habits group perceived control is the main behaviour predictor. This indicates that vegetable consumption may be intentional as well as habitual, depending on the level of habit strengths. Possible intervention strategies based on the relevant behavioural, normative and control beliefs are discussed.

**Keywords:** /Vegetable Consumption/

### **FRUITS**

#### **AVOCADO**

Hernandez, I., et.al. 2017. Effects of heat shock and nitrogen shock pre-treatments on ripening heterogeneity of Hass avocados stored in controlled atmosphere. Scientia Horti 225: 408-415.

### **Abstract**

Hass avocado ripening heterogeneity generates logistics problems to importers and ripeners due to higher labour costs, inconsistent quality delivery and postharvest losses. The main aims of this research were: (i) to evaluate two postharvest pre-treatments (nitrogen shock N<sub>2</sub> and heat shock) prior controlled atmosphere (CA) on reduction of ripening heterogeneity of Hass avocado without being detrimental to fatty acid profile and (ii) to study the potential metabolic processes implicated in such ripening synchronization with focus on cell wall remodelling and ethylene biosynthetic pathways. Results showed that heat shock prior to CA storage significantly reduced ripening heterogeneity in early and middle season fruit while N<sub>2</sub> + CA did not. Pectin methyl esterase (PME) and polygalacturonase (PG) activity did not display significant differences among treatments. Additionally, none of the treatments altered the fatty acid profile. ACS transcript for early and middle season fruit kept constant during storage for heat + CA, CA and N<sub>2</sub> + CA. ACO instead displayed less abundance after 21 d storage for all treatments of early season fruit. These results point to ripening synchronization in Hass avocado subjected to heat to be related to induction of metabolic processes related to ethylene (biosynthesis),

possibly at the action level (receptors) but the efficiency of the heat treatment was related to the maturity stage of the batch.

**Keywords:** /Avocado/ /Ethylene/

Ramirez-Gil, J.G., et.al. 2017. Economic impact of the **avocado** (cv. Hass) wilt disease complex in Antioquia, Colombia, crops under different technological management levels. Crop Prot 101: 103-115.

### **Abstract**

The avocado wilt disease complex is the most important pathology in avocado crops worldwide. Despite its importance, research about its economic losses is limited. In this work, the objective was to determine the economic impact of the wilt disease in three regions located in Antioquia, Colombia, and its relationship with the technological level of farm management. Six nurseries and 20 fruit production lots were tested for economic losses due to the wilt disease, including all crops stages of development. Results showed an average incidence and mortality of 28.2 and 60.8%, respectively, at the nursery level. Economic losses due to the disease were 356, 340 and 325 USD per nursery per production cycle. Cost over-run for the nursery stage was 64.5, 75.4 and 50.9 USD for the northern, eastern and southwestern regions, respectively. In the field crops, an incidence of 33.83 and mortality of 25.06 were observed, economic losses were 2340, 1702 and 2103 USD ha<sup>-1</sup>, with a cost over-run of 225, 372 and 287.9 USD ha<sup>-1</sup> for the same regions, respectively, during a 8-year period. As expected, the highest yields, lowest incidence of the wilt disease and best cost/benefit relationship, were registered for high technological grade of farm management. In this work, the economic impact of the avocado wilt disease during the different stages of crop development were determined as a direct effect of plant deaths and reduction of plant production, in addition to the cost over-run due to replanting and disease management.

**Keywords:** /Avocado/

### **BLUEBERRY**

Hee Duk Oh, et.al. 2017. Abscisic acid stimulates anthocyanin accumulation in 'Jersey' highbush **blueberry** fruits during ripening. Food Chem244: 403-407.

### **Abstract**

Non-climacteric blueberry (*Vaccinium* spp.) fruits accumulate high levels of anthocyanins during ripening, which are a good source of dietary antioxidants. This study examined the effects of exogenous abscisic acid (ABA) application on fruit characteristics and anthocyanin accumulation in a northern highbush blueberry (*V. corymbosum* 'Jersey') during development. Fruits on shrubs were treated with 1 g L<sup>-1</sup> ABA before the initiation of fruit colouration. Application of ABA temporarily increased the level of ABA in the fruits during development. Exogenous ABA had no obvious effect on fruit growth, but stimulated fruit colouration by accelerating the accumulation of individual anthocyanins, mainly malvidin, delphinidin and petunidin glycosides. This is the first report to show that ABA promotes the

accumulation of anthocyanins in blueberry fruits. However, exogenous ABA also promoted fruit softening, which is undesirable during harvest and shelf life.

**Keywords:** /Blueberry/ /Ripening/ /Fruit Colouration/

Xinang Cao, et.al. 2017. Evaluation of pulsed light treatments on inactivation of *Salmonella* on **blueberries** and its impact on shelf-life and quality attributes. Int J Food Microbiol 260: 17-26.

### **Abstract**

Blueberry have a short shelf life when fully ripe and susceptible to contamination of various pathogens. Our study investigated the effect of pulsed light (PL) on inactivation of *Salmonella* on blueberries and its impact on shelf-life, quality attributes and health-benefit compounds of blueberries. Dry PL (6 J/cm<sup>2</sup>) and water-assisted PL (samples were agitated in water during PL treatment; 9 J/cm<sup>2</sup>) along with two controls, dry control (untreated) and water-assisted control (water washing without PL), were applied to blueberries with subsequent storages at room temperature (3 days) or 5 °C (7 days). For *Salmonella* inactivation, dry PL treatment achieved 0.9 and 0.6 log reduction of *Salmonella* for spot and dip inoculation, respectively; while the water-assisted PL treatment reduced *Salmonella* by 4.4 log and 0.8 log for spot and dip inoculation, respectively. The water-assisted PL treatment resulted in *Salmonella* populations significantly lower than the dry control after storage regardless of the storage temperature and inoculation method. Neither dry nor water-assisted PL treatments improved the shelf life of blueberries even though direct inactivation of natural yeasts and molds were achieved. Surface lightness was instantly reduced after both dry and water-assisted PL treatments. Compared with the dry control, the two PL treatments did not reduce the firmness of blueberries. Weight loss was increased for the dry PL treated samples, but not for the water-assisted PL treatment for both storage conditions. Delayed anthocyanins accumulation and reduced total antioxidant activity were induced by both PL treatments at the end of storage at room temperature, while slight enhancement in total phenolics content was achieved by water-assisted PL treatment. In conclusion, the water-assisted PL treatment could effectively decontaminate *Salmonella* on blueberries while showed minimal or no impact on the shelf-life, quality attributes and health-benefit compounds of blueberries. PL processing parameters need to be further evaluated and optimized before possible application in the blueberry industry.

**Keywords:** /Blueberry/ /Shelf-life/

### **CANTALOUPE**

Yezhi Fu, et.al. 2017. Biofilm of *Escherichia coli* O157:H7 on **cantaloupe** surface is resistant to lauroyl arginate ethyl and sodium hypochlorite. Int J Food Microbiol 260: 11-16.

### **Abstract**

Biofilms formed by *Escherichia coli* O157:H7 on cantaloupe rind were characterized in this study. Cantaloupe rind pieces inoculated with *E. coli* O157:H7 B6-914 was sampled after 2, 12, and 24 h incubation for imaging with cryo-scanning electron microscopy (Cryo-SEM) or treating with lauroyl

arginate ethyl (LAE) or sodium hypochlorite (SHC). Cryo-SEM images showed that *E. coli* O157:H7 formed a biofilm within 12 h on the rind surface. For rind samples treated with LAE or SHC, the residual cell counts were significantly different ( $p < 0.05$ ) between 2 and 12 h incubation, and between 2 and 24 h of incubation. For the 2 h incubation samples, *E. coli* O157:H7 was undetectable ( $> 5$ -log reduction) after treatment with 2000  $\mu\text{g}/\text{mL}$  of LAE or SHC. In contrast, for 12 h incubation samples, 2000  $\mu\text{g}/\text{mL}$  of LAE or SHC could only achieve 1.74 or 1.86-log reduction, respectively. The study showed the low efficacy of LAE and SHC on cantaloupe rind surface to reduce the *E. coli* biofilm, suggesting the needs for cantaloupe cleaning methods beyond washing with conventional antimicrobial agents.

**Keywords:** /Cantaloupe/ /Biofilm/

## CHERRY

Velardo-Micharet, B., et.al. 2017. Effect of irrigation on postharvest quality of two sweet **cherry** cultivars (*Prunus avium* L.). *Acta Horti* 1161: 667-672.

### Abstract

Sweet cherry has been traditionally a rainfed crop, but the change in climatic conditions and the introduction of new cultivars make of irrigation an interesting alternative. The goal of this work was to study the influence of irrigation on postharvest fruit quality of 'Lapins' and 'Ambrunés' sweet cherry cultivars. For that, fully irrigated (FI) and non-irrigated (NI) cherries of both cultivars, harvested at commercial maturity, were compared. The postharvest storage was performed at 4°C and 90% relative humidity for 14 days ('Lapins') and 33 days ('Ambrunés'). The quality parameters analyzed were: firmness, total soluble solids (TSS), titratable acidity (TA), TSS/TA, weight loss, moisture, stem colour and rot incidence. FI 'Lapins' cherries were larger than NI cherries at harvest, whereas the physico-chemical quality of cherries remained unaffected, which represents a great commercial advantage. In the case of 'Ambrunés', irrigation did not provide any advantage in terms of postharvest fruit quality parameters, although further studies over several years are required. FI cherries of both cultivars had a higher rot incidence than NI cherries.

**Keywords:** /Cherry/ /Postharvest Quality/

Tsaniklidis, G., et.al. 2017. The effect of postharvest storage temperature on sweet **cherry** (*Prunus avium* L.) phenolic metabolism and colour development. *Scientia Horti* 225:751-756.

### Abstract

Sweet cherry storage at 1 °C significantly affected many biochemical parameters linked to anthocyanin concentration in fruits and subsequently their colour. While no significant differences in the concentration of total phenolics were detected among treatments, total anthocyanin concentration and phenylalanine ammonia-lyase enzyme activity, as well as the transcription of anthocyanidin synthase and flavonol 3-O-glucosyltransferase (genes coding for enzymes fundamental for the anthocyanin synthesis) were considerably lower in fruits stored at 1 °C (with or without a 24-h period of storage at 20

°C) in comparison to the initial fruits at harvest. In contrast, the fruits stored continuously at 20 °C exhibited higher levels of total anthocyanins and Phenylalanine Ammonia-Lyase activity and also elevated expression of the genes coding for enzymes involved in the biosynthesis of anthocyanins in comparison to fruits that underwent cold storage. Our results suggest that cold storage of sweet cherries at low, but non-chilling temperatures, decelerates the accumulation of anthocyanins and consequently causes slower colour development in fruits.

**Keywords:** /Cherry/ /Cold Storage/

Ying Xin, et.al. 2017. Influence of chitosan-based coatings on the physicochemical properties and pectin nanostructure of Chinese **cherry**. *Postharvest Biol & Technol* 133: 64-71.

#### **Abstract**

The effects of chitosan-based coatings on the postharvest performance Chinese cherry during a twenty days storage period were investigated. The chitosan-based coatings effectively delayed postharvest ripening parameters including weight loss, decay rate, firmness, soluble solid content (SSC) and titratable acidity (TA). The most effective treatment was a combined chitosan and nano-SiO<sub>x</sub> coating, which led to 51% less weight loss, 32% less decay rate, 57% more firmness, and less SSC and TA content changes than the control group. This combined coating also maintained a higher content of sodium carbonate-soluble pectin (SSP), and inhibited pectin chain degradation. Qualitative and quantitative analysis revealed that the firmness of fruit was closely related to nanostructural morphologies and SSP chain width. In addition, modifications of SSP were correlated with fruit softening, especially SSP polymers and branched chains. These results demonstrate the effect of chitosan and nano-SiO<sub>x</sub> coating on extending the shelf life of Chinese cherries during postharvest storage.

**Keywords:** /Cherry/ /Quality/ /Chitosan/

#### **CITRUS**

Klein, M.N. and K.C. Kupper. 2018. Biofilm production by *Aureobasidium pullulans* improves biocontrol against sour rot in **citrus**. *Food Microbiol* 69:1-10.

#### **Abstract**

The biocontrol efficiency of *Aureobasidium pullulans* strain ACBL-77 against *Geotrichum citri-aurantii*, causal agent of sour rot in citrus, and their interactions were evaluated. For this, we evaluated the incorporation of nutrients in optimizing the antagonistic activity of the yeast, the competition for nutrients between microorganisms, the effect of nutrients on yeast cell and biofilm production and their correlation in the biocontrol of disease, the survival of yeast in citrus fruits and the interaction between microorganisms using scanning electron microscopy. Micronutrients (boric acid, cobalt chloride and ammonium molybdate) favoured the antagonistic action of *A. pullulans*. Ammonium sulfate 1% and sucrose 0.5% favoured the yeast during the competition between the microorganisms. The addition of ammonium sulfate (1%) in the yeast culture stimulated biofilm production and increased

the antagonistic activity against the disease, as also allowed the better survival of yeast in wounded sites of citrus fruit. The yeast was found to be able to form biofilms on citrus, deforming the pathogen hyphae. These results showed the importance of the addition of nutrients in *A. pullulans* based-formulations when aiming for their use on a commercial scale. This is the first report of a positive correlation between the increase in the quantity of biofilm produced by *A. pullulans*, with increased antagonistic activity.

**Keywords:** /Citrus/

## FIG

Pereira, C., et.al. 2017. Influence of ripening stage on bioactive compounds and antioxidant activity in nine **fig** (*Ficus carica* L.) varieties grown in Extremadura, Spain. *J Food Comp & Anal.* 64: 203-212.

## Abstract

The aim of this study was to characterise nine commercial fig (*Ficus carica* L.) varieties differing in colour (dark-purple, brown, green, and yellow-green) at three different ripening stages in regards to the health-promoting compounds of their fruits and to identify and quantify the bioactive compounds as well as total antioxidant activity (TAA) in the skin and flesh of each variety. Significant differences ( $p < 0.05$ ) were found between varieties and ripening stages. Dark-coloured varieties showed the highest levels of total phenolic compounds (from 26.7 to 169.5 mg gallic acid equivalents/100 g), quercetin-3-O-rutinoside (between 4.6 and 11.9 mg/ 100 g), and anthocyanins, specially cyanidin-3-O-rutinoside (from 3.03 to 97.4 mg/100 g), while brown-, green-, and yellow-green-coloured varieties contained the highest levels of chlorogenic acid (between 0.7 and 2.1 mg/ 100 g), total Vitamin C (from 0.8 to 9.0 mg/100 g), and (+)-catechin as proanthocyanin cleavage products (from 3.1 to 17.3 mg/100 g). Levels of TAA were measured by 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) diammonium salt (ABTS) total radical scavenging capacity both in hydrophilic (H-TAA) and lipophilic (L-TAA) fractions. The darker varieties exhibited higher H-TAA values, ranging from 16.3 to 177.4 mmol Trolox equivalents/100 g, than the lighter ones. In the case of L-TAA, its concentration also depended directly on the genotype and less on the ripening stage. We found higher concentrations of bioactive compounds and a higher antioxidant capacity in the skin compared to the flesh; moreover, their content increased during the ripening process, reaching the maximum level of phenolic compounds at stage three, although these changes were deeper in the dark-coloured varieties and in the brown-coloured variety 'San Antonio' Based on our results, it is advisable to consume unpeeled, fully ripe, dark figs in order to optimally benefit from the health-promoting properties.

**Keywords:** /Fig/ /Ripening/

Sen, F., et.al. 2017. Impact of yearly conditions on major physical and chemical properties of fresh, semi-dried and sun-dried **fig** (*Ficus carica* L. 'Sarilop') fruit. *Acta Horti* 1173: 309-314.

## Abstract

The study was carried out on fresh, semi-dried (shriveled) and fully sun-dried fig (*Ficus carica* L. 'Sarilop') fruit from the same orchard during four consequent crop years in order to assess the effect of yearly conditions on physical and compositional properties. The samples were collected at fresh, semi-dried and dried fig stages. The mean moisture content and water activity levels were similar in all four years. The total soluble solids contents were the highest in 2012. The effect on titratable acidity and fruit firmness were limited. The colour values  $L^*$  and  $b^*$  remained almost constant however  $a^*$  value of fresh fruit attained a higher value in 2012. The fruit samples contained mainly fructose and glucose however low concentrations of sucrose were determined in some dried fruit samples. The major impact of yearly conditions was found on the ratio of defected fruit (sunscald, crack and brown-neck). Yearly differences were significant also in terms of fruit weight, total soluble solids, and sugar composition of fig fruit.

**Keywords:** /Fig/

Villalobos, M.C., et.al. 2017. Application of modified atmosphere packaging with moisture absorber to extend the shelf life of 'Domenico Tauro' breba fruit. *Acta Horti* 1173: 365-370.

### **Abstract**

The aim of this work was to study the effect of the packaging under active modified atmosphere (MAP) and its combination with Calcium sulfate ( $\text{CaSO}_4$ ) powder as a moisture absorber. Breba fruits from 'Domenico Tauro' cultivar were packaged in polypropylene punnets under gas concentrations of 20 kPa  $\text{CO}_2$  and 20 kPa  $\text{O}_2$ . Batches were as follows: fruit stored in MAP (M); MAP with 3% (p/p) of  $\text{CaSO}_4$  (MG); fruit stored in air with 3% (p/p) of  $\text{CaSO}_4$  (G) and fruit stored in air (C). All batches were stored at  $0^\circ\text{C}$  and 90-95% relative humidity (RH). The analysis of gas concentration, weight loss, firmness, acceptability level, mould and yeast counts and sensory quality were measured at 0, 7, 14 and 21 days of cold storage. All MAP batches reached similar gas levels, around 28 kPa  $\text{CO}_2$  and 8 kPa  $\text{O}_2$  after 14 days. MG treatment showed the lowest weight loss, whilst breba fruits stored with MAP (M) showed the best acceptability throughout storage. The highest firmness was observed for G fruits, with values of  $4.9 \text{ N mm}^{-1}$  after the storage period. Moreover, the combination of MAP with  $\text{CaSO}_4$  was the most effective treatment to delay fungal development, maintaining counts  $<2 \log \text{ cfu g}^{-1}$  versus values of  $3.9 \log \text{ cfu g}^{-1}$  reached in C. Thus, the application of MAP showed to be effective in maintaining quality. Nevertheless, although the application of  $\text{CaSO}_4$  showed highest firmness mean values, a deleterious effect was observed by decreasing breba fruit acceptability, without significant synergistic effects in combination with MAP except for fungal control.

**Keywords:** /Fig/ /Fruit Quality/ /Modified Atmosphere Packaging/

### **GRAPEFRUIT**

Romero-Trigueros, C., et.al. 2017. Effect of deficit irrigation and reclaimed water on yield and quality of grapefruits at harvest and postharvest. *LWT-Food Sci & Technol* 85: 405-411.

### **Abstract**

The aim of our research was to discover the effects of the long-term irrigation with saline reclaimed (RW) and transfer (TW) water and different irrigation strategies: control (C) and regulated deficit irrigation (RDI) on yield and fruit quality of grapefruit at harvest and during cold storage. TW-RDI treatment decreased tree canopy (TC) and crop load, resulting in a 21% reduction of fruit yield. Regarding fruit quality, RW notably decreased peel thickness at harvest (about 8%); however, this difference was not remained during cold storage. Sugar/acid ratio was mainly increased by RDI, but also by RW, due to an important increase in soluble solid content (11% of average value for TW-RDI, RW-C and RW-RDI). In addition, RDI combined with RW, significantly increased the number of fruits in small category 5 at the end of cold storage. Finally, neither ratio yield/TC nor irrigation water productivity were affected by any irrigation treatments.

**Keywords:** /Grapefruit/ /Quality/ /Postharvest/

## **GUAVA**

Silva, W.B., et.al. 2018. Chitosan delays ripening and ROS production in **guava** (*Psidium guajava* L.) fruit. Food Chem 242: 232-238.

### **Abstract**

Guava is a typically tropical fruit highly perishable with a short shelf-life due to intense metabolic activity after harvested. In attempt to minimize the problems related to the postharvest, we evaluated the physiochemical characteristics and antioxidant system in guava fruits under chitosan coating at concentrations of 1%, 2%, and 3% stored at 25 °C during 96 h. The chitosan suppressed the respiratory rate, fresh weight loss, firmness and skin color with delay in the degradation of chlorophyll. In the treatment with 2% and 3% of chitosan in the solid soluble content and ascorbic acid were reduced; retarded the loss of titratable acidity during 96 h after treatment. These treatment induced significant decreases in the phenylalanine ammonia-lyase activity and significantly increases of peroxidase Activity. Our results suggest that chitosan effectively prolongs the quality attributes in guava fruits after harvesting due to increases in the antioxidant processes, delaying the ripening during room temperature of storage.

**Keywords:** /Guava/ /Chitosan/ /Ripening/ /Quality/

## **JACKFRUIT**

Ying-zhi Li, et.al. 2017. Changes in soluble sugar accumulation and activities of sucrose-metabolizing enzymes during fruit ripening of **jackfruit**. J Agric Sci 9(8): 155-166.

### **Abstract**

Jackfruit (*Artocarpus heterophyllus* Lam.) is an important food crop widely grown in the tropical region. However, little is known about sugar metabolism during fruit ripening of jackfruit. Here we

examined sugar profiles (sucrose, glucose and fructose) and corresponding enzyme activities (SPS, E.C.2.4.1.14; SuSy, EC 2.4.1.13; IV, EC 3.2.1.26) of four soft type and four firm type varieties of jackfruit during four stages of fruit ripening. We found that during fruit ripening, there was a rapid increase in contents of total soluble sugar and sucrose, whereas increases in glucose and fructose contents were much slower. Ratios of glucose versus fructose varied among different varieties and ripening stages but within the range of 0.9 to 1.2 in the ripe fruits. Five of these varieties exhibited markedly high levels of SuSy activity for sucrose synthesis at early ripening stage, and then decreased towards fully ripe stage. All soft type varieties exhibited a conspicuous peak of AIV activity and had overall higher AIV activities than NIV during ripening. The changing patterns for other enzymes varied among varieties. Our studies support the notion that sucrose was the major sugar species contributing to the fruit sweetness, followed by fructose and glucose. We also demonstrated that AIV and NIV were probably the primary enzymes responsible for sucrose hydrolysis during ripening, while SPS and SuSy were responsible for sucrose synthesis. We propose that during fruit ripening of jackfruit, glucose is released from starch hydrolysis, followed by sucrose hydrolysis leading to increase in both glucose and fructose contents.

**Keywords:** /Jackfruit/ /Ripening/

## LEMON

Cerioni, L., et.al. 2017. Conventional and reduced-risk fungicides to control postharvest *Diplodia* and *Phomopsis* stem-end rot on lemons. *Scientia Horti* 225: 783-787

### Abstract

Stem-end-rot (SER), caused by *Lasiodiplodia theobromae* or *Diaporthe citri*, is an important postharvest disease in humid and warm citrus growing areas, such as the Northwestern region of Argentina. The commercial control of SER has been accomplished by applications of the systemic fungicide carbendazim (CARB). However, alternative chemicals for this fungicide are needed due to increasing restrictive regulations in overseas markets. The aim of this work was to evaluate the effectiveness of conventional and reduced-risk postharvest fungicides to control SER. *In vitro* tests show that *L. theobromae* was more resistant to fungicides than *D. citri*. In trials using artificially inoculated lemons, SER caused by *D. citri* (Phomopsis SER) was controlled by the fungicides evaluated. The conventional fungicides imazalil and thiabendazole (TBZ) were the most effective chemicals to control SER caused by *L. theobromae* (Diplodia SER), while other fungicides, as fludioxanil, azoxystrobin, pyrimetanil and propiconazole, were not effective. The best control of Diplodia SER was obtained by immersion for 60 s in 2000 mg/L of TBZ at pH 5 and 20 °C. In this condition, TBZ-residue loading on lemons was 3.0 mg-L<sup>-1</sup>, which did not exceed the allowed maximum residue levels. TBZ applied in lemon commercial treatments is the best option to reduce SER caused by both pathogens. At this time, this is the unique suitable alternative to replace CARB treatment in Argentinean packinghouses.

**Keywords:** /Lemon/

Siboza, X.I., et.al. 2017. Enzymatic antioxidants in response to methyl jasmonate and salicylic acid and their effect on chilling tolerance in **lemon** fruit [*Citrus limon* (L.) Burm. F.]. *Scientia Horti* 225: 659-667.

### **Abstract**

To prevent excessive accumulation of reactive oxygen species (ROS), as typically occurs during cold storage, fruit have evolved antioxidant defence mechanisms, such as the production of heat shock proteins (HSPs), that reduce chilling injury (CI). It was hypothesised that treatments with methyl jasmonate (MJ) and salicylic acid (SA) may enhance chilling tolerance in lemon fruit by inducing the production of enzymatic antioxidants. Fully mature lemon fruit were sourced from three production sites with varying climate: moderate subtropical (New Venture Farm), warm temperate (Tala Valley Citrus Estate) and cool subtropical conditions (Sun Valley Estate). The fruit were treated with MJ and SA, waxed and stored at -0.5, 2, or 4.5 °C for 28 days plus 7 days at 23 °C. The manifestation of CI and changes in ROS, as well as in enzymatic antioxidant systems, such as catalase (CAT), ascorbate peroxidase (APX) and glutathione reductase (GR), as well as HSPs were investigated in lemon flavedo. Symptoms of CI were more severe in control fruit stored at 4.5 °C than at 2 or -0.5 °C. Fruit sourced from the moderate subtropical and warm temperate locations had higher enzymatic antioxidant activities (CAT, APX and GR), a higher HSPs expression and a lower accumulation of ROS than those sourced from the cool subtropical location. Treatment with 10 µM MJ plus 2 mM SA reduced CI, suppressed ROS production, increased CAT, APX and GR activity, and enhanced the accumulation of HSPs, suggesting that enzymatic antioxidants and HSPs are involved in conveying chilling tolerance to MJ- and SA-treated lemon fruit. The increase in activity of these antioxidant enzymes, together with HSPs, could be part of the mode of action by which MJ and SA convey chilling tolerance to lemon fruit.

**Keywords:** /Lemon/ /Chilling Injury/

### **LONGAN**

Shen Zhang, et.al. 2018. *Lasiodiplodia theobromae* (Pat.) Griff. & Maubl.-induced disease development and pericarp browning of harvested **longan** fruit in association with membrane lipids metabolism. *Food Chem* 244: 93-101.

### **Abstract**

Effects of *Lasiodiplodia theobromae* inoculation on disease development, pericarp browning and membrane lipids metabolism of harvested "Fuyan" longan fruit were studied. Compared with control fruit, *L. theobromae*-in-oculated longans showed higher fruit disease index, pericarp browning index and cell membrane permeability, as well as higher activities of phospholipase D, lipase and lipoxygenase. Additionally, there were lower contents of membrane phospholipids but higher content of phosphatidic acid, and lower level of unsaturated fatty acids but higher level of saturated ones with lower ratio of unsaturated fatty acid to saturated fatty acid and lower index of unsaturated fatty acids in pericarp of *L. theobromae*-inoculated longans. These results suggested that *L. theobromae*-induced disease development and pericarp browning of harvested longans might be attributed to the damaged cellular

membrane structural integrity, induced by the activated membrane lipids-degrading enzymes increasing the degradation of membrane phospholipids and unsaturated fatty acids in pericarp of harvested longan fruit.

**Keywords:** /Longan/ /Postharvest Disease/ /Browning/

## MANDARIN

Yongxin Li, et.al. 2018. Continuous exposure to ethylene in the storage environment adversely affects 'Afourer' **mandarin** fruit quality. Food Chem 242: 585-590.

### Abstract

'Afourer' mandarins were stored in air containing ethylene at 0.001, 0.01, 0.1, and 1  $\mu\text{L L}^{-1}$  at 20, 10, 5 and 0 °C and changes in a range of external and internal quality parameters were examined for up to 10 weeks in storage. At all storage temperatures, reducing ethylene concentration in the storage environment decreased the rate of respiration, visible deterioration of the calyx region, ethanol accumulation in the juice, loss of eating quality, and at chilling temperatures reduced rind pitting. The quality attributes limiting mandarin storage life differed between the different storage temperatures but retention of mandarin quality was always optimised by maintaining the lowest possible ethylene atmosphere around fruit. Thus, the primary target should be to ensure the ethylene levels are  $\leq 0.01 \mu\text{L L}^{-1}$ , as loss of quality was accelerated above this concentration.

**Keywords:** /Mandarin/ /Ethylene/ /Storage/

## MELON

A maro, A.L., et.al. 2018. Multitrait analysis of fresh-cut cantaloupe **melon** enables discrimination between storage times and temperatures and identifies potential markers for quality assessments. Food Chem 241: 222-231.

### Abstract

Fresh-cut cantaloupe melon is valued for its aroma but is highly perishable. Temperature of storage (typically 0–5 °C) is critical for maintaining fresh-cut melon quality, but often reaches 10 °C during transportation and in retail outlets. A comparison amongst 0, 5 and 10 °C storage temperatures for fresh-cut melon over 14 days reveals that storage at 0 °C is optimal for avoiding increases in microbial load and loss of vitamin C especially at later time points. However, higher temperatures maintain better the balance of esters (acetate versus non-acetate) and phenolic content. The whole volatile organic compound (VOC) profile can be used to discriminate both time and temperature effects especially at earlier time points. Potential VOC markers for changes in vitamin C from day 0 to day 6 of storage (3-methyl butane nitrile) and temperature (limonene) are identified through a multi-trait analysis.

**Keywords:** /Melon/ /Storage/ /Fresh-cut/ /Quality/

## **MANGO**

Cortes, V., et.al. 2017. Integration of simultaneous tactile sensing and visible and near-infrared reflectance spectroscopy in a robot gripper for **mango** quality assessment. Biosyst Eng 162: 112-123.

### **Abstract**

Development of non-destructive tools for determining mango ripeness would improve the quality of industrial production of the postharvest processes. This study addresses the creation of a new sensor that combines the capability of obtaining mechanical and optical properties of the fruit simultaneously. It has been integrated into a robot gripper that can handle the fruit obtaining non-destructive measurements of firmness, incorporating two spectrometer probes to simultaneously obtain reflectance properties in the visible and near-infrared, and two accelerometers attached to the rear side of two fingers. Partial least square regression was applied to different combinations of the spectral data obtained from the different sensors to determine the combination that provides the best results. Best prediction of ripening index was achieved using both spectral measurements and two finger accelerometer signals, with  $R_p^2 = 0.832$  and RMSEP of 0.520. These results demonstrate that simultaneous measurement and analysis of the data fusion set improve the robot gripper features, allowing assessment of the quality of the mangoes during pick and place operations.

**Keywords:** /Mango/ /Quality Assessment/

## **NECTARINE**

Munera, S., et.al. 2017. Ripeness monitoring of two cultivars of **nectarine** using VIS-NIR hyperspectral reflectance imaging. J Food Eng 214: 29-39.

### **Abstract**

Visible-near-infrared (450-1040 nm) hyperspectral reflectance imaging was studied in order to assess the internal physicochemical properties and sensory perception of 'Big Top' and 'Magique' nectarines (*Prunus persica* L. Batsch var. *nucipersica*) (yellow and white-flesh cultivar, respectively) during ripening using the Ripening Index (RPI) and the Internal Quality Index (IQI). Hyperspectral images of the intact fruits were acquired during the ripeness under controlled conditions, and their physicochemical properties (flesh firmness, total soluble solids, titratable acidity and flesh colour) were analysed. IQI and RPI were used to relate the spectral information obtained from nectarines with the physicochemical properties and the sensory perception of their maturity using Partial Least Square (PLS) regression with proper variable selection. Optimal results were obtained with  $R^2$  values higher than 0.87 for the two indices and the two cultivars. The ripeness of each fruit could be visualised by projecting the

PLS models of the IQI on the pixels of the fruits in the images, showing great potential for further monitoring of the evolution of intact nectarine ripeness in industrial setups.

**Keywords:** /Nectarine/ /Ripeness/

## **ORANGE**

Emmanouilidou, M.G., et.al. 2017. Rootstock-modulated yield performance, fruit maturation and phytochemical quality of 'Lane Late' and 'Delta' sweet orange. 225: 112-121.

### **Abstract**

Graft combinations of sweet orange cultivars Delta and Lane Late on six rootstocks were established on calcareous clayey soil and evaluated for compatibility, yield, and fruit physicochemical quality attributes at three stages of harvest maturity. Citrumelo proved a deleterious rootstock to both scions, while GouTou was deleterious to Delta and had low compatibility with Lane Late. Most compatible rootstock for Delta was Sour Orange, whereas all rootstocks except GouTou were equally compatible with Lane Late. Yield and fruit weight were highest on Volkameriana. Titratable acidity was highest on Sour Orange and Carrizo and lowest on Volkameriana. Dominant acids were citric (8.5–11.3 g/L), malic (1.8–1.9 g/L) and succinic (1.3–1.4 g/L). Citrate/malate ratio was lower in Lane Late and declined further with maturation. Acids were highest on Sour Orange and Carrizo. Increased levels of malate (2.07–2.21 g/L) elicited by Volkameriana may constitute an index of inferior sensory quality. Soluble solids were highest on Sour Orange, Carrizo and Cleopatra (9.6–10.6%) and lowest on Volkameriana (9.3–9.7%). Sucrose was the most abundant soluble carbohydrate (33.9–39.9 g/L) and sugar ratios were stable across rootstocks, however sucrose concentration in Delta increased with maturity at the expense of glucose and fructose. Increase in chroma paralleled increase in soluble solids during maturation of Delta but not Lane Late. Fruit phenolics were highest with the least compatible GouTou and lowest with the highly productive Volkameriana. Maximal ascorbate levels were attained at mid-maturity (380.4–450.2 mg/L) and were lowest on Volkameriana (323.4–398.8 mg/L). Considering its overall performance and resistance to Citrus Tristeza Virus, Carrizo appears as a promising rootstock alternative to Sour Orange particularly on calcareous soils.

**Keywords:** /Orange/

Khorram, F., et.al. 2017. Shellac, gelatin and Persian gum as alternative coating for orange fruit. Scientia Horti 225: 22-28.

### **Abstract**

Postharvest fruit coatings are an effective method to replace natural waxes lost during washing and handling. The coatings can reduce water loss and impart gloss to the fruit. Edible coatings, instead of synthetic waxes, are perceived to offer advantages with respect to human health concerns and environmental protection. In this research, edible coatings made from relatively inexpensive, easy to dissolve components that are suitable for increasing fruit gloss were studied on 'Valencia' oranges

during storage. The coating materials included 5, 6 and 7% gelatin, 3.5, 4 and 4.5% Persian gum, 9, 10 and 11% shellac were compared to un-coated control, and fruit coated with a commercial wax. After coating, the fruit were stored for up to 60 days at 5 °C. Every 20 days fruit were removed from storage and evaluated. Scanning electron microscopy images of coated rind surfaces were also obtained. The results indicated that weight loss, fruit firmness, total soluble solids (TSS), titratable acidity (TA), pH, ascorbic acid content, total phenolic content (TPC), total antioxidant capacity (TAC) and respiration rate were affected by the coatings. Shellac coatings reduced weight and firmness loss. As the storage time was increased fruit TA and ascorbic acid content decreased, and pH, TPC and TAC increased. Glossiness was observed in all coatings, however, with increasing storage time, fruit coated by gelatin and Persian gum coatings, showed visible cracks. Shellac was the best coating as it dried quickly, forming a not sticky and odorless coating, and gave highest fruit gloss.

**Keywords:** /Orange/ /Fruit Coating/ /Postharvest Quality/

## PEACH

Dong Li, et.al. 2017. Effect of nano-ZnO-packaging on chilling tolerance and pectin metabolism of peaches during cold storage. *Scientia Horti* 225: 128-133.

### Abstract

The effects of nano-ZnO-based low-density polyethylene (NZLDPE)-packaging on chilling tolerance and pectin metabolism in postharvest “Hujingmilu” peaches were investigated. Peaches packed in low-density polyethylene (LDPE) and NZLDPE were stored at 2 °C for 40 d. Compared with the control, both packages alleviated the development of chilling injury, showed higher fruit firmness with lower browning index, electrolyte leakage, relative viscosity, and decay rate. NZLDPE-packaging performed better than LDPE-packaging because of the rapid formation of low O<sub>2</sub> and high CO<sub>2</sub>. Moreover, NZLDPE-packaging inhibited pectin esterase and enhanced polygalacturonase and β-galactosidase, leading to the promotion of alkali soluble-pectin and water-soluble pectin, and the decrease of chelater-soluble pectin. These effects were of great benefit to the maintaining of cell wall structure and the degradation of calcium-pectate gel, which finally alleviated the chilling injury and therefore maintained good quality during chilling stress.

**Keywords:** /Peach/ /Quality/

Eun-Ha Chang, et.al. 2018. Cell wall degrading enzymes activity is altered by high carbon dioxide treatment in postharvest ‘Mihong’ peach fruit. *Scientia Horti* 225: 399-407.

### Abstract

Peach fruits are ripen rapidly after harvest, especially at room temperature. It is difficult to handle because they are scars easily and easy to decay. It is generally acknowledged that modified atmospheres with elevated CO<sub>2</sub> inhibits fruit ripening by reduces ethylene biosynthesis. This study was to investigate the affect of high concentration CO<sub>2</sub> treatment on ethylene biosynthesis, ACO and

softening-related enzymatic activity. Peaches were treated with high CO<sub>2</sub> (90 kPa) at the time of sealing in the plastic chambers and then the chambers were ventilated after 3 and 12 h. Fruits treated with 90 kPa CO<sub>2</sub> for 3 or 12 h exhibited a significant delay in firmness when compared to control fruits. In addition to fruit softening inhibition, the decay rate was also inhibited by CO<sub>2</sub> treatment. Four days after storage at room temperature, CO<sub>2</sub> untreated peaches had decay rate of 14%, whereas the decay rate was 6% and 3.5% in fruits treated with 90 kPa CO<sub>2</sub> for 3 and 12 h. The ACO was inhibited by CO<sub>2</sub> and the inhibition was enhanced with higher CO<sub>2</sub> exposure time. Also High CO<sub>2</sub> treatment inhibited the activities of softening-related enzyme such as PG,  $\beta$ -Galactosidase, PEL promoted by ethylene biosynthesis in peaches. These results indicate that increasing levels of CO<sub>2</sub> inhibit ethylene biosynthesis by reducing the ACO activity of peach fruits. Results suggest that the effect of CO<sub>2</sub> on ethylene production in 'Mihong' peach fruit depended on exposure time and CO<sub>2</sub> level. Also a short-term treatment with a high concentration of CO<sub>2</sub> may be used to reduce ethylene biosynthesis, which may be induced after postharvest of fruit.

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

## PEAR

Collazo, C, et.al. 2017. Effect of *Pseudomonas graminis* strain CPA-7 on the ability of *Listeria monocytogenes* and *Salmonella enterica* subsp. *enterica* to colonize Caco-2 cells after pre-incubation on fresh-cut pear. Food Chem 241: 301-307

## Abstract

To further gain insight into the mechanism by which the biopreservative bacterium *Pseudomonas graminis* CPA-7 develops its antimicrobial activity, we have examined the effect that the prior interaction established by this bacterium and two foodborne pathogens on fresh-cut pear, has on their capacity to colonize human epithelial cells (Caco-2 cell line) which is crucial for establishing infection. CPA-7 inhibited the growth of *L. monocytogenes* and *S. enterica* subsp. *enterica* ser. Enteritidis by 5.5 and 3.1 log<sub>10</sub>, respectively, after 7 d of interaction at 10 °C. Furthermore, CPA-7 attenuated the adherence of *S. enterica* to Caco-2 cells by 0.8 log<sub>10</sub> regardless of the pre-adaptation on the fruit. Conversely, the adhesiveness of *L. monocytogenes* was not influenced by the interaction with the antagonist but it was reduced by 0.5 log<sub>10</sub> after incubation on the food matrix. Pathogen-antagonist-food matrix interaction was associated to a significant reduction of the relative invasiveness of both pathogens, by 1.3 log<sub>10</sub> in the case of *L. monocytogenes* and to an undetectable level (below 5 CFU/g fruit) for *S. enterica*. CPA-7 can adhere to and internalize into intestinal epithelium which enables it for competition. Its adherence positively correlates to the multiplicity of infection (MOI) with respect to Caco-2 cells, increasing by 0.6 log<sub>10</sub> in an MOI range of 0.1:1 to 100:1. For the same levels of inoculum, internalized cells could only be detected after 7 d of pre-adaptation in the fruit (pH 4.5–5.0). However, the combination of gastrointestinal digestion and habituation on the fruit resulted in a significant reduction of CPA-7 populations (by 2 log<sub>10</sub> more after 7d of incubation than on inoculation day) as well as in the decrease of its adhesiveness (by 0.8 log<sub>10</sub>) and invasiveness (to undetectable levels).

**Keywords:** /Pear/

Cui Sun, et.al. 2018. Yeast cell wall induces disease resistance against *Penicillium expansum* in **pear** fruit and the possible mechanisms involved. *Food Chem* 241: 301-307

#### **Abstract**

The results from this study showed that cell wall prepared from *Rhodospiridium paludigenum* induced strong disease resistance against blue mold rot caused by *Penicillium expansum* in pear fruit. Yeast cell wall reduced germination of *P. expansum* *in vitro* and in fruit wounds after 24 h of treatment. Moreover, the cell wall treatment significantly enhanced the activities of defense-related enzymes ( $\beta$ -1,3-glucanase and chitinase) and the genes expression of PR proteins (*PR1-like*, *endoGLU9*, *endoCHI-like* and *PR4*), which may be an important mechanism by which cell wall reduces the fungal disease of pear fruit caused by *P. expansum*. These findings suggest that the mechanism by which *R. paludigenum* induced fruit resistance was linked to the function of its cell wall and application of cell wall might be a useful strategy for the control of postharvest disease in pear fruit.

**Keywords:** /Pear/

Jian Li, et.al.. 2017. Hypobaric storage reduced core browning of Yali **pear** fruits. *Scientia Horti* 225: 547-552.

#### **Abstract**

Core browning is a major issue of pear fruits. The primary factor leading to development of core browning is high levels of CO<sub>2</sub> in storage. Hypobaric storage is a new postharvest technique to extend the shelf life of fruits and can reduce CO<sub>2</sub> partial pressure. In this study, the effect of hypobaric storage on core browning of Yali pear fruits (*Pyrus bretschneideri* Rehd.) was evaluated. Results showed that fruits after 0.025 MPa hypobaric treatment had 37.3% lower rate of core browning development and higher acidity and soluble solid content than control fruits. In addition, 0.025 MPa hypobaric treatment increased activities of cytochrome oxidase (CCO) and peroxidase (POD), and 2,2-diphenylpicrylhydrazyl (DPPH) radicals and superoxide anion scavenging capabilities. In comparison with the control, hypobaric treated fruits had lower activity of polyphenol oxidase (PPO) and higher level of total polyphenols. Hypobaric treatment also reduced an increase of succinate dehydrogenase (SDH) and glucose-6-phosphate dehydrogenase (G-6-PDH) activities. Results indicated that hypobaric treatment could control core browning of pear fruits by regulating reactive oxygen species (ROS) generation and elimination enzymes to maintain cell membrane integrity and reduce enzymatic browning

**Keywords:** /Pear/ /Quality/ /Storage/

#### **PLUM**

Hanxu Pan, et.al. 2018. Modifications of cell wall pectin in chilling-injured 'Friar' **plum** fruit subjected to intermediate storage temperatures. *Food Chem* 242: 538-547.

## **Abstract**

'Friar' plum (*Prunus salicina* Lindl.) fruit were stored at low (0 °C), intermediate (5 and 15 °C) and ambient temperature (25 °C). Flesh translucency was evidenced as the main chilling injury (CI) symptom and the CI developed rapidly at 5 and 15 °C but suppressed at 0 °C. Modifications of cell wall pectin in 'Friar' plums were investigated during storage. Sodium carbonate-soluble pectin (SSP) was found to be predominant in the fruit but it decreased more rapidly at 5 and 15 °C than 0 °C. Nevertheless, SSP possessed abundant galactose, arabinose and rhamnose at 5 and 15 °C. Nanostructural observations indicated that the detachment and degradation of linear backbone chains in SSP molecules were enhanced at 5 and 15 °C. Therefore, the development of CI of 'Friar' plums at intermediate temperatures was associated with the modifications of SSP in the cell wall pectin of the fruit subjected to chilling stress.

**Keywords:** /Plum/ /Storage Temperature/ /Chilling Injury/

## **POMEGRANATE**

Mukama, M., et.al. 2017. Energy usage of forced air precooling of pomegranate fruit inside ventilated cartons. J Food Eng 215: 126-133.

## **Abstract**

Energy usage is a crucial factor when computing the cost of storing produce. With the ever-increasing cost of energy and attention to environmental problems, understanding energy use and exploring energy saving options is becoming a priority for the economic sector. In this study, the effect of container design, plastic liners and stack orientation on the airflow, cooling rate and energy usage of forced air cooling of pomegranate fruit were investigated. Electricity usage was calculated based on the power ratings of the air driving fan, evaporator fan, compressor cooling fan and the condenser of the cooling unit with duration of power usage dictated by the seven-eighth cooling time (SECT). SECT for different package types were obtained from the cooling experiments. Efficiency of electricity usage was measured as the ratio of produce cooling accomplished to the total electricity consumed. The energy usage differed by 1.5-fold between container design 1 (CT1) and container design 2 (CT2). Depending on the container design, stack orientation (with respect to the direction of the cooling airflow) can influence the energy usage. Plastic liners affected the precooling process the most, increasing energy usage by up to 3-fold compared to stacks with no liners. Container design with high vent-area reduced the resistance to airflow (RTA) and increased fruit cooling rate (reduced SECT), and this may offer the most economically feasible way to reduce electricity use during precooling.

**Keywords:** /Pomegranate/ /Ventilated Packaging/

## **STRAWBERRY**

Oro, L., et.al. 2018. Volatile organic compounds from *Wickerhamomyces anomalus*, *Metschnikowia pulcherrima* and *Saccharomyces cerevisiae* inhibit growth of decay causing fungi and control postharvest diseases of **strawberries**. Int J Food Microbiol. 265: 18-22.

#### **Abstract**

The effectiveness of *Wickerhamomyces anomalus*, *Metschnikowia pulcherrima* and *Saccharomyces cerevisiae* as biocontrol agents on postharvest decay of strawberry (*Fragaria x ananassa*, cv. 'Alba') fruit, and their inhibitory activities on some decay-causing fungi were evaluated. Volatile organic compounds from these yeasts decreased mycelial growth of *Botrytis cinerea* by 69%, and by less for *Monilinia fructicola*, *Alternaria alternata*, *Aspergillus carbonarius*, *Penicillium digitatum*, *Cladosporium* spp., and *Colletotrichum* spp. Strawberry fruit exposed to 6-day-old liquid cultures of *W. anomalus*, *M. pulcherrima* and *S. cerevisiae* for 48 h showed 89%, 40%, and 32% reductions, respectively, in gray mold McKinney Index. Vapours of ethyl acetate, the main volatile organic compound of these yeasts, completely inhibited *B. cinerea* growth at 8.97 mg/cm<sup>3</sup>, and suppressed gray mold on strawberry fruit at 0.718 mg/cm<sup>3</sup>. The biocontrol activities of these yeasts can be ascribed to ethyl acetate, which can be used for control of postharvest gray mold of strawberry fruit.

**Keywords:** /Strawberry/ /Postharvest Diseases/

#### **TABLE GRAPES**

Tarricone, L., et.al. 2017. Plastic films and soil management interaction on organic 'Sugrathirteen'<sup>®</sup> **table grapes** quality in Apulia region. Acta Horti 1170: 1125-1132.

#### **Abstract**

In order to advance or delay grape ripening, colored covering plastic films with different radiometric properties are often used in table grape viticulture in South Italy. Covering films protect also clusters from adverse weather conditions, such as rain, hail and wind, and reduce damage of the berries from diseases, especially in organic viticulture. The covering of vineyards is a sustainable choice for the organic soil management strategies that will influence also grape quality and quantity. This paper presents the results obtained during an experimental test carried out during 2012 at an organic irrigated 'Sugrathirteen'<sup>®</sup> table grape vines cultivation at Gioia del Colle (Bari, Italy). Three plastic films, coded Yellow, Neutral and Red film, were used to cover the grapes. Three different soil inter-row space management, such as tilled cultivation, permanent resident cover crop and temporary sub-terranean clover, were applied. The interaction effects of the plastic films and of the soil inter-row space management were analysed. Radiometric tests were carried out in laboratory on the plastic films at the beginning of the vegetation period. Different soil management strategies and plastic films covering have shown high interaction on vines water status in relation to midday stem water potential during berry growth period. Berry weight was affected from plastic film\*soil management interactions with a highest berry mass on Yellow plastic film\*Trifolium soil management. An high interactions between different soil managements\*plastic films were observed in terms of T.S.S., T.A. and pH, with the highest sugar accumulation on berries under Yellow plastic film\*Trifolium soil treatment. In conclusion a temporary

cover crop with sub clover or resident vegetation under Yellow plastic film seems to improve table grape performance with clear effects on quality berry parameters.

**Keywords:** /Table Grapes/ /Plastic Films/ /Quality/

## VEGETABLES

### CLUSTER BEANS

Waghmare, R.B. and U.S. Annapure. 2017. Effects of hydrogen peroxide, modified atmosphere and their combination on quality of minimally processed **cluster beans**. J Food Sci Technol 54(11): 3658-3665.

#### Abstract

The aim of this study was to determine the potential of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) and modified atmosphere packaging (MAP) on quality of fresh-cut cluster beans. Fresh-cut cluster beans were dipped in a solution of 2% H<sub>2</sub>O<sub>2</sub> for 2 min, packed in an atmosphere of (5% O<sub>2</sub>, 10% CO<sub>2</sub>, 85% N<sub>2</sub>) and stored in polypropylene bags at 5 °C for 35 days. Passive MAP was created by consuming O<sub>2</sub> and producing CO<sub>2</sub> by fresh-cut cluster beans. The combined effect of H<sub>2</sub>O<sub>2</sub> and MAP on physico-chemical analysis (Headspace gas, weight loss, chlorophyll, hardness and color), microbial quality (mesophilic aerobics and yeasts and molds) and sensory analysis were studied. Chemical treatment and MAP both are equally effective in extending the shelf life at 5 °C for 28 days. Hence, MAP can be an alternative for chemical treatment to achieve a shelf life of 28 days for fresh-cut cluster beans. Control samples, without chemical treatment and modified atmosphere, stored at 5 °C were spoiled after 14 days. Chemical treatment followed by MAP underwent minimum changes in weight, chlorophyll, hardness and color of fresh-cut cluster beans. Combination treatment gives a storage life of 35 days

**Keywords:** /Cluster Beans/ /Packaging/ /Shelf Life/

### CRUCIFEROUS SPROUTS

Baenas, N., et.al. 2017. Bioavailability and new biomarkers of **cruciferous sprouts** consumption. Food Res Int 100: 497-503.

#### Abstract

The evaluation of the bioavailability of bioactive compounds from cruciferous foods is one challenge in the design of clinical trials for studying their functionality. Currently, studies of bioavailability are mainly based on the analysis of total isothiocyanates and indoles, and sulforaphane metabolites after broccoli consumption. However, as far as we are aware, there are not any biomarkers studied or established for the intake of radish sprouts. In this work, a 7-days-cross-over study with fourteen women was undertaken to compare the bioavailability of glucosinolates from broccoli and radish sprouts. The urinary excretion of isothiocyanates, indoles and their metabolites was analysed by

UHPLC-QqQ-MS/MS. For the first time, sulforaphene, sulforaphane-*N*-acetyl-L-cysteine (SFN-NAC) and 3,3'-diindolylmethane (DIM), were studied as biomarkers of dietary exposure to radish. The SFN-NAC and DIM were already considered biomarkers of broccoli consumption. Higher excretion of conjugated isothiocyanates and constant excretion of indoles were found during the first 12 h after ingestion. Metabolites were excreted homogeneously during the study, suggesting no accumulation. The different urinary biomarker profiles provided new information to distinguish between the consumption of broccoli or radish sprouts. The results provide valuable information to better understand the bioavailability of cruciferous bioactives.

**Keywords:** /Cruciferous Sprouts/

## **CUCUMBER**

Tastan, Ozge., et.al. 2017. Decontamination of fresh-cut cucumber slices by a combination of a modified chitosan coating containing carvacrol nanoemulsions and pulsed light. *Int J Food Microbiol* 260: 75-80

### **Abstract**

In this study, the impact of the combination of pulsed light (PL) treatments with antimicrobial coatings, consisting of modified chitosan suspensions incorporating carvacrol nanoemulsions, was investigated on the decontamination of fresh-cut cucumber slices.

The upper surface of the cucumber slices, with or without the coating deposition, was inoculated with *Escherichia coli* ATCC 26 to reach a final concentration of  $10^7$  CFU/g of the vegetable. PL treatments were conducted at different fluence (4, 8, and 12 J/cm<sup>2</sup>) on the inoculated surface of cucumber slices.

Results showed that the microbial reduction was only marginally affected by the coating formulation. A slight increase was observed when the carvacrol nanoemulsions were embedded in the chitosan matrix, but microbial reduction levels remained always below 1 log cycle. In contrast, the different PL treatments resulted in a statistically significant increase in inactivation with increasing the treatment fluence, reaching 2.6 log cycles at the maximum fluence.

Remarkably, the combination of the antimicrobial coating with the most intense PL treatments resulted in a strong synergistic effect. For example, by combining a PL treatment at 12 J/cm<sup>2</sup> with one of the antimicrobial coatings a microbial reduction >5 log cycles was reached.

Therefore, it can be concluded that the combination of antimicrobial coatings and PL treatment is a promising method for surface decontamination of fresh-cut vegetables, which could be exploited in view of ensuring their microbiological safety.

**Keywords:** /Cucumber/ /Fresh-cut/ /Coating/

## **LEAFY GREENS**

Shazer, A., et.al. 2017. Approaches toward identification of surrogates to validate antimicrobial washes as preventive controls for fresh-cut leafy greens. *J Food Prot* 80(10): 1600-1604.

## Abstract

In fresh-cut produce production, antimicrobials may be used during washing to control the risk of cross-contamination by microbial hazards. Surrogate microorganisms have long been used to validate processes, but none have been identified for validating the efficacy of antimicrobial washing of fresh-cut produce. The objective of this study was to develop procedures by which surrogates may be identified for use in validating the control of cross-contamination for fresh-cut lettuce operations. Four microbial characteristics, which may be important factors in cross-contamination events, were quantitatively evaluated in potential surrogate microorganisms for comparison to a reasonably foreseeable hazard, *Escherichia coli* O157:H7: sensitivity to chlorine in solution, sensitivity to chlorine on lettuce leaf surfaces, shedding from contaminated lettuce leaves into the water during washing, and cross-contamination from inoculated to uninoculated lettuce leaves during chlorine washing. A procedure of practical quantitative experiments for comparing the characteristics reduced the original pool of 80 potential strains, which consisted of lactic acid bacteria, probiotics, and isolates obtained from lettuce enrichment cultures, to five strains: *Lactobacillus plantarum*, *Pediococcus pentosaceus*, probiotic 22C, and two lettuce enrichment isolates. These strains may be evaluated in additional studies involving comparisons to other reasonably foreseeable hazards and including other potential process variables that should be understood and controlled to prevent cross-contamination in fresh-cut lettuce operations.

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

## LETTUCE

Andrasch, M., et.al. 2017. Scale-up to pilot plant dimensions of plasma processed water generation for fresh-cut lettuce treatment. Food Packag & Shelf Life 14: 40-45.

## Abstract

The increasing demands of society for healthy nutrition in combination with continuously decreasing willingness to spend time for food preparation leads to a rising consumer demand for minimal processed ready-to-eat (RTE) products (convenient food).

The USA is the leading nation in the consumption and therefore, the biggest market for these kinds of products. Thus, the U.S. Food and Drug Administration (FDA) has long term experience in the evaluation of consequences of the consumption of minimal processed RTE products. This authority publicized a list of the ten riskiest foods with leafy greens on the top.

Sanitation steps based on plasma processes could be an promising addition to conventional cleaning procedures. Plasma, often introduced as forth state of matter, differs from the gaseous state of matter by a certain amount of free charge carriers caused by ionization processes of the gas atoms and molecules due to the supply of energy. The electrical conductivity allows supplying the energy needed to sustain this state electrically, giving access to a huge variety of plasma generation methods with

excitation frequencies from DC to several GHz offering wide parameter ranges e.g. electron energies from 0.5 eV to 10 eV.

The treatment of natural products with changing parameters like size, shape or water content is a challenging task for design and optimization of plasma processes. The lack of effectiveness of sanitation processes on the surfaces of food products is a general problem of all discussed methods.

In order to overcome these problems a specific plasma process was established, based on a microwave plasma torch operated with compressed air delivering plasma processed air (PPA) as antimicrobial acting process gas. If PPA is brought into contact with water, plasma processed water (PPW) is generated which has antimicrobial properties. This PPW process was implemented into a pilot-plant scale salad-rinsing unit in order to demonstrate the scalability and applicability of this treatment procedure. During the trial 45 kg Endive (*Cichorium endivia*) and about 1.500 l of plasma generated disinfectant were consumed. Off the cuff, the process was competitive to industrial established chemical processes.

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

Blanch, M., et.al. 2017. Water relations, short-chain oligosaccharides and rheological properties in lettuces subjected to limited water supply and low temperature stress. *Scientia Horti* 225: 726-735.

## **Abstract**

Reducing water consumption and increasing the quality of vegetables is a particularly high priority in agricultural production. Thus, we set out to analyze the effect of restricting the water supply on water relations, rheological properties, and the accumulation of solutes and protective fructooligosaccharides (FOS) and raffinose family compounds (RFOs) in lettuces grown under controlled greenhouse conditions. In addition, we analyzed whether water restriction can prevent senescence-related changes and overcome the stress imposed by subsequent exposure to low temperature. Lettuces var. Maravilla de Verano were grown under three different water supply regimes, well-watered (WW), moderate water deficit (MWD) and severe water deficit (SWD). Our results indicate that accumulated transpiration (AT) was higher in WW plants than in lettuces subjected to water deficit. The relative water content (RWC) was significantly influenced by a restricted water supply but not by additional low temperature stress. Water deficit caused a significant decrease in the amount of unfreezable water (Uw), determined calorimetrically, in association with a significant decrease in total water content (Tw). After the additional low temperature stress, there was no further drop in Tw, although a significant decrease in Uw was evident, mainly in SWD lettuces. A moderate water deficit enhanced nystose and kestopentaose accumulation. After imposing low temperature stress, MWD lettuces had a lower apparent viscosity, concomitant with an increase in firmness, fewer senescence-related changes and a sharp increase in raffinose. We conclude that moderate water limitation, improving the endogenous levels of FOS and reducing the cleavage of wall polysaccharides backbones, thus reducing viscosity and increasing firmness, could be useful to retain water inside cells, avoiding quality loss and increasing the capacity of the lettuce to resist low non-freezing temperatures.

**Keywords:** /Lettuce/

## MICROGREENS

Shabir Ahmad Mir, et.al. 2017. **Microgreens**: Production, shelf life, and bioactive components. Crit Rev Food Sci Nutr 57(12): 2730-2736.

### Abstract

Microgreens are emerging specialty food products which are gaining popularity and increased attention nowadays. They are young and tender cotyledonary leafy greens that are found in a pleasing palette of colors, textures, and flavors. Microgreens are a new class of edible vegetables harvested when first leaves have fully expanded and before true leaves have emerged. They are gaining popularity as a new culinary ingredient. They are used to enhance salads or as edible garnishes to embellish a wide variety of other dishes. Common microgreens are grown mainly from mustard, cabbage, radish, buckwheat, lettuce, spinach, etc. The consumption of microgreens has nowadays increased due to higher concentrations of bioactive components such as vitamins, minerals, and antioxidants than mature greens, which are important for human health. However, they typically have a short shelf life due to rapid product deterioration. This review aimed to evaluate the postharvest quality, potential bioactive compounds, and shelf life of microgreens for proper management of this specialty produce.

**Keywords:** /Microgreens/ /Shelf Life/ /Storage/ /Fresh Produce/

## ROMAINE LETTUCE

Guzel, M., et.al. 2017. Quantifying the effectiveness of washing treatments on the microbial quality of fresh-cut **romaine lettuce** and cantaloupe. LWT-Food Sci & Technol 86: 270-276.

### Abstract

The increase in foodborne illness outbreaks associated with fresh and fresh-cut produce in the USA has been attributed to ineffectiveness of current handling practices. This study describes the change in concentration of population of *Listeria innocua* to then quantify the effectiveness of washing treatments and storage temperature in the growth of *Listeria monocytogenes* in two popular fresh-cut produces, romaine lettuce and cantaloupe. *L. innocua* was used as a surrogate for *L. monocytogenes* to experimentally evaluate the effectiveness of washing treatments (water and chlorine) and develop growth curves at 5-36 °C storage. Both treatments were more effective ( $p < 0.05$ ) in reducing *L. innocua* concentration in fresh-cut romaine lettuce than in cantaloupe. For instance, chlorinated water treatment reduced *L. innocua* population by 0.98 log on fresh-cut romaine lettuce compared to just 0.57 log on cantaloupe rind. The experimental data on *L. innocua* were used to test the Baranyi-Roberts model in both produce and results demonstrate that it can be a useful tool to estimate the growth of *L. monocytogenes* in selected fresh-cut produce during distribution, storage or at the market, or at home using quantitative risk assessment methods.

**Keywords:** /Romaine Lettuce/ /Fresh Produce/ /Leafy Greens/ /Handling Practices/

## **SPINACH**

Yusof, N.L., et.al. 2017. Influence of vacuum impregnation with different substances on the metabolic heat production and sugar metabolism of spinach leaves. Food Bioprocess & Technol. 10:1907-1917

### **Abstract**

Vacuum impregnation (VI) has been widely used as pre-treatment prior to, e.g., minimal processing, freezing, or drying of fruit and vegetables. Most of the investigations have focused on the applicability of VI to modify physicochemical, sensory, and nutritive characteristics. However, little attention has been paid to the metabolic consequences of impregnating different substances into the plant tissue. This study explores short- and long-term metabolic responses of baby spinach leaves at 5 °C after impregnation with several substances that are commonly used in food industry, e.g., sucrose, calcium lactate, citric acid, and ascorbic acid. Short-term metabolic response of impregnated spinach leaves was measured with isothermal calorimetry for 7 h. Results demonstrated that leaves impregnated with calcium lactate and sucrose showed a drastic increase in metabolic heat production, but no change was recorded in leaves impregnated with solutions of ascorbic acid or citric acid. Long-term metabolic responses were evaluated by measuring sugars and starch. The different impregnation solutes provoked specific changes in the carbohydrate composition during cold storage and the concentrations at each time point are likely to be the result of mobilization of starch, which sharply decreased during storage, and solute-specific differences in metabolization and interconversion of sugars.

**Keywords:** /Spinach/

## **TOMATO**

Patane, C., et.al. 2017. Mediterranean long storage tomato as a source of novel products for the agrifood industry: Nutritional and technological traits. LWT – Food Sci & Technol 85: 445-448.

### **Abstract**

Long storage tomato is a crop traditionally cultivated under no irrigation in Southern Italy. Recently, great interest has been directing towards this crop, as a source of novel products for industrial purposes. A research has been conducted to assess some nutritional and technological traits which affect the fruit suitability to processing, in two Sicilian landraces ('Pizzottello di Montallegro' and 'Locale di Filicudi') of long storage tomato, compared to the Hy. 'Brigade' of processing tomato (Dry and Irrigated). High total solids (>103 g/kg), total soluble solids (>8° Brix) and reducing sugars (>53 g/kg), mostly greater than those of the control, reveal the tastiness of long-storage tomatoes. These were slightly poorer in lycopene than the control (both dry and irrigated) but richer in polyphenols (≥0.12 mg/g) and vitamin C (≥0.59 mg/g), as also revealed by the antioxidant activity (DPPH>80%). Degradative enzymatic activities (pectin methyl esterase and polygalacturonase) were the lowest in 'Pizzottello di

Montallegro', proving a fruit susceptibility to softening even lower than control. In turn, low polyphenol oxidase activity in 'Locale di Filicudi' indicates a great aptitude of fruits to retain the nutritional value.

**Keywords:** /Tomato/ /Storage/

Xiuxiu Sun, et.al. 2017. Effect of controlled-release chlorine dioxide on the quality and safety of cherry/grape tomatoes. Food Control 82: 26-30

### **Abstract**

The effect of controlled-release chlorine dioxide (ClO<sub>2</sub>) gas on the food safety and quality of cherry/grape tomatoes was investigated. Whole grape tomatoes artificially inoculated with either *Escherichia coli* or *Alternaria alternata*, or whole cherry tomatoes inoculated with *Salmonella enterica* Newport, were packed in 1-lb clamshells, and stored at 20 ° C for 14 days. ClO<sub>2</sub>pouches were attached under the lids with the following four dosages/release rates: single dose slow-release (S), single dose fast-release (F), fast/slow-release combination (FS), and double dose fast-release (FF). The corresponding equilibrium ClO<sub>2</sub>concentration in the headspace was about 2, 4, 6 and 8 ppm, respectively. Treatment with F reduced populations of *E. coli* and *A. alternata* by 2.9—4.7, and 1.6 to 4.0 log CFU/g, respectively, within 14 days storage at 20 ° C. FS and FF treatments showed little benefit over F. The F and FF treatments reduced population of *S. enterica* for inoculated cherry tomatoes by 3.28 and 3.80 log CFU/g, respectively, compared to control after 14 days' storage at 20 ° C. ClO<sub>2</sub>-treated grape tomatoes retained higher firmness and had less weight loss compared to the control. The results indicate that 2 ppm of ClO<sub>2</sub> (S) in the clamshells did not adequately control microbial populations; the minimum effective concentration of ClO<sub>2</sub>was 4 ppm (F). Higher concentrations provided a small but incremental improvement in ability to control microorganisms. ClO<sub>2</sub>released into packages of cherry tomatoes during storage reduced weight loss, while maintaining firmness.

**Keywords:** /Tomato/ /Storage/

## **HERBS AND SPICES**

### **BELL PEPPER**

Frans, M., et.al. 2017. Environmental effects on growth and sporulation of *Fusarium*spp. causing internal fruit rot in bell pepper. Eur J Plant Pathol 149: 875-883.

### **Abstract**

Internal fruit rot in bell pepper (*Capsicum annuum* L.) is mainly caused by members of the *Fusarium lactis* species complex (FLASC) and to a lesser extent by *Fusarium oxysporum* and *Fusarium proliferatum*. Despite the importance of the disease, there is hardly no information about growth, sporulation and germination dynamics of FLASC. In order to understand the dominance of FLASC as main pathogen of internal fruit rot, the effects of temperature (5 °C – 35 °C), water activity (a<sub>w</sub> 0.76–0.96), pH

(pH 3 - pH 9) and oxygen concentration (2.5% - 20%) on growth and sporulation of all three *Fusarium* species were compared. In addition, germination kinetics were also investigated. FLASC showed optimal mycelium growth and sporulation in the narrow range of 25 °C, while both other strains were also tolerant for higher temperatures to 30 °C. FLASC was also characterized by a broad pH optimum from pH 3–7 while *F. oxysporum* (pH 4–7) and *F. proliferatum* (pH 5–8) were more demanding concerning pH. In addition, optimal sporulation occurred in the acid region for FLASC (pH 3) whilst neutral and alkaline pH were more favourable for the other species. Germination kinetics revealed that FLASC did not benefit from an earlier and/ or faster germination process. A thorough understanding of the growth characteristics and dominance of FLASC as main pathogen for internal fruit rot is inevitable to develop sustainable control measures for the disease

**Keywords:** /Bell Pepper/ /Internal Fruit Rot/

## CHILLI

Boukaew, S., et.al. 2018. Fumigant activity of volatile compounds of *Streptomyces philanthi* RM-1-138 and pure chemicals (acetophenone and phenylethyl alcohol) against anthracnose pathogen in postharvest chili fruit. Crop Prot 103: 1-8.

### Abstract

Application of volatiles from *Streptomyces philanthi* RM-1-138 grown on sterile wheat seeds (volatiles RM-1-138) and pure commercial volatile compounds (acetophenone and phenylethyl alcohol) against chili anthracnose pathogen were investigated *in vitro* and *in vivo*. Among 42 isolates of *Colletotrichum* species tested, *C. gloeosporioides* PSU-NY8 was selected as the most aggressive anthracnose pathogenic strain on chili fruit against the volatiles RM-1-138. The optimum inoculum size (15 g L<sup>-1</sup>) and spore concentration (10<sup>7</sup> spore mL<sup>-1</sup>) of the wheat seed culture of *S. philanthi* RM-1-138 exhibited the complete suppression (100% inhibition) on *C. gloeosporioides* PSU-NY8. In addition, the *in vivo* result indicated the optimum fumigation period of the volatiles RM-1-138 (15 g L<sup>-1</sup>) was at 6 h. Phenylethyl alcohol showed no antifungal activity at all concentrations tested (10e1000 µL L<sup>-1</sup>) while acetophenone at 100 µL L<sup>-1</sup> of airspace exhibited antifungal activity both *in vitro* and *in vivo* after 12 h fumigation. The fumigant activity was evidenced by the damage of cell wall of *C. gloeosporioides* PSU-NY8 illustrated by SEM. Therefore, the volatiles from *S. philanthi* RM-1-138 have a high potential for biocontrol of chili anthracnose disease in postharvest system.

**Keywords:** /Chilli/

Panigrahi, J., et.al. 2017. Gibberellic acid coating: A novel approach to expand the shelf-life in green chilli (*Capsicum annuum* L.). Scientia Horti 225: 581-588.

### Abstract

In the present study, for the first time, we report the effectiveness of gibberellic acid (GA<sub>3</sub>) coating on the expansion of postharvest shelf-life in green chilli (*Capsicum annum* L.). The fruits were

coated with GA<sub>3</sub> dipping in 1, 2 and 3 ppm for 30 s and then stored at 4 ± 1 °C. Fruits without any GA<sub>3</sub> coating were considered as control. All the treated and control fruits were stored as such for 45 days and throughout the storage period (with every nine days intervals) the multiple enzyme and antioxidants (associated with storage) such as titratable acidity, ascorbic acid content, ferrous ion chelating activity, reducing power, 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging activity, hydroxyl radical scavenging activity, total phenolic content and enzymatic study of polyphenol oxidase and pectate lyase activity were assessed. The fruits coated with all three levels of GA<sub>3</sub> showed a significant delay in change of skin colour, decline in titratable acidity, total phenolic and ascorbic acid content, increase in enzyme and antioxidant activities during the cold-storage in comparison to the control fruits. GA<sub>3</sub>, used as the coating in green chillis, eventually showed beneficial roles in decelerating the mechanism of ripening. The results further indicated that the 2 ppm of GA<sub>3</sub> concentration served superiorly than the 1 ppm or 3 ppm throughout storage and provided expanded shelf-life of green chilli.

**Keywords:** /Chilli/ /Coating/ /Shelf-life/

## **WILD ROCKET**

Edelenbos, M., et.al. 2017. Seasonal variation in color and texture of packaged wild rocket (*Diplotaxis tenuifolia* L.). Food Packag. & Shelf Life 14: 46-51.

### **Abstract**

Wild rocket (*Diplotaxis tenuifolia* L.) is sold year round and different raw material qualities are packaged. The objective of this study was to determine the effect of growing season on quality of packaged wild rocket stored for 3 week at 5 °C or for 1 week at 20 °C to mimic the supply chain for unwashed, packaged wild rocket. Quality was determined by multispectral imaging at 570 nm (color) and 780 nm (texture). Data from multispectral analysis showed that green color was better preserved in the spring than in the late summer and that texture i.e. dry leaves that sprinkled upon touch, was better preserved in the later summer than in the spring. Wild rocket stored at low temperature remained greener for longer than at high temperature, and short storage time preserved the texture better than long storage time. Multispectral imaging is a useful tool for quality control of wild rocket to better manage stocks and meet the priorities of potential customers.

**Keywords:** /Wild Rockets/ /Leafy Greens/ /Modified Atmosphere Packaging/

## **POTATO & TUBERS**

### **POTATO**

Kai Chen, et.al. 2017. A novel inhibitor against mushroom tyrosinase with a double action mode and its application in controlling the browning of potato. Food Bioprocess Technol 10: 2146-2155.

### **Abstract**

In order to search for a new method for the anti-browning of food products, a novel hydroxypyridinone (HPO) derivative with a formyl group was evaluated for its anti-tyrosinase property. This compound was found to exhibit potent tyrosinase inhibition on the monophenolase activity of mushroom tyrosinase with an  $IC_{50}$  value of 1.33  $\mu$ M, indicating that this HPO derivative was 12-fold stronger than kojic acid ( $IC_{50}$  15.89  $\mu$ M). This molecule can inhibit tyrosinase via two action modes, namely copper reduction and chelation, and the formation of a Schiff's base with the amino group at the active site of the enzyme. A synergistic effect of these two action modes to enhance the inhibitory activity was observed. This compound was also investigated for the inhibitory effect on diphenolase activity of mushroom; the inhibitory mechanism was found to be reversible and of competitive-uncompetitive mixed-type inhibition. This hydroxypyridinone was demonstrated to effectively control the browning of vegetable products

**Keywords:** /Potato/ /Browning/

Yellareddygari, S.K.R. and N.C. Gudmestad. 2017. Bland-Altman comparison of two methods for assessing severity of Verticillium wilt of **potato**. Crop Prot 101: 68-75.

### **Abstract**

The agreement between two disease assessment approaches is important to know prior to replacing or interchanging the use of an established method with a recently developed method of measurement. Frequently used statistical methods to compare two different disease rating methods is the Pearson correlation coefficient or the ordinary least square regression (OLS), but they have their shortcomings. Bland-Altman proposed an alternative method for studying agreement between methods using simple graphs and basic statistics. Traditionally, when disease management strategies are being evaluated in the field, the severity of the disease is estimated using a visual assessment. Canopeo, designed by the Oklahoma State University app center, is a smart phone app designed for measuring green canopy cover. Thus, the aim of this study was to explain the Bland-Altman method with examples of visual and Canopeo methods of wilt measurement. Symptoms of Verticillium wilt in potato were estimated (repeated measures) in two trials using Canopeo and a traditional visual assessment method. Complete wilt data (repeated measures) were considered for studying the agreement between visual and Canopeo assessments. A preset cutoff limit of  $\leq 5\%$  bias (total allowable) between rating methods was considered acceptable prior to using the Bland-Altman comparison. The Bland-Altman method for determining the agreement in wilt severity methods in trial 1 and trial 2 estimated that the mean difference between rating methods were 5.10 and 5.91%, respectively. A mean difference greater than five indicates that the methods of measuring wilt are not in agreement. The study reported here demonstrates that Pearson correlation and OLS regression are inappropriate for assessing the agreement between two methods of measurement.

**Keywords:** /Potato/

**ORNAMENTALS**

## ANTHURIUM

Simi, S., et.al. 2017. Effect of pre-cooling and holding solutions on the keeping quality of cut flower Anthurium andrianum 'White King'. Acta Horti 1165: 97-100.

### Abstract

Investigations were carried out under the All India Coordinated Floriculture Improvement Programme, College of Horticulture, Vellanikkara during 2012-2013 to study the effect of pre cooling temperatures on the keeping quality of cut anthurium stems. The cut flowers of *Anthurium andrianum* 'White King' were harvested early in the morning and subjected to pre cooling at three different temperatures for three durations. The longest vase life of 19.33 days was obtained in the pre cooling treatments, T<sub>6</sub> (12°C for 5 h) and T<sub>8</sub> (14°C for 3 h). Investigations were carried out under the All India Co-ordinated Floriculture Improvement Programme, College of Horticulture, Vellanikkara during 2012-2013 to study the effect of pre cooling temperatures on the keeping quality of cut anthurium stems. The cut flowers of *Anthurium andrianum* 'White King' were harvested early in the morning and subjected to pre cooling at three different temperatures for three durations. The longest vase life of 19.33 days was obtained in the pre cooling treatments, T<sub>6</sub> (12°C for 5 h) and T<sub>8</sub> (14°C for 3 h). This was followed by T<sub>5</sub> (12°C for 3 h) which showed a vase life of 15.67 days. Experiments were also carried out to study the effect of holding solutions on the keeping quality of anthurium cut flowers. The freshly harvested flower stems were put in different vase solutions and evaluated at 23±2°C after recutting the basal portion under water and keeping in holding solutions at 16 h illumination (1000 lux intensity provided by 40 W fluorescent tubes) under laboratory conditions. Of the eleven treatments tried, the flowers subjected to the treatment sucrose (5%) + Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>.16H<sub>2</sub>O, 300 ppm (T<sub>7</sub>) exhibited the highest vase life (14 days). This was followed by T<sub>1</sub> (NaOCl 50 ppm) (13 days) which was on par with T<sub>2</sub> (Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>.16H<sub>2</sub>O, 300 ppm) and T<sub>4</sub> (Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>.16H<sub>2</sub>O, 300 ppm + kinetin, 25 ppm). Total water absorbed ranged from 4.33 mL (T<sub>1</sub>) to 16.67 mL (T<sub>8</sub>). Phytotoxic symptoms were not observed on the spathe in any of the treatments.

**Keywords:** /Anthurium/ /Vase Life/ /Postharvest Technology/ /Package/

## CHRYSANTHEMUM

Taufique, T., et.al. 2017. Flower blooming pattern and color based classification of chrysanthemum cultivars in Bangladesh. Acta Horti 1149: 349-358.

### Abstract

Flower classification is a way to group flowers using specific features. An experiment was conducted to characterize chrysanthemum cultivars on flower blooms and color basis. Thirty two chrysanthemum cultivars (coded from V<sub>1</sub> to V<sub>32</sub>) were classified into 13 blooming pattern viz., irregular incurve (V<sub>1</sub>); reflex (V<sub>2</sub>); regular incurve (V<sub>3</sub>, V<sub>4</sub>); decorative (V<sub>5</sub>- V<sub>10</sub>); intermediate incurve (V<sub>11</sub>- V<sub>13</sub>); pompon (V<sub>14</sub>, V<sub>15</sub>); single and semi-doubles (V<sub>16</sub>- V<sub>20</sub>); anemone (V<sub>21</sub>- V<sub>24</sub>); spoon (V<sub>25</sub>- V<sub>27</sub>); quill (V<sub>28</sub>); spider (V<sub>29</sub>, V<sub>30</sub>); brush and thistle (V<sub>31</sub>); and unclassified (V<sub>32</sub>) in accordance to NCS. According to RHS Color Chart a wide color range were found and these were red to purplish red (V<sub>1</sub>, V<sub>8</sub>, V<sub>18</sub>, V<sub>25</sub> and V<sub>31</sub>);

yellow to greenish yellow (V<sub>4</sub>, V<sub>7</sub>, V<sub>10</sub>, V<sub>15</sub>, V<sub>17</sub>, V<sub>24</sub>, V<sub>26</sub> and V<sub>29</sub>); white (V<sub>3</sub>, V<sub>22</sub> and V<sub>28</sub>); orange to orangish yellow (V<sub>2</sub>, V<sub>5</sub>, V<sub>9</sub>, V<sub>12</sub>, V<sub>19</sub> and V<sub>27</sub>); pink to purplish pink (V<sub>6</sub>, V<sub>14</sub>, V<sub>16</sub>, V<sub>20</sub>, V<sub>30</sub> and V<sub>11</sub> and V<sub>32</sub>) and purple (V<sub>13</sub>, V<sub>21</sub> and V<sub>23</sub>). This classification may be helpful for easy identification and for a future breeding program of chrysanthemum cultivars in Bangladesh.

**Keywords:** /Chrysanthemum/

## DENDROBIUM

Imsabai, W. and A. Laongkaew. 2017. A survey of ethylene response in **Dendrobium** cut-flower hybrids. Acta Horti 1167: 399-406.

### Abstract

Export of *Dendrobium* cut-flower hybrids from Thailand has a problem of low quality at the consumer end because of their sensitivity to ethylene. However, there is no research on the ethylene response of various *Dendrobium* hybrids in Thailand. The objective of this study was to survey ethylene response to 35 cultivars of *Dendrobium* cut-flower hybrids in Thailand. The cultivars were divided by color into 9 groups: white, white-pink, purple-red, purple-red with white, purple-pink with white, purple-blue, white with purple lip/purple-pink, purple with strips on petal and green-yellow. They were fumigated with ethylene gas at 0.4  $\mu\text{L L}^{-1}$  for 24 h and the ethylene response was recorded every 6 h after being fumigated with ethylene (HAFE). It was found that all nine groups were highly to very highly sensitive to ethylene (6-12 HAFE) except for *Dendrobium* 'Kenny', *Dendrobium* 'Lucky', *Dendrobium* 'Yokon' and *Dendrobium* 'Jade Gold' which showed very low sensitivity or the least sensitivity (>24 HAFE). The senescence symptoms of open flowers were drooping, downward, tepal venation, yellowish at lip, and flower abscission while the symptoms of flower buds are yellowing, epinasty of peduncle, water soaking and abscission. Ethylene response of the inflorescence ranged from very tolerant to very sensitive. Both open flowers and flower buds of *Dendrobium* 'Kenny', *Dendrobium* 'Lucky', *Dendrobium* 'Yokon' and *Dendrobium* 'Jade Gold' were tolerant to ethylene at 0.4  $\mu\text{L L}^{-1}$ . These results suggested that ethylene response in *Dendrobium* cut-flower hybrids in each cultivar was different. The research findings provided exporters the information for proper postharvest handling of *Dendrobium* cut-flower hybrids.

**Keywords:** /Dendrobium/ /Cut-flowers/ /Ethylene/ /Yellowing/

## JASMINE

Suntipabvivattana, N. and W. Tongdeesuntorn. 2017. Shelf-life extending of **jasmine** garland. Acta Horti 1167: 419-424.

### Abstract

In Thailand, jasmine flower is consumed as a fresh jasmine garland. Demand of jasmine flower is high throughout the year. However, marketing of jasmine garland is limited due to a short shelf-life.

Therefore, effectiveness of boric acid and benzyladenine on shelf-life extending were studied. Jasmine flower buds were treated with benzyladenine or boric acid at concentrations of 0, 100, 500 and 1,000 mg L<sup>-1</sup> for 15 min before completion of garlands. The results showed that both benzyladenine and boric acid could reduce respiration and weight loss. Moreover, both chemicals also gave good effects on extending shelf-life. In addition, pre-treated garlands packed in PP and PE bag were compared. PP bag could maintain quality of jasmine garlands better than PE bag. These indicated that application of 500 mg L<sup>-1</sup> benzyladenine or boric acid combined with packing in PP bag could extend shelf-life of jasmine garland to 10 days.

**Keywords:** /Jasmin Flower/ /Modified Atmosphere Packaging/

## LILY

Zhang, Y.Y., et.al. 2017. Effects of exogenous hormone and cold storage on Asiatic lily 'Gironde' x 'Renoir' bulblet growth and development . Acta Horti 1171: 75-82.

## Abstract

Asiatic hybrid lily (*Lilium*) is an excellent cut flower because of its various types and colors. Also, because of its strong cold tolerance, Asiatic hybrid lily is a superior choice to breed new cultivars. A group of bulblets, obtained from hybridizing *Lilium* Asiatic 'Gironde' and *Lilium* Asiatic 'Renoir', was treated in vitro with nine different concentrations of exogenous hormone (abscisic acid (ABA), gibberellic acid 3 (GA<sub>3</sub>), and 6-benzylaminopurine (6-BA)) solutions, then stored at 4°C for 5 weeks. The effects of exogenous hormone levels and low temperature on further bulb growth were studied. Exogenous ABA could restrain the increase of soluble sugar during the low-temperature treatment, especially when the ABA content reached 0.2 mg L<sup>-1</sup>. Meanwhile, the exogenous hormone GA<sub>3</sub> raised the soluble sugar content remarkably. The relative content of carbohydrates is directly related to bulb growth and development after transplanting, thus, we can draw the conclusion that exogenous hormone (GA<sub>3</sub>, ABA) treatment could have a significant impact on plant height and leaf number of bulblets after transplanting. Furthermore, a decreasing amount of starch and high accumulation of soluble sugar in outer scales of bulblets were found in the process of dormancy breaking of Asiatic hybrid lily 'Gironde' × 'Renoir'.

**Keywords:** /Lily/ /Cold Storage/