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GENERAL

EDIBLE COATINGS

Sabina Galus, Sabina, Justyna Kadzinska. 2015. Food applications of emulsion-based edible films and coatings. Trends Food Sci. & Technol. 46: 273 – 283.

Abstract

Background: An increasing awareness among consumers regarding the healthy lifestyle have prompted research on novel techniques of prolonging the shelf life of food products without the necessity of using preservatives. Thanks to their ability to improve global food quality, edible films and coatings have been particularly considered in food preservation. Changing mechanical and barrier properties depending on the main component in the biopolymer matrix caused an increasing interest in composite structures, which enable to explore the complementary advantages of each component as well as to minimize their disadvantages. **Scope and approach:** This review discusses the potential food applications of emulsified edible films and coatings. The materials, preparation methods, and physical properties are also presented. Lipids are usually added to edible films and coatings to impart hydrophobicity and thereby reduce moisture loss. A very wide range of lipid components is available including natural waxes, resins, acetoglycerides, fatty acids, and petroleum-based, mineral and vegetable oils. The emulsification process of the lipid phase in the aqueous phase is necessary prior to the coating application. **Key findings and conclusions:** Emulsion-based edible films and coatings find application in fresh and processed food products, fruits and vegetables, cheeses, meat, sausages and bakery products. Composite emulsion-based edible materials produced from hydrocolloids and lipids result in better functionality than films produced with one component, especially with respect to their water barrier properties. In general, more research is needed to improve application processes of emulsion-based edible materials, especially sensory aspects, to be appropriate for each product.

Keywords: /Edible Coatings/ /Edible films/ /Food Coating/

ETHYLENE

Blanke. M., R. Shekarizz . 2015. **Ethylene** levels along the food supply chain – a key to reducing food waste? Acta Hort. 1091: 101 – 106.

Abstract

Ethylene accelerates ripening of fruits and accumulation of ethylene at locations in the supply chain may lead to increased fruit decay and waste. Monitoring of ethylene levels is essential to understanding and managing ethylene and a new generation of instruments is becoming available to enable continuous insitu determination of ethylene. This new nano-technology provides for portable, battery-driven, light weight devices. In a trial to test utility of one of the available devices, ethylene

levels were measured along the supply chain of apple fruit from harvest to the consumer. Ethylene levels ranged from 9-12 nl L⁻¹ in a controlled atmosphere, to 70-72 µl L⁻¹ in the fruit bin within a fruit bin in a storage compartment to 500 ppb on the sorting belt in the grading facility to 15-30 µl L⁻¹ levels in the perforated farm plastic bag of apples. This contribution also takes into account exogenous ethylene originating from other sources than fruit and discusses pros and cons of this new technology and potential applications for the supply chain to aid reducing food waste.

Keywords: /Ethylene/ /Ethylene Scrubber/ /Nano-Technology/ /Postharvest/ /Supply Chain/

FRESH CUT

Gil, M. I., et. al. 2015. Should chlorate residues be of concern in **fresh-cut** salads? Food Control. 60: 416 - 421.

Abstract

Chlorine remains the most popular method used by the fresh produce industry for decontamination. However, the occurrence of disinfection by-products (DBP) derived from chlorine-based disinfectants has been highlighted as a problem. After recent reports, chlorate residues in fresh produce are of concern in Europe. This study evaluated the chlorate accumulation in process wash water and the residues in fresh cut lettuce when sodium hypochlorite was used as a wash aid. At a commercial processing facility, total chlorine was continually added to achieve a free chlorine level of 1e80 mg L⁻¹ for water disinfection as the organic load measured as chemical oxygen demand (COD) increased over time (1000e1500 mg O₂ L⁻¹). This resulted in chlorate accumulation (19e45 mg L⁻¹) in the process water. When fresh-cut lettuce was washed in that water, chlorate residues were detected in the lettuce and the concentrations increased linearly with the repeated use of the same process water, reaching concentrations of 4.5-5.0 mg kg⁻¹. To understand the chlorate accumulation in the process wash water, several experiments were performed at a pilot plant scale with different levels of COD and free chlorine. There was a significant ($p < 0.001$) correlation ($R = 0.91$) between the total added chlorine and the chlorate accumulation in the process water. We demonstrated that the added chlorine needed to maintain a free chlorine level in the process water was the contributing factor to chlorate accumulation. Chlorate residues in the washed fresh-cut lettuce after rinsing for 1 min in tap water and in commercial bags were below the limit of quantification. This study contributes to the knowledge of chlorate accumulation in the process water when sodium hypochlorite was used as a sanitizer.

Keywords: /Fresh Cut/ /Food safety/ /Sanitizers/ /Sodium Hypochlorite/

ShihChi Weng, et. al. 2015. Assessment and speciation of chlorine demand in **fresh-cut** produce wash water. Food Control 60: 543 - 551.

Abstract

For the fresh-cut produce industry, a critical area of concern is potential pathogen cross-contamination during wash operations when wash water is reused and re-circulated in wash systems continuously imputed with fresh-cut produce. However, little research has focused on the chemical properties of wash water. Organic input from residual soil and vegetable material deteriorates water quality and creates increasing chlorine demand within this wash water. This study evaluated the origins of chlorine demand input and chlorine decay kinetics of fresh-cut produce wash water. Using a model system, vegetable juice released per kg of processed produce for shredded romaine lettuce, shredded iceberg lettuce, shredded carrot and baby spinach was 82.1 mL/kg, 94.5 mL/kg, 158 mL/kg, and 2.26

mL/kg, respectively. Batch water analysis revealed a rapid reaction between constituents in the wash water and chlorine where over a 90-min observation period, 50% of chlorine demand occurred within first 5 min, underscoring the challenge for any water treatment process to reduce chlorine demand once vegetables are deposited into washing systems. Moreover, the results also showed sustained chlorine demand over 90-min periods, indicating an accumulative effect on chlorine consumption with continuous organic input. Additionally, HPLC-SEC analysis showed that the constituents contributing to chlorine demand are predominantly dissolved small molecules (<3400 Da), which will challenge water reuse treatment approaches. This study provides quantitative information of chlorine demand origins and chlorine decay kinetics in wash water and provides baseline data critical for integrating water reuse in the fresh produce processing industry.

Keywords: /Fresh-cut/ /Chlorination/

FRESH PRODUCE

Barnes, J., et. al. 2015. Investigation of potential reasons for bacterial survival on 'ready-to- eat' leafy produce during exposure to gaseous ozone. *Postharvest Biol. & Technol.* 111: 185 – 190.

Abstract

Fresh leafy produce, such as lettuce and coriander, are subject to post-harvest microbial contamination and decay. Because of increasing pesticide resistance and consumer pressures, alternative residue-free treatments, such as ozone, are being actively explored and encouraged to reduce microbial loads and curb spoilage of crops in storage/transit. However, several researchers have reported that a component of the bacterial population on leaf surfaces is resistant to ozone treatment. To investigate the potential reasons for this bacterial survival, confocal microscopy was used to visualise microbes on leaf surfaces before and after ozone treatment. Direct observation (live/dead cell staining) of cells after ozone exposure showed that some cells were still alive; this included cells in small colonies as well as individual cells. We hypothesised that cell (colony) age and prior stress (cold) contributes to, or is responsible for, the ozone resistance observed. Interestingly, cells derived from older agar-grown colonies (7–12-day-old) and coldstressed cells of a *Pseudomonas* sp. (isolated from coriander) showed higher ozone resistance than that of control cells (4-day-old colonies). These findings suggest that a range of factors are responsible for ozone resistance and further work to improve our understanding of the mechanisms of ozone resistance may lead to improved methods to reduce microbial spoilage of fresh produce.

Keywords: /Fresh Produce/

MINIMALLY PROCESSED

Roversi, T., et. al. 2015. Mesoscale investigation of the structural properties of unrefined cell wall materials extracted from minimally processed salads during storage. *J. Food Eng.* 168: 191–198.

Abstract

Cell walls in plants are polymeric composite systems, which determine the textural attributes of vegetal tissue. In this paper, results are presented on the investigation on the structural properties of cell wall materials (CWMs), intended for use as structuring materials in manufactured products. Specifically, CWMs were extracted from fresh and ripened minimally processed *Valerianella locusta* Laterr. At the tissue level, the structural resilience inferred by CWM varies with storage time, as it was

evaluated both quantifying the membrane degradation and the mechanical characteristics of salads texture wilting. Mechanical spectra of the rehydrated CWM gel show the increase of the elastic character with the salad aging time. Stress relaxation spectra deduced from rheological study on water suspension of the extracted cell wall polysaccharides, showed fast and slow relaxation modes, whose ratio changed with the aging of the salad tissue. The use of unrefined cell wall materials (CWMs) in food formulations may infer naturalness to food offerings and this paper shows how CWM extraction from salad that underwent different time storage histories, can provide modulation of the functional properties of these structures in final manufactured products.

Keywords: /Minimally Processed/ /Storage/

PESTICIDE RESIDUES

Misra, N.N. 2015. The contribution of non-thermal and advanced oxidation technologies towards dissipation of **pesticide residues**. Trends Food Sci. & Technol. 45: 229 – 244.

Abstract

Background: The use of pesticides has stabilised the food production to a great extent and their usage cannot be avoided anymore. Nevertheless, common food processing operations always allowed dissipating pesticide residues in foods to some extent. Within the food science community and the food processing sector, non-thermal food technologies are being researched and commercialised at a great pace over the past three decades. **Scope and Approach:** In this review we provide a critical analysis of the literature pertinent to the fate of pesticide residues during non-thermal processing of solid and liquid foods. We also identify the opportunities for further development and provide guidelines for future research. The non-thermal technologies considered include high pressure processing, pulsed electric fields and advanced oxidation processes (AOPs) such as ozone, ultrasound, ultraviolet light, ionising radiation, non-thermal plasma, and their synergy. **Key Findings and Conclusions:** In general, information about the fate of pesticides during non-thermal processing of foods is still very scarce. A considerable number of studies have reported the efficacy of AOPs for breakdown of pesticides in food and water; however, information regarding the mechanism of action and toxicity is limited. For industrial adoption and commercial success, researchers are advised to focus their studies through an economic lens.

Keywords: /Pesticide Residues/ /Irradiation/

POSTHARVEST LOSSES

Boonyakiat, D., et. al. 2015. Appropriate **postharvest** management to reduce **losses** of vegetables in the royal project foundation. Acta Hort 1091: 109 – 116.

Abstract

Appropriate postharvest management to reduce losses of vegetables in the Royal Project Foundation was conducted by surveying and gathering information on supply chain of five vegetables, namely pointed cabbage, baby Chinese cabbages (pak-choi), bi-colored sweet corn, chayote shoot and Japanese cucumber. Postharvest losses of vegetables were determined at each stage of the supply chain starting from Chiang Mai province through Bangkok; in the field after harvesting, at the Development Center packhouse, at Chiang Mai packhouse, at Bangkok packhouse and at the Royal Project retail shop

in Bangkok. The results showed that for pointed cabbage, Chinese cabbage, sweet corn postharvest losses were 63.79, 59.14 and 3.85%, respectively. Postharvest losses of chayote shoot were 39.37%, which were mainly due to wilting. The main factor contributing to losses of Japanese cucumber (59.11%) was due to produce not meeting the required market standard. After applying appropriate postharvest management, for example, temperature control, hygienic cleaning, using active packaging and reducing the duration of the supply chain, postharvest losses of all vegetables were remarkably reduced.

Keywords: /Postharvest Losses/ /Cabbage/ /Baby Chinese Cabbages/ /Cucumber/

POSTHARVEST TREATMENTS

Maalekuu. B. K., et. al. 2015. Effects of sources of irrigation water and pesticides on postharvest quality of three vegetables in the Wa municipality of the upper west region of Ghana. *Acta Hort* 1091: 239 – 244.

Abstract

The objectives of the study were to document sources of irrigation water, microbial load in the water and in vegetables, pesticides used and its residue in produce and postharvest treatments applied to produce. A survey and laboratory experiments were used in the study. One hundred (100) respondents were interviewed and the data analysed using SPSS 19. Data of microbial content and pesticides residue in produce were analysed using Statistix 9. Major source of irrigation water for vegetable production was dug out well (88%). Watering cans and buckets were the common aids for irrigation (82%) adopted during the dry season vegetable farming. Cypermethrin, dichlorodiphenyl trichloroethene (DDT), Lamda and Actelic 25 EC were the most common pesticides used in controlling pests and diseases. The major postharvest treatment applied to the produce was washing of vegetables in salted water (45%). Consumption of contaminated vegetables, resulted in, stomach ache (77.5%) and diarrhea (22.5%). Laboratory analysis of water for irrigation and the vegetables produced thereof, indicated the presence of total coliforms, faecal coliforms, *E. coli* and *Salmonella*. Heptachlor, Alpha Endosulfan, Endrin, 1,1-dichloro-2, 2-bis(4-chlorophenyl) ethylene (PP-DDE), 1,1,1- dichlo-2,2-bis (4-chlorophenyl) ethane (PP-DDT) and Permethrin were pesticides residues found exceeding the International Maximum Residue Level (MRL) allowed in vegetables.

Keywords: /Postharvest Treatments/ /Postharvest Quality/

SUPPLY CHAIN

Stegelin, F. E. 2015. Adopting strategic alliances to enhance horticulture supply chain sustainability and profitability. *Acta Hort*. 1090: 61 – 66.

Abstract

Agribusinesses with the purpose of growing and supplying horticultural crops to the end-user often realize there is power in numbers; in other words, using some form of organizational structure to provide economic gains (acquiring inputs cheaper, increasing distribution efficiencies, combining selling activities). Accomplishing these growth or survival strategies often involves collaborative purchasing and marketing with supply chain partners. The horticultural industry, among others, is abuzz with sustainability, emphasizing it as the original green industry. Sustainability encompasses three components: societal or community wellbeing, economics and profitability, and environmental quality. Hence, adopting a strategic alliance among industry partners should enhance the horticulture supply

chain sustainability and profitability; but does it? The formation of horticultural crops producer strategic alliances, evaluating the supply chain participation within each of the alliances, and conducting a life cycle assessment to determine the carbon neutrality and sustainability of the supply chain was the impetus of this study. Net results of five transportation alliances established among small- to mid-sized greenhouse (floriculture) and container nurseries (annuals and perennials) in Georgia indicated a 12% average annual total cost savings to participating firms in each alliance, a 23% average annual total miles driven reduction and savings, an 18% average annual vehicle ownership expense savings to the alliance partners, a 31% average annual savings in driver labor and hours of drive time, and a 19% overall (system-wide) reduction in total carbon dioxide equivalent (CO₂e) emissions reducing the carbon footprint, but not reaching carbon neutrality.

Keywords: /Supply Chain/

TRADE STANDARDS

Mattson, K. 2015. Standards for fresh fruit and vegetables – for trading in high quality products. *Acta Hort.* 1091: 73 – 80.

Abstract

Trade standards provide a product description that serves as a basis for commercial agreements between seller and buyer. When they contain quality classes (extra, I and II), different prices can be set. Today the United Nations Economic Commission for Europe (UNECE) and the *Codex Alimentarius* Commission draw up quality standards for fresh fruits and vegetables, and both the Organisation for Economic Co-operation and Development (OECD) and UNECE interpret standards. To be useful to traders, quality standards need to reflect current production and trade practices. A standard should be applicable in all regions where it is used; otherwise it will become a technical barrier to trade. By providing commonly agreed product descriptions, standards clarify the buyers' requirements for producers, sorters and packers. This reduces misunderstandings and returns. Quality standards can increase waste by limiting the lowest acceptable quality, if there is a demand for products of a quality below the standard's lowest acceptable limit and if it is compulsory to apply the standards. But if standards correctly reflect market requirements, they will not increase waste since buyers would have the same requirements even if standards did not exist. To some extent, the influence between standard-setting and market requirements is reciprocal. When standards are being drafted or changed, requirements need to be set at the correct level. "Cosmetic" requirements with no effect on eating quality, keeping quality or nutritional value may increase waste and/or use of pesticides and fungicides without improving consumer eating satisfaction. Greater consumer knowledge and awareness, however, would lead to less waste and less use of chemicals. Thus, producers, traders, retailers, consumers and standard-setting bodies all have a role in reducing waste and the use of chemicals in the production and distribution of fresh fruits and vegetables.

Keywords: /Trade Standards/ /Fruit/ /Vegetables/

FRUITS

APRICOT

Christen, D., et. al. 2015. Quality management in the apricot supply chain. *Acta Hort.* 1091: 297 – 302.

Abstract

At present, the quality concept for apricot is mainly based only on external quality, like fruit size and absence of epidermis damages. However, Swiss retailers want to change the standards by introducing a quality check based on internal quality, such as sugar content. The aims of this project were to measure physicochemical parameters along the apricot supply chain, to conduct consumer hedonic tests and to develop prediction models for consumer satisfaction. Over three years, physico-chemical parameters of the four main cultivars 'Orangered', 'Goldrich', 'Bergarouge' and 'Bergeron' were measured at harvest, after storage and after shelf-life. Different storage temperatures were applied. Consumer satisfaction was determined by using "in-store" consumer tests. The satisfaction index was defined as the median of the hedonic results. The physico-chemical parameters skin colour, fruit size, soluble solids concentration (SSC) and total acidity were stable along the chain. On the contrary, firmness and ripening index (DA_i) decreased. The consumer tests showed that cultivars largely influenced the consumer satisfaction. The tasted apricots obtained medium to good hedonic scores. In order to define the physicochemical parameters influencing the consumer satisfaction, a multiple-parameter model was built for every cultivar. The important parameters were different for each cultivar. The models allowed an accurate prediction of the consumer satisfaction. In conclusion, a new quality concept for all key players involved in the Swiss apricot supply chain is discussed.

Keywords: /Apricot/ /Prunus armeniaca/ /Postharvest Quality/

AVOCADO

Burdon, J., et. al. 2015. Relationship between dry matter and ripening time in 'hass' avocado. Acta Hort. 1091: 291 – 296.

Abstract:

'Hass' avocado fruit harvested early in the season take a longer time to ripe than fruit harvested later in the season. As the harvest season progresses, the dry matter content of fruit increases. Dry matter can be quantified by near-infrared spectroscopy (NIR). The objective of this study was to determine the relationship between fruit dry matter content and the time taken to ripen, and whether NIR can be used to grade fruit for time to ripen. 'Hass' avocado fruit were taken from field bins on the day of harvest from three orchards on three occasions: early, mid and late season. At each harvest, 150 fruit, approximately count 23, were taken per orchard, of which 100 fruit were used to determine time to ripen/dry matter relationship and estimate dry matter by NIR, and 50 fruit were used for NIR calibration. Fruit were allowed to ripen at 20°C without prior cold storage. Throughout the harvest season there was a relationship between higher dry matter and shorter time to ripen, although there was considerable variability in ripening time at any given dry matter ($R^2=0.25$). Within a single harvest, with a limited range of dry matter and time to ripen, there was a less clear relationship between dry matter and the rate of ripening. Fruit from different orchards with similar dry matter may have different ripening times. Given the relationships established, it remains to be demonstrated whether NIR could be routinely used to segregate fruit into commercially useful ripening categories.

Keywords: /Avocado/ /Persea americana Mill./ /Ripening/

Magwaza, L., S. Tesfay. 2015. A review of destructive and non-destructive methods for determining avocado fruit maturity. Food Bioprocess Technol. 8: 1995 – 2011.

Abstract

Optimum harvest maturity is one of the important factors determining the quality of avocado fruit. Currently, avocado harvest maturity is mostly determined using markers or indices such as mesocarp oil, dry matter, or moisture content, all quantified destructively using representative samples of a batch in a consignment. Although useful, destructive techniques are time-consuming and results reflect properties of specific produce evaluated. High variation in maturity stages affect postharvest quality and the rate of ripening within a consignment, causing logistical difficulties. Emerging analytical techniques have particular advantages in non-destructive detection of food quality and safety. In this paper, destructive and non-destructive analytical methods and instruments for determining maturity parameters of avocado fruit are discussed. This review also looks at the trends in applying emerging optical and imaging techniques to the analysis of avocado fruit maturity and quality, in particular, visible to near infrared spectroscopy, ultrasonic system, ultrasound imaging, hyperspectral imaging, magnetic resonance imaging, and fluorescence imaging. On the basis of the observed trends, the technical challenges and future prospects for commercial application of these non-destructive techniques for maturity determination of individual avocado fruit are presented.

Keywords: /Avocado/ /Non Destructive/

BANANA

Huang, Hua, et.al. 2016. Enhanced chilling tolerance of **banana** fruit treated with malic acid prior to low- temperature storage. *Postharvest Biol. & Technol.* 111: 209 – 213.

Abstract

The effects of postharvest malic acid (MA) treatment on alleviating the occurrence of chilling injury (CI) symptoms in banana (*Musa* spp., AAA group, cv. Brazil) fruit under 6 °C were evaluated. Application of 80 mM MA alleviated CI symptoms (surface browning), delayed the decrease in chlorophyll fluorescence (Fv/Fm) and chlorophyll content. The activities of peroxidase (POD) and polyphenol oxidase (PPO) were also suppressed by MA. Furthermore, compared with the control group, fruit that were treated with MA showed lower levels of reactive oxygen species, but higher antioxidant activities. The results suggest that the application of MA, as an organic acid, exhibited the potential for alleviating chilling injury symptoms of banana fruit by reducing skin browning and inducing antioxidant activities under low temperature.

Keywords: /Banana/ /Chilling Injury/

Jedermann, R., et. al. 2015. The intelligent container for **banana** transport supervision and ripening. *Acta Hort.* 1091: 213 – 220.

Abstract

Bananas differ from other fruits by the fact that a special ethylene treatment is applied in the destination country to turn 'green' into ripe bananas. Moderate differences in bunch age at harvest, transport duration and temperature have no measurable effect on the fruit quality after ripening as long as the bananas are maintained in a mature green state with no signs of unwanted self-induced ripening (turners) before ethylene treatment. Therefore, systems for automated transport supervision should focus on the detection of turners by higher respiration activity and gas production as well as by the detection of potential hot spots caused by high respiration heat in combination with insufficient air flow through the affected pallet. Under optimal cooling conditions, the subsequent ripening process can be carried out directly in the container. This paper will focus on three topics related to meeting this

challenge. Firstly, the technical system of the intelligent container for remote online supervision of transports, which has been tested during three transports of bananas from Costa Rica to Europe, but can also be used for different types of perishable products. Second, a simple heat transfer model is introduced which allows estimating index values for local cooling effects and respiration activity per pallet from the measured temperature curves. The model can thereby predict the risk of hot spots. Finally, we present the first test results for container ripening of bananas. The major obstacle therein is the large amount of heat generated during the process, which is about 5 times higher than during the transportation of green bananas. We applied different modifications in the packing scheme to improve the air flow, which showed clear benefits with regard to the amount of heat removed by cooling.

Keywords: /green life/ /temperature mapping/ /respiration heat/

BAYBERRY

Shi, Liyu, et. al. 2015. Chinese **bayberry** fruit treated with blue light after harvest exhibit enhanced sugar production and expression of cryptochrome genes. *Postharvest Biol. & Technol.* 111: 197 – 204.

Abstract

The effect of blue light exposure on sugar metabolism and cryptochrome gene expression in postharvest Chinese bayberry fruit was investigated. Results showed blue light treatment significantly increased the contents of sucrose, fructose, and glucose in bayberries during storage. Expression analysis revealed that transcripts of three sucrose phosphate synthase (*MrSPS1*, *MrSPS2*, and *MrSPS3*) were markedly induced by blue light treatment throughout the storage period, but increases in expression of two acid invertase genes (*MrINV2* and *MrINV3*) were detected only at the beginning of storage. Meanwhile, a hexokinase gene (*MrHKK1*) and two genes of cryptochrome (*MrCRY1* and *MrCRY2*) were isolated from bayberry fruit. The expression levels of *MrHKK1* and *MrCRY1* were up-regulated during blue light exposure only at the end of storage; however, significantly higher amounts of *MrCRY2* transcripts were found in blue light exposed-fruit throughout the storage period. Results suggest that blue light treatment increases the sugar content in postharvest bayberries during storage by regulating the expression levels of genes involved in sugar metabolism. Additionally, the enhancement of transcripts of *MrCRY1* and *MrCRY2* might also be associated with the increase in sugar content in blue light exposed fruit.

Keywords: /Bayberry/

CITRUS

Manrakhan, A., et. al. 2015. Phytotoxic effect of gf-120 of fruit fly bait on fruit of mandarin (*Citrus reticulata* blanco cv. *nadorcott*): influence of bait characteristics and fruit maturity stage. *Crop Protection.* 78: 48-53.

Abstract

The phytotoxicity of the fruit fly bait GF-120 NF (containing 0.24 g/L spinosad and fruit fly attractants including a protein hydrolysate, ammonium acetate and a number of additives including sugar, polyethylene glycol, polysorbate and soybean oil) on fruit of mandarin (*Citrus reticulata* Blanco cv. *Nadorcott*) was investigated in an orchard in Mpumalanga, South Africa. Trials were conducted on 'Nadorcott' mandarin fruit at different stages of maturity. Droplets of GF-120 were applied on marked areas at the styler ends of fruit in the orchard. The effects of GF-120 concentration, droplet size, droplet

coverage and bait wetness on incidence of phytotoxicity were determined. Phytotoxicity of GF-120 was recorded on 'Nadorcott' mandarin fruit which were at the green and colour-break stages. Incidence of burn increased with increasing concentration of GF-120. Phytotoxicity of GF-120 was accentuated with increasing droplet size, droplet coverage and prolonged wetness of bait droplets. No phytotoxicity was observed when GF-120 was applied on Nadorcott mandarin at full rind colour development. Alternative methods of GF-120 application other than ground-based canopy sprays would therefore have to be sought for 'Nadorcott' mandarin orchards, especially if baiting is to start early before full colour development. Use of other fruit fly management techniques such as bait stations would also help avoid the risk of phytotoxicity on fruit of 'Nadorcott' mandarin at the green and colour break stages.

Keywords: /GF-120 NF/ /'Nadorcott' mandarin/ /Phytotoxicity/

GRAPES

Litcher, A., et. al. 2015. Using auto fluorescence to follow the effect of abscisic acid and leaf removal on color development of 'flame seedless' grapes. Acta Hort. 1091: 183 – 186.

Abstract

Color development of table grapes can be compromised in hot climate and enhanced by the plant growth regulators ethylene and abscisic acid (ABA). The effect of ABA on ripening of 'Flame Seedless' was studied using auto-fluorescence emission from the berries and compared to anthocyanin content in the juice as measured by optical density. In addition, the effect of light during ripening on color development was studied by leaf removal at verison. ABA was applied at 2 time points and 2 rates. The auto-fluorescence was measured using the portable Multiplex III instrument that measures three emission channels derived from four excitation spectra and calculates the ratios between different signals. The FER_RG auto-fluorescence ratio quantified the dose response to ABA and the correlation R^2 values were 0.91 or 0.96 for linear and third order trend lines, respectively. Leaf removal at verison did not improve the color as measured by both methods but it enhanced the FER_RUV ratio which correlates to flavonoid content in grape berries. This study demonstrates the efficiency of non-destructive tools in improving phenotypic analysis of table grapes.

Keywords: /Grapes/ /Maturity/ /Non-destructive/

GUAVA

Teixeira, G. H. A., et. al. 2015. Quality of guava (*psidium guajava* l. cv. pedro sato) fruit stored in low- O_2 controlled atmospheres is negatively affected by increasing levels of CO_2 . Postharvest Biol. & Technol. 111: 62 – 68.

Abstract

Guava is a climacteric fruit, extremely perishable, that has a short shelf life. Controlled atmosphere (CA) and cold storage can be used to extend guava shelf life. However, few studies have been conducted to evaluate the effects of CA storage on guavas, especially with high levels of carbon dioxide (CO_2). Therefore the objective of this study was to evaluate the quality changes of 'Pedro Sato' guava fruit during CA storage with atmospheres containing low concentrations of O_2 and increasing levels of CO_2 . For that, 'Pedro Santo' guavas were stored at 12.2°C for up to 28 days in atmospheres with low oxygen (O_2) concentration (5 kPa) and increasing level of CO_2 (1, 5, 10, 15 or 20 kPa CO_2) in order to evaluate the fruit quality changes. It was possible to identify the relationships among quality variables in

response to atmosphere composition and storage duration which were related to modifications due to ripening (ratio SS/TA, TSS, RS, TA), ripening and early CO₂ injury modifications (pH, SS, chromaticity), and CO₂ injury modifications (hue angle, firmness, soluble pectin). A clear CO₂ injury occurred in fruit stored in 5 kPa O₂+ 15 kPa CO₂ and 5 kPa O₂+ 20 kPa CO₂ after 28 days at 12.2°C, with increasing pH values and soluble pectin content, which were inversely related to fruit firmness. 'Pedro Sato' guavas should be stored in atmospheres with 5 kPa O₂ and no more than 5 kPa CO₂ in order to prevent CO₂ damage. Further investigation is necessary to identify the metabolites responsible for the onset of responses to high CO₂ in guava fruit.

Keywords: /Guava/ /Firmness/ /Postharvest/

KIWIFRUIT

Bolle, A. F., et. al. 2015. Wireless temperature monitoring system in a global **kiwifruit** supply chain. Acta Hort 1091: 205 – 212.

Abstract

New Zealand is a major exporter of fresh kiwifruit. The supply chain is characterised by short and long term storage in New Zealand; two main modes of transport (containers and chartered reefer vessels); multiple distribution and storage channels in markets with varying capabilities to manage the product. The cool chain is the key technology for maintaining a high quality product over a long selling season and a complex supply chain. Improved visibility and accountability for management of temperatures right along the supply chain from harvest to final customer is seen as one of the vital enablers for management of fruit quality. In 2011 the New Zealand kiwifruit industry embarked on a trial to evaluate a potentially transformational method for monitoring the product temperature with a proprietary temperature monitoring system using wireless communication to download data. This technology offers the opportunity to monitor individual pallets with virtually no human intervention and have the data available to users throughout the chain on a web-based platform. The aim of such systems is to provide evidence of best practice and react to alarms and alerts where temperatures are out of specification. The power of these systems, however, is the opportunity to utilise information on the supply chain history to predict out-turn quality. The current pilot has been used to research possible techniques to model fruit quality throughout the chain. One of the major complicating factors has been dealing with vast quantities of often imprecise data and relating these to impacts on fruit quality.

Keywords: /Kiwifruit/ /Supply Chain/

LONGAN

Lin, Y., et. al. 2015. The roles of metabolism of membrane lipids and phenolics in hydrogen peroxide-induced pericarp browning of harvested **longan** fruit. Postharvest Biol. and Technol. 111: 53 – 61.

Abstract

The effects of hydrogen peroxide (H₂O₂), as exogenous reactive oxygen, on browning, membrane lipids metabolism, and phenolic metabolism in a pericarp of harvested 'Fuyan' longan (*Dimocarpus longan* Lour. cv. Fuyan) fruits were investigated. The results showed that as compared to the control fruit, there was a higher browning index, a higher lipoxygenase (LOX) activity and a higher cellular membrane permeability. In addition, there were lower relative contents of unsaturated fatty

acids and higher relative contents of saturated fatty acids, and thereby lower index of unsaturated fatty acids (IUFA) and lower unsaturated degree of fatty acids in the pericarp of H₂O₂-treated longan fruit. Furthermore, the fruit treated with H₂O₂ displayed higher activities of polyphenol oxidase (PPO) and peroxidase (POD), and lower content of total phenolic. These results indicated that H₂O₂-induced browning in the pericarp of harvested longan fruit might be due to an increment of LOX activity and acceleration of unsaturated fatty acids degradation in membrane lipids, which damaged cellular membrane structural integrity, and the consequent loss of cellular compartmentalization that, in turn, resulted in the contact o

Keywords: /Longan/ /Pericarp Browning/

MANGO

Blanes, C., et. al. 2015. Non-destructive assessment of **mango** firmness and ripeness using a robotic gripper. *Food Bioprocess Technol.* 8: 1914 – 1924.

Abstract

The objective of the study was to evaluate the use of a robot gripper in the assessment of mango (cv. "Osteen") firmness as well as to establish relationships between the non-destructive robot gripper measurements with embedded accelerometers in the fingers and the ripeness of mango fruit. Intact mango fruit was handled and manipulated by the robot gripper, and the major physicochemical properties related with their ripening index were analyzed. Partial least square regression models (PLS) were developed to explain these properties according to the variables extracted from the accelerometer signals. Correlation coefficients of 0.925, 0.892, 0.893, and 0.937 with a root-mean-square error of prediction of 2.524 N/mm, 1.579 °Brix, 3.187, and 0.517, were obtained for the prediction of fruit mechanical firmness, total soluble solids, flesh luminosity, and ripening index, respectively. This research showed that it is possible to assess mango firmness and ripeness during handling with a robot gripper.

Keywords: /Mango/ /Non Destructive/ /Firmness/ /Ripening/ /

Charles. F., et. al. 2015. Combined effects of postharvest heat treatment and modified atmosphere on quality of fresh-cut melons and **mangoes**. *Acta Hort.* 1091: 267 – 274.

Abstract

Melon (*Cucumis melo* L.) and mangoes (*Mangifera indica* L.) are highly appreciated by consumers, due to sensory attributes and nutritional content. Producing minimally processed fruits has a potential, because consumers look for freshness and convenience. However, fresh-cut processing increases the decompartmentalization of enzymes and substrates which causes browning, softening and decay. These changes, mainly controlled with low temperature storage and modified atmosphere packaging, are still problems with fresh-cut fruits. This work investigated the effect of combination of heat treatment with modified atmosphere packaging on the quality of fresh-cut melons and mangoes. Whole fruits were dipped in hot water (50°C - 30 min), cooled, minimally processed and packaged in traditional polymeric film (oriented polypropylene, OPP) or biologically-based film (Poly lactic acid, PLA). The heat treatment improved the storage of both freshcut melons and mangoes even if the effect on respiration rate was different. The firmness was maintained due to the MAP. Combining MAP and heat treatment significantly reduced color change and oxidation enzyme activities. It can be concluded that heat treatment combined with MAP could be a good opportunity to preserve the quality of fresh-cut melons and mangoes.

Keywords: /Mango/ /Firmness/ /Modified Atmosphere Packaging/ /Biodegradable Film/

Penchaiya, P., et. al. 2015. Dynamics of firmness and colour of thai **mango** cultivar 'nam dok mai si-thong'. Acta Hort. 1091: 261 – 266.

Abstract

Firmness and colour of Thai mango ('Nam Dok Mai Si-Thong') were assessed (firmness at two opposite sides) at regular intervals during storage at 13°C for 14 days, followed by storage at 28°C for another 8 days. The mangoes were individually labelled and the obtained data were analysed using a logistic decay for firmness and all colour attributes (L*, a*, and b*), including the biological variation within in a batch. The variation in maturity was expressed as biological shift factor. Explained parts of around 90% were obtained for all variables. The biological shift factors are normally distributed. No major difference was found for firmness between both sides of the mangoes. Hardly any relation was found between the biological shift factors of the colour attributes with that of firmness. That confirms that (skin) colour cannot be used to assess the maturity status of firmness in this cultivar. As expected, a pronounced effect of temperature was found, but only on the rate constant of the softening and colour decay process. At 28°C, softening was almost 1.65 times faster and colour development 5 times faster for a* and b* colour aspects than at 13°C. The other model parameters and the model structure were, however, not affected by temperature. That means that in the supply chain, the same model can be used to assess and predict the behaviour of colour and firmness in the entire chain.

Keywords: /Mango/ /Firmness/ /Softening/

Sivankalyani, V., et. al. 2015. Increased anthocyanin and flavonoids in **mango** fruit peel are associated with cold and pathogen resistance. Postharvest Biol. and Technol. 111: 132 – 139.

Abstract

Mango fruit (*Mangifera Indica* L., cv. Shelly) developing at the exterior of canopy and exposed to sunlight acquires a red peel color on the sun-exposed side compared to the green peel fruit that develop within the canopy. Measurements of the red tissue showed a significant increase in total anthocyanin and flavonoids accumulation but not in chlorophyll. The ripening parameters between red and green mango fruit harvested at the same day from the same orchard, including; TSS, firmness and titratable acidity were similar at harvest, during cold storage and further shelf life. However, fruit with a red side or that were mostly green showed a varied response to biotic and abiotic stresses. After three weeks of cold-storage at 5°C 'green fruit' showed significantly more lipid peroxidation and developed significantly more chilling injury symptoms, such as black spots and pitting, than the 'red fruit'. Furthermore, 'red fruit' were found to be more resistant to a challenge of *Colletotrichum gloeosporioides* fungal inoculation and showed reduction in general decay incidence. Thus, mango fruit with more red color in their peel correlates to anthocyanin and flavonoids accumulation, and showed increased resistance to chilling and pathogens. The results point to new agro-technological approaches to extend shelf life and quality in mango.

Keywords: /Mango/ /Anthocyanin/ /Chilling injury/ /Decay/ /Storage/ /Ripening/

Walsh, K. B., et. al. 2015. A case study of a decision support system on **mango** fruit maturity. Acta Hort. 1091: 195 – 204.

Abstract

Mango fruit maturity can be difficult to determine from external attributes. Assessment of parameters of fruit on tree (dry matter, internal flesh colour) relevant to estimation of fruit maturity was undertaken with a handheld (near infrared spectroscopic) system. Measurement error on dry matter was low (typical RMSEP 0.6% DM). Repeated measurements on the same individual fruit from 78 different blocks across two farms demonstrated that each piece of fruit was on a similar, but individual, maturation trajectory, with a time offset. The offset was presumably related to date of pollination or environmental conditions around the fruit (e.g., inner or outer canopy). A non-linear indexed regression model, coupled with the use of a 'biological shift factor', was used to describe the time series data. Estimated biological shift factors were larger for dry matter than flesh colour, indicative of an earlier change in dry matter, albeit at a lower rate. Differences between blocks within a farm and between two farms were small, indicating the maturation processes were independent of local conditions. This technique could be used to trace the source of variation within a block (e.g., to location in canopy or plant water status), towards the goal of reducing this variation, leading to crops of greater uniformity.

Keywords: /Mango/ /Maturation/ /*Mangifera indica*/

MELON

Charles. F., Morgado, C. M. A., et. al. 2015. Combined effects of postharvest heat treatment and modified atmosphere on quality of fresh-cut melons and mangoes. Acta Hort. 1091: 267 – 274.

Abstract

Melon (*Cucumis melo* L.) and mangoes (*Mangifera indica* L.) are highly appreciated by consumers, due to sensory attributes and nutritional content. Producing minimally processed fruits has a potential, because consumers look for freshness and convenience. However, fresh-cut processing increases the decompartmentalization of enzymes and substrates which causes browning, softening and decay. These changes, mainly controlled with low temperature storage and modified atmosphere packaging, are still problems with fresh-cut fruits. This work investigated the effect of combination of heat treatment with modified atmosphere packaging on the quality of fresh-cut melons and mangoes. Whole fruits were dipped in hot water (50°C - 30 min), cooled, minimally processed and packaged in traditional polymeric film (oriented polypropylene, OPP) or biologically-based film (Poly lactic acid, PLA). The heat treatment improved the storage of both freshcut melons and mangoes even if the effect on respiration rate was different. The firmness was maintained due to the MAP. Combining MAP and heat treatment significantly reduced color change and oxidation enzyme activities. It can be concluded that heat treatment combined with MAP could be a good opportunity to preserve the quality of fresh-cut melons and mangoes.

Keywords: /Melon/ /Respiration rate/ /Firmness/ /Modified Atmosphere Packaging/ /Biodegradable Film/

PAPAYA

Hewajulige, I. G. N., et. al. 2015. Extending storage life of commercially important tropical fruits using bio-waxes. Acta Hort. 1091: 283 – 290.

Abstract

Commercial storage of papaya and mango is restricted by postharvest diseases caused by fungi. The use of bio-waxes on storage life extension and quality retention of these commodities was

investigated. Three different bio-waxes (chitosan, ITI wax 1 and ITI wax 2) formulated from locally available ingredients were used in this study. Papaya and mango harvested at commercial maturity were dipped in wax formulations and stored at low temperature at 13°C and 80% relative humidity for 7, 14 and 21 days. Since, chitosan is reported as an antifungal compound, an in vitro antifungal assay was also conducted for disease causing fungi, *Colletotrichum* spp. and *Botryodiplodia* spp. isolated from fruit prior to in vivo assay. In vitro studies on chitosan revealed significant inhibition on radial mycelial growth of the disease causing organisms isolated from these commodities at treatments of 1% chitosan and above. Significant changes were observed in all bio-wax coated fruits compared with non-treated controls with respect to peel colour, firmness, internal CO₂ concentration and respiration rate while other organoleptic characteristics of fruit were not affected. Both papaya and mango coated with 1% chitosan and ITI wax 1 showed improved keeping quality with high marketability throughout the storage period of 14 days at 13±1°C plus 2 days at 28±2°C. Mangoes coated with the ITI wax 1 formulation showed storage life extension of 17 days at the same temperature. Significant increase in the activity of plant defense enzymes, chitinase and β, 1-3, glucanase were observed in the papaya peel samples of chitosan coated fruits compared to controls. The results of this study confirmed that the storage life of these tropical fruits could be extended using bio-waxes without detrimental effects on external and internal quality of fruit.

Keywords: /Papaya/ /Mango/ /Chitosan/ /Storage/

PEACH

Huan, Chen, et. al. 2015. Potential role of *glutathione* peroxidase gene family in peach fruit ripening under combined postharvest treatment with heat and 1-MCP. *Postharvest Biol. & Technol.* 111: 175 – 184.

Abstract

Glutathione peroxidases (GPXs) are central members in the antioxidant system and play an important role in response to oxidant stress. To understand the role of the major molecular players in peach fruit ripening, the GPX gene family was investigated in this study. Eight *Glutathione peroxidase* genes (*PpaGPX1-8*) in peach fruit were isolated from genome databases and characterized using bioinformatics analysis. The expression patterns of GPX genes were analyzed in peach fruit harvested at three different maturity classes and treated with heat + 1-MCP (HM). The unripe fruit were found to have both higher enzymatic and transcriptional capacity compared with the more mature fruit, and the ripe fruit were more sensitive to HM treatment. *PpaGPX6* and *PpaGPX8* were the most abundantly expressed genes at all three maturity classes of peach fruit. All the *PpaGPX* genes (except *PpaGPX1*) showed up-regulated expression in the late stage of ripening (after the peak of respiratory climacteric). Moreover, HM treatment dramatically delayed the postharvest ripening process of peach fruit, by postponing the climacteric peak in respiration, enhancing firmness, increasing GPX activity and up-regulating *PpaGPXs* expression. These data indicated that *PpaGPXs* had a more important regulating function in the late stage of peach fruit ripening.

Keywords: /Peach/ /Ripening/ /Postharvest/

PEAR

Cronje, Arina, et.al. 2015. Canopy position and cold storage duration affects mealiness incidence and consumer preference for the appearance and eating quality of 'Forelle' pears. *Scientia Hort.* 194: 327 – 336.

Abstract

The position of fruit within the pear tree canopy may affect fruit quality characteristics. The objective of this study was to determine whether outer and inner canopy 'Forelle' pears differ in quality attributes and how these differences relate to consumer preference when stored for 9, 12 and 16 weeks at -0.5°C in air and ripened for 7 days at 20°C . Fruit firmness, size, colour, total soluble solids concentration (TSS), titratable acidity (TA), internal ethylene concentration, dry matter concentration (DMC) as well as the incidence of mealiness were determined after each cold storage period and subsequent ripening. The flavour and texture of the pear samples were assessed by a trained panel and consumer groups scored pears for eating quality and appearance. In 2011, inner canopy pears that were cold stored for 12 and 16 weeks and ripened were preferred for eating quality. Mealiness was generally low in inner canopy pears and significantly lower than in outer canopy pears. Mealiness was low for both canopy positions after 16 weeks cold storage plus ripening. While the preference for inner canopy pears after 12 weeks storage may relate to the lower incidence of mealiness, reasons for the preference after 16 weeks cold storage are uncertain. In 2012, the incidence of mealiness in outer canopy pears was double that of inner canopy pears, which may explain the general consumer preference for inner canopy pears. The canopy position effect was less in 2012 when fruit were picked at more optimal firmness (± 6.4 kg) compared to harvesting at pre-optimum firmness (± 7.9 kg) in 2011. Mealiness levels decreased from 9 and 12 weeks cold storage to 16 weeks cold storage in 2012. This study therefore supports the mandatory 12 weeks cold storage period at -0.5°C for 'Forelle' pears to ensure optimum eating quality. In light of the above, inner canopy 'Forelle' pears should not be viewed as inferior to outer canopy pears. The consistent differences in mealiness incidence between inner and outer canopy 'Forelle' pears opens up a new avenue for investigating mealiness development.

Keywords: /Pear/ /Texture/ /Mealiness/ /Quality/

Li, Guopeng, et. al. 2015. Effects of 1-MCP on volatile production and transcription of ester biosynthesis related genes under cold storage in 'Ruanerli' pear fruit (*Pyrus ussuriensis* Maxim.) Postharvest Biol. & Technol. 111: 168 – 174.

Abstract

Fruit of *Pyrus ussuriensis* Maxim. produces an intense aroma accompanied by elevated ethylene levels and fruit firmness loss. Although 1-methylcyclopropene (1-MCP) treatment is an effective method to delay fruit ripening, the effect on aroma of pear fruit remains unknown so far. In this study, fruit of 'Ruanerli' pear (*P. ussuriensis*) were treated by 1-MCP under room temperature, and then transferred to cold storage. Changes in the total volatile concentrations and the volatile composition were detected during storage. Although the amount of total volatiles increased during storage in 1-MCP treated fruit, concentrations of both total volatiles and esters were lower in 1-MCP treated fruit compared with control. The effect of 1-MCP on ester production was stronger than on aldehydes. Different transcript patterns of ester biosynthesis related genes were observed in 1-MCP treated fruit. During the storage period, the transcript levels of *PuLOXs* and *PuAAT* were inhibited dramatically in 1-MCP treated fruit. However, the transcript levels of *PuADHs* were not suppressed in treated pear fruit during storage. Treatment with 1-MCP effectively prolonged the storage time and delayed the fruit firmness loss in pear fruit. The lower content of total volatiles and esters may be ascribed to the suppression of *PuLOXs* and *PuAAT* genes

Keywords: /Pear/ /1-MCP/ /Cold storage/

Ochoa-Velasco, Carlos Enrique, José Ángel Guerrero-Beltrán. 2016. The effects of modified atmospheres on prickly pear (*Opuntia albicarpa*) stored at different temperatures. *Postharvest Biol. & Technol.* 111: 344 – 321.

Abstract

The aim of this study was to evaluate the effect of modified atmosphere packaging (MAP) on fresh prickly pear (*Opuntia albicarpa*). Unpacked prickly pears (control) and packaged under passive ($20.3 \pm 0.1\%$ O₂ and $0.03 \pm 0.0\%$ CO₂) and active ($6.25 \pm 0.1\%$ O₂ and $3.65 \pm 0.1\%$ CO₂) atmospheres were stored at three temperatures (4, 10, and 27 °C). Fruit were evaluated for weight loss, color, firmness, bioactive compounds, microbial load, and sensory characteristics every 10 d for 40 d. Prickly pears, stored under modified atmospheres at 4 and 10 °C. Experienced a delayed weight loss by 1.0% and a total color change (DE) of 13.7 was observed. In general, the firmness of prickly pears stored under modified atmospheres was lower than for unpacked fruit. During storage, phenolic compounds increased in fruit under all storage conditions. Microbial growth increased in fruit packaged in modified atmosphere; however, at low temperatures the microbial growth decreased. Sensory evaluation judges detected changes in color and softening of fruit during storage.

Keywords: /Pear/ /Modified Atmosphere/

Vanoli, M., Grassi, A. Rizzolo Ripening behavior and physiological disorders of 'Abate Fetel' pears treated at harvest with 1-MCP and stored at different temperatures and atmospheres. *Postharvest Biol. & Technol.* 111: 274 – 285.

Abstract

'Abate Fetel' pears are susceptible to superficial scald (SupSc), a storage disorder usually prevented by ethoxyquin treatments, which, being recently banned in Italy, may be replaced by alternative methods such as 1-methylcyclopropene (1-MCP) treatment at harvest and dynamic controlled atmosphere (DCA) storage. Aiming at finding the better strategy to prevent storage disorders and to ensure fruit softening of 'Abate Fetel' pears, the effect of 300 nL L⁻¹ 1-MCP treatment at harvest in combination with two storage temperatures (-0.5 °C, 1 °C), three oxygen levels (21%, air—NA; 2%, controlled atmosphere—CA; 0.8%, DCA) and two storage times (20 and 28 weeks) was studied. 1-MCP treatment strongly reduced ethylene production in pears stored at -0.5 °C, inhibiting softening, yellowing and the development of SupSc, soft scald (SoftSc) and internal breakdown, regardless storage atmosphere and time. NA and DCA treated pears stored for 28 weeks at 1 °C had a sufficient ethylene production to trigger the ripening process, while CA treated pears stored in the same conditions were less able to recover the ripening capacity. Treated pears stored for 28 weeks at 1 °C developed SupSc in NA and SoftSc in CA fruit, even if the severity was slight and fruit were still marketable. DCA control fruit stored at -0.5 °C for 20 weeks were capable to soften to an eating quality, showing low incidence of storage disorders. NA and CA control fruit stored at -0.5 °C well ripened, but showed a very high SupSc incidence in NA and developed SupSc, SoftSc and internal breakdown, even if at slight severity, in CA. After 28 weeks at -0.5 °C, storage disorders incidence in control fruit dramatically increased in all the atmospheres and pears became unmarketable. Control fruit stored at 1 °C were not marketable having the worst quality characteristics and the highest incidence of storage disorders regardless storage atmosphere and time.

Keywords: /Pears/ /Ethylene/ /Firmness/ /Superficial Scald/ /1-Methylcyclopropene/

Xie, Xingbin, et. al. 2015. Initiation of ripening capacity in 1-MCP treated green and red 'Anjou' **pears** and associated expression of genes related to ethylene biosynthesis and perception following cold storage and post-storage ethylene conditioning. *Postharvest Biol. & Technol.* 111: 140 – 149.

Abstract

1-Methylcyclopropene (1-MCP) is valuable technology for control superficial scald (SS) and to extend storage life of European pears, but initiating ripening capacity (RC) of the 1-MCP treated fruit following cold storage is a challenge. Green 'Anjou' and its bud mutation red 'Anjou' pears at commercial maturity were treated with 1-MCP at 0.15 mL L⁻¹ and stored at -1°C for 7 months. While control fruit of both cultivars developed RC and SS, 1-MCP treated green and red pears developed neither RC nor SS in 7 d at 20°C following 2–7 months of storage. RC development was triggered by post-storage ethylene conditioning (PSEC) in 1-MCP treated red but not green pears following 6–7 months of storage. Ethylene production increased in control fruit and was inhibited by 1-MCP in both green and red pears during storage, however, the 1-MCP treated red but not green pears increased ethylene production after 5 months of storage. PSEC enhanced the ethylene production in 1-MCP treated red but not green pears following 6–7 months of storage. In correspondence, the expression of ethylene synthesis genes (PcACO1, PcACS1, PcACS2, PcACS4, and PcACS5) increased after 6 month of storage in 1-MCP treated red but not green pears. The signal genes (PcETR1, PcETR2, PcETR5 and PcCTR1) were stable at extremely low level in 1-MCP treated green and red pears during cold storage. PSEC up-regulated PcACO1 and PcETR2 after 6 months of storage, and down-regulated the other genes in 1-MCP treated red pears, while it down-regulated all the genes in 1-MCP treated green pears. In conclusion, PcACO1 may play an important role in initiating ripening capacity in 1-MCP treated red 'Anjou' pear upon PSEC.

Keywords: /Pear/ /1-MCP/ /Ripening/ /Ethylene/

PERSIMMON

Fang, F., et. al. 2105. *DkMYB6* is involved in **persimmon** fruit deastringency, via transcriptional activation on both *DkPDC* and *DkERF*. *Postharvest Biol. and Technol.* 111: 161 – 167.

Abstract

Postharvest deastringency is important for persimmon fruit, since most cultivars are of the astringent type. In the present research, astringency as indicated by the decrease in soluble tannin content, was removed from 'Mopan' persimmon by placing them in an atmosphere of 95% CO₂. In contrast to the decrease in soluble tannin, increases in concentrations of acetaldehyde and ethanol were transiently triggered by CO₂ treatment. Four *DkMYB* genes, *DkMYB5–8*, belonging to the R2R3 MYB family, were isolated. mRNA accumulation studies indicated that *DkMYB5–8* were up-regulated by CO₂ treatment, and that expression was positively correlated with persimmon fruit astringency removal. However, using a dual-luciferase assay, only one of these four *DkMYB* genes, *DkMYB6*, showed the ability to trans-activate the promoters of the previously identified persimmon fruit deastringency-related genes *DkPDC2* and *DkPDC3*. Furthermore, *DkMYB6* were also observed to be an activator of the previously characterized deastringency regulators, *DkERF9* and *DkERF19*. Thus, *DkMYB6* is a putative transcriptional activator, induced by high CO₂, which is involved in persimmon fruit deastringency, by operating on both *DkPDC* structural genes and *DkERF* transcription factors.

Keywords: /Persimmon/ /Postharvest/ /Deastringency/

PITAYA FRUIT

Garcia-Cruz, Leticia, et.al. 2015. Postharvest quality, soluble phenols, betalains content, and antioxidant activity of *Stenocereus pruinosus* and *Stenocereus stellatus* fruit. Postharvest Biol. and Technol. 111: 69 – 76.

Abstract

Fruit of the *Stenocereus* genus have good acceptance and high potential in the fresh fruit market. However, their use is limited to regional production areas due to they are highly perishable and the postharvest behavior has not been studied. The objective of the work was to characterize morphological, physio-logical, physical, and chemically, red and orange fruit of *Stenocereus pruinosus*, and red and white fruit of *Stenocereus stellatus* in postharvest. Storage during 10 d at 24°C was carried out and shelf life was estimated in six days. Respiration rate suggested non-climacteric behavior. Color, acidity, pH, soluble phenols content, and betalains content distinguished fruit. These variables, besides total soluble solids, remained without significant changes throughout the storage period, but weight loss, firmness, and total sugar content experimented modification. Antioxidant activity was highest in red fruit.

Keywords: /Pitaya Fruit/ /Postharvest/

POMEGRANATE

Mayuoni-Kirshenbaum, L. and R. Porat,R. 2015. Defining minimum maturity indices for harvest and marketing of early season 'Acco' **pomegranate** fruit. Acta Hort. 1089. 453 - 458.

Abstract:

In order to send the produce early to the market, growers tend to harvest early-season pomegranate fruit prior to its maturity which often results in immature fruit with low flavor and quality. Therefore, in order to standardize minimum maturity indices for harvest of the early-season pomegranate cultivar 'Acco', fruits were evaluated to know the quality parameters at 10-day intervals during the last period of the ripening process. It was found that slight changes only in peel and aril color, juice total soluble solids and acid contents were observed with gradual increase in fruit and aril weights during the last stage of ripening. Further, gradual and significant increase was observed in fruit flavor preference that was accompanied by a decrease in perception of undesired astringency mouth-feel sensation during the final stages of ripening. High correlation between flavour preference and aril weight ($r_2=0.92$) was observed, aril weight of more than 0.25 g might be considered as a simple and reliable maturity index for determining the period for commercial harvest of early-season 'Acco' pomegranate fruit.

Keywords: /Pomegranate/ /Maturity/ /Astringency/ /Ripening/

Mayuoni-Kirshenbaum, L. and R. Porat. 2015. Factors governing sensory quality of **pomegranate** fruit. Acta Hort. 1089: 307 - 310.

Abstract

A combination of various taste (sweet, sour, bitter), aroma (red wine, fruity and off-flavor odors), and mouthfeel sensations (astringency, juiciness and seed hardness) resulted in perceivable flavor of pomegranate. Sensory analysis tests explored wide varietal variability in sensory quality of pomegranate arils among distinct cultivars, comprised of large variations in perception of sweetness, sourness, bitterness, red-rind, fruity odors and seed hardness. Furthermore, sensory quality and flavor preference of pomegranate arils considerably altered during the ripening process. Sweet-sour cultivars expressed a significant decrease in perception of 'sourness', whereas in "sweet" cultivars a significant decrease in perception of 'astringency' mouthfeel was noticed. Gradual decrease in flavor preference, which was attributed to a decrease in typical 'fruity' pomegranate odor and increases in 'overripe' and 'off-flavor' odors was observed during prolonged storage. Overall the importance of selection of exclusive cultivars could be emphasized with high preferred flavor and to harvest fruit at optimal maturity and not to store the fruit too long after harvest.

Keywords: /Pomegranate/ /Ripening/ /Storage/

Nerya, O. and A. Levin. 2015. Innovative treatment of pomegranates from harvest to market. Acta Hort. 1089: 489 – 493.

Abstract:

The greatest global marketing challenge is to supply the markets with high quality edible pomegranates throughout the year. Extension of shelf-life requires advanced R&D systems, and modern cold storage facilities. Israel produces more than 60,000 t of pomegranates annually, the majority for export. The fruit requires careful cultivation techniques, including tree forming and plant protection from the early stages of flowering and fruit formation, through postharvest treatments, cold storage, packing and export. Extension of the marketing season required development of storage methods for the late ripening cultivar 'Wonderful'. Indicators were developed to determine optimal timing of harvesting: necessary conditions for extending storage periods included a deep red color, both inside (the arils) and out (the peel), sugar content exceeding 16% and a total lack of blemishes or defects. Appropriate storage methods differ according to the grower's marketing goals. The following systems can be noted: (a) traditional storage, without cooling, allows domestic marketing only, over a one- to two-week shelf life; (b) storage over 1-2 months in a regular atmosphere (RA) at temperatures between 0-5°C, produces quality fruit throughout the period. More sophisticated storage techniques that allow extension of shelf life include: (a) modified atmosphere (MA) at 5-7°C allowing storage over 2-3 months while maintaining high quality; (b) controlled atmosphere (CA) at 5-7°C and suitable relative humidity offers the greatest marketing flexibility, including sales even beyond 3-5 months while maintaining high fruit quality and exportability. Special techniques developed in Israel prevent fruit weight loss, protect against storage diseases and allow shipment of desired cultivars to top European markets. The exporters are not limited by the harvest season and have a marketing potential of close to six months. These capabilities require modern cold storage facilities. Investment in such systems under Israeli conditions ranges between € 1,500-2,000 per ton of storage capacity.

Keywords: /Pomegranate/ /Harvesting/ /Storage/

Porat, R., et. al. 2015. Reduction of crown rots development during storage of pomegranate fruit by preharvest and postharvest fungicidal treatments. Acta Hort. 1089: 173 – 178.

Abstract

Crown rot decay caused by the gray mold *Botrytis cinerea* and *Penicillium* sp. is responsible for severe economic losses during postharvest storage and marketing of pomegranate fruit. In the present study, the efficacy of Switch® and Scholar® (Syngenta Crop Protection Inc., NC, USA) fungicides as pre- and postharvest sprays on development of crown rots in pomegranate fruit was evaluated. It was found that preharvest sprays with 0.1% Switch®, at the end of flowering/beginning of fruit set period significantly reduced postharvest crown rot decay development by 60 to 75%. In addition, dipping of fruits after harvest in 0.15% Scholar® further reduced crown rot decay development by similar rates of 60 to 80% as compared with control untreated fruit. In both pre- and postharvest treatments, it was not possible to reduce decay to a level below 10%. The residual level of fungus after harvest was below the permitted thresholds. Overall, the feasibility to reduce crown rot decay development by pre- and postharvest fungicidal treatments was demonstrated.

Keywords: /Pomegranate/Botrytis/ /Crown Rot/

Shlomo, M. 2015. Efficiency of bagging pomegranate fruits. Acta Hort. 1089: 485 – 488.

Abstract

Bagging is an important physical protection method to pomegranate (*Punica granatum*). However, in Israel the method is not widespread because the economic benefits of bagging exceed the high expenses involved, and the reduced export quality. In this article, we studied the efficiency of bagging pomegranate. The results suggested that bagging, by the method employed, had multiple and contradictory effects. Similarly, bagging provides, as expected, good mechanical protection against serious pest infestation after bagging. The problem seems to be the pest and disease situation on the fruit at the time of bagging. It appears that such a simple method as bagging, in order to give the optimal results, requires investments to obtain necessary detailed information about the phytopathological situation in the field. It forces us to identify the problems and their relative importance in order to implement the appropriate protective methods. Thus, instead of a complete cover, as we employed, introducing bags of the right mesh can provide better ventilation and accession of the pesticides while preventing damage by larger pests. Experiments are under way to find the right mesh to bag with, open bags at the bottom, use of air transmissible plastics and devices to save labor in the process of bagging.

Keywords: /Pomegranate/ /Bagging/

RAMBUTAN

Wijesinghe, C.J., et.al. 2015. A liquid formulation for biological control of anthracnose in rambutan. Acta Hort. 1091: 117 - 129.

Abstract

The anthracnose pathogen *Colletotrichum gloeosporioides*, is a major cause of postharvest loss of rambutan in Sri Lanka. Results of our investigation demonstrated antagonistic activity of *Trichoderma asperellum* against a rambutan isolate of *C. gloeosporioides*. The antagonistic activity was mainly due to coil formation around the pathogen hyphae by *T. asperellum*. Fungicidal activity was observed when rambutan fruit inoculated with 10⁵ conidia/ml of *C. gloeosporioides*, were treated with the formulation containing spores of *T. asperellum* within 10 and 30 min after inoculation. Treated fruit were observed

to be free of disease when stored at $28\pm 2^{\circ}\text{C}$ for 7 days. Fruit treated with the control formulation (formulation without conidia) and untreated control fruit showed characteristic symptoms of anthracnose disease. Anthracnose symptoms were also observed on fruit that were inoculated with *C. gloeosporioides* and held as inoculated controls under similar storage conditions. Chemical parameters including pH and titratable acidity among treated, untreated (controls) and fruit treated with the control formulation showed no significant differences. The formulation was observed to be effective when stored at ambient temperature of $28\pm 2^{\circ}\text{C}$ for a period of up to 6 months. The data suggest that a formulation of *T. asperellum* might be an alternate, eco-friendly method for the control of anthracnose disease of rambutan.

Keywords: /Rambutan/ /Biocontrol/

RASPBERRIES

Junqueira-Gonçalves, Maria Paula. 2016. The efficacy of potassium sorbate-coated packaging to control postharvest gray mold in raspberries, blackberries and blueberries. Postharvest Biol. & Technol. 111: 205 – 208.

Abstract

The aim of this work is to build on the success of in vitro studies of an active packaging, produced by coating the surface of post-consumer recycled polyethylene terephthalate (PCRPET) package with an aqueous silicone solution (2%, v/v) containing an antifungal agent (potassium sorbate, KS). Antifungal efficacy was evaluated, in vivo, during the storage of raspberries, blackberries and blueberries by examining their shelf life extension. The packaging effectively delayed the growth of Botrytis by extending its lag-phase, which, in turn, extended the shelf life of the berries by up to 3 d. Among the three berries tested, the packaging proved to be more advantageous in the case of raspberries, due to their physiological characteristics and shorter shelf life. Based on sensory panel evaluations, it was shown that the coating, containing KS, did not influence the packaging appearance and transparency, and the fruit did not suffer from any off-flavor development.

Keywords: /Raspberries/ /Blackberries/ /Blueberries/ /Active Packaging/ /Shelf Life/ /Botrytis Cinerea/

STRAWBERRY

Bishop, C.F.H. 2015. The use of It'sFresh! ethylene adsorption pads to reduce the effects of temperature breaks in the supply chain. Acta Hort. 1091: 91 – 94.

Abstract

It'sFresh! ethylene adsorption active "e+™" is in commercial use, being contained within a hydrophobic and breathable pad, and used on a number of products including strawberries. No treatment can completely replace correct temperature management with fresh produce, but the potential of It'sFresh! Pads has been evaluated in a trial mimicking a temperature break in the supply chain for strawberries. Fruit were harvested and packed commercially and sent through the standard cool chain before having a break for 24 h at $18\text{-}22^{\circ}\text{C}$ and then being placed in a cold store set at $6\text{-}7^{\circ}\text{C}$. The trial was carried out with 100 punnets per week of two cultivars with 100 punnets with the pads placed in at harvest and 100 punnets without the pads for a 12-week period. Five punnets of each cultivar, with and without the pads, were assessed each day until 50% of the berries in all treatments

were considered to have rot or mould. The punnets with the pads were found to have approximately two days more shelf life than those without.

Keywords: /Strawberry/ /Temperature/ /Ethylene/

Chen, Jingxin, et.al. 2016. Involvement of abscisic acid in postharvest water-deficit stress associated with the accumulation of anthocyanins in **strawberry** fruit. *Postharvest Biol. & Technol.* 111: 99 - 105.

Abstract

Fruits are prone to suffer water-deficit stress and accelerated senescence after harvest. To understand the effect of postharvest water-deficit on the senescence progress of strawberry fruit, fruit peduncles were dipped into water or abscisic acid solution and stored at 20°C with 50% relative humidity in the dark. The results showed that detached fruit without water supply through the peduncles suffered serious water-deficit stress with great weight loss and low moisture content. However, fruit absorbing water through their peduncles successfully avoided the water-deficit stress with a slight change of weight loss and moisture content. Water-deficit significantly promoted anthocyanin levels with increased PAL, C4H and DFR activities. The expressions of transcriptional factors that regulate anthocyanin biosynthesis (FaMYB1, FabHLH3 and FaTTG1) were also up-regulated under water-deficit stress. Meanwhile, stress elevated the abscisic acid level as well as FaNCED1 and FaASR expression in strawberry fruit. Furthermore, exogenous ABA application exhibited the similar features with water-deficit stress. These results suggested that postharvest water-deficit would accelerate anthocyanin accumulation in strawberry fruit and that abscisic acid may play a role in the response to water-deficit stress.

Keywords: /Strawberry/ /Abscisic Acid/ /Anthocyanin/

Samec, Dunja, et.al. 2016. Assessment of the differences in the physical, chemical and phytochemical properties of four **strawberry** cultivars using principal component analysis. *Food Chem.* 194: 828 – 834.

Abstract

The worldwide established strawberry cultivar 'Albion' and three recently introduced cultivars in Europe: 'Monterey', 'Capri', and 'Murano', grown hydroponically, were studied to ascertain the influence of cultivar and harvesting date on the physical, chemical, antioxidant and phytochemical properties of their fruits. Interrelationships of investigated parameters and these cultivars were investigated by the statistical approach of principal component analysis (PCA). Results indicated that cultivar had a more significant effect on the analyzed parameters than harvesting date. Thus grouping of the variables in a PCA plot indicated that each cultivar has specific characteristics important for consumer or industrial use. Cultivar 'Monterey' was the richest in phytochemical contents and consequently in antioxidant activity, 'Albion' showed the highest contents of total soluble solids, titratable acidity content and ascorbic acid, 'Capri' had the highest value of firmness, while 'Murano' had lighter color in comparison to others. Potential use of these cultivars has been assessed according to these important measured attributes.

Keywords: /Strawberry/ /Antioxidant/ /Phytochemical/ /Harvesting/

TABLE GRAPES

de Lima, C.P.F., et.al. 2015. Maintaining table grape quality by applying quarantine treatments during cooling. Acta Hort. 1091. 55 - 62.

Abstract:

'Red Globe', 'Thompson Seedless' and 'Crimson Seedless' grapes were picked directly into ventilated polystyrene boxes and chilled for 6-8 h to approximately 20°C before being fumigated with 52.6 g m⁻³ ethyl formate + 21.6% carbon dioxide to treat external pests and stages likely to be found in harvested produce: 1st-3rd instar light brown apple moth and red back spiders; long-tailed mealy bug crawlers; adult two spotted spider mites, plague thrips and western flower thrips. Fumigation was applied for 2.5 h at 21°C in a refrigerated shipping container (68 m³) while cooling to 15°C. Cooling was continued to 1 and 2°C for 16 and 18 days, respectively to simulate control of Mediterranean and Queensland fruit flies. The results show that pests in harvested grapes can be killed and optimum fruit quality maintained in the cool chain.

Keywords: /Table Grapes/ /Fruit Flies/

YOUNG COCONUT

Meethaworn, K., et al. 2015. Postharvest behavior during storage of young coconut *Cocos nucifera* L. at different temperatures. Acta Hort. 1091: 125 – 132.

Abstract:

Trimmed young coconuts wrapped with PVC film have a short storage life. Current commercial shipments are carried out at 3-6°C without visual chilling symptoms. Experiments were conducted to study chemical composition and postharvest features of intact and trimmed fruit wrapped with PVC film and stored at 4 and 25°C. After 3 weeks at 25°C, coconut water had a slight off-flavor score while at 4°C a strong off-flavor score was observed. Similar findings were found in the coconut kernel but the scores were higher. Trimmed fruit had a much higher respiration and ethylene production rate than intact fruit. At 4°C, the coconut water had about 100-300 nl L⁻¹ dissolved O₂, but at 25°C, O₂ could not be detected. TBA reactive compounds in coconut water at 25°C increased slightly during storage, while at 4°C it was about 50% higher than 25°C after 2 weeks of storage. TBA reactive compounds in the coconut kernel were 3 times higher than in coconut water, but there was no difference between the two storage temperatures. Electrical conductivity in coconut water at 4 and 25°C was similar, while the electrolyte leakage from the kernel at 4°C was 20% higher than at 25°C. The data suggested that 4°C was a suboptimal storage temperature for young coconut.

Keywords: /Young Coconut/ /Chilling Injury/ /

VEGETABLES

BAMBOO SHOOT

Liu, Zhanli, et.al. 2016. Effect of brassinolide on energy status and proline metabolism in postharvest bamboo shoot during chilling stress. Postharvest Biol. & Technol. 111: 240 – 246.

Abstract

In this study, the effects of brassinolide treatment on chilling injury, energy status and proline metabolism in postharvest bamboo shoots (*Phyllostachys praecox* f. *prevernalis*) at 1 °C were investigated. It was shown that chilling injury of bamboo shoots during 42-day storage was effectively reduced by brassinolide treatment at the concentration of 0.5 mM. In terms of energy status, brassinolide treatment significantly inhibited the increase of electrolyte leakage and the accumulation of malondialdehyde. Meanwhile, brassinolide treatment markedly retarded the decline of ATP content and maintained higher energy charge. Enzyme activities of energy metabolism including H⁺-ATPase, Ca²⁺-ATPase, succinate dehydrogenase (SDH) and cytochrome C oxidase (CCO) were significantly enhanced by brassinolide treatment. Bamboo shoots treated by brassinolide treatment promoted D1-pyrroline-5-carboxylate synthetase (P5CS) and ornithine-d-aminotransferase (OAT) activity and inhibited proline dehydrogenase (PDH) activity, which elevated proline accumulation. These results suggest that the alleviation in chilling injury by brassinolide may be caused by enhanced enzyme activities related to energy and proline metabolism.

Keywords: /Bamboo Shoot/ /Chilling Injury/ /

BITTER GOURD

Muchjajib, S. and U. Muchjajib. 2015. The development of a production system and postharvest handling for Gac fruit (*Momordica cochinchinensis*): knowledge transfer to a community enterprise in Thailand. *Acta Hort.* 1091: 63 – 66.

Abstract:

Spiny bitter gourd or Gac fruit (*Momordica cochinchinensis*) is a tropical cucurbit indigenous to Southeast Asia where it is widely used as food and traditional medicine. The mature fruit contains high levels of antioxidant phytonutrients including lycopene, beta-carotene, lutein, phenolic acid and flavonoid. A drink prepared from the Gac fruit aril has recently been commercialized in the Thai market, and Gac fruit is now cultivated throughout the country. Production and postharvest handling technologies for Gac fruit were transferred to the Thamakhom Community, Kanchanaburi Province. Staff of Rajamangala University of Technology Suvarnabhumi, the Organic Agricultural Innovation Network and the Thamakhom Community Enterprise collaborated on the project. The optimal propagation technique was cutting establishment, taking only 7 days for rooting; seed propagation required 45-60 days. Pruning is recommended to obtain maximum fruit yield (9.05 t ha⁻¹ y⁻¹); the non-pruned plants produced 6.46 t ha⁻¹ y⁻¹. To protect the fruit from the melon fruit fly (*Bactrocera cucurbitae*), fruit wrapping was recommended. After harvesting, to minimize the storage space requirement, the red aril membrane was removed from the fruit, packed in polyethylene bags, and stored at -15°C to be available year-round. The beta-carotene content decreased slightly after one year of storage (to 11,300 µg from 13,500 µg 100 g⁻¹).

Keywords: /Bitter Gourd/ /Postharvest Handling/

BROCCOLI

Hasperue, Joaquin, H. et.al. 2016. Continuous white blue LED light exposition delays on postharvest senescence of broccoli. *LWT - Food Sci. & Technol.* 65: 495 - 502.

Abstract

In this work, the impact of low intensity ($20 \text{ mmol m}^{-2} \text{ s}^{-1}$) continue illumination with white and blue light-emitting diodes (WB LED) on the shelf life of broccoli heads stored at 5°C or at 22°C was assessed. At both temperatures, heads stored under WB LED showed the highest levels of chlorophylls, reflected in a higher Hue angle and lower L* values compared to controls stored in the darkness. Also, during storage at 22°C the treated samples had a slower rate of sugar lost compared to dark stored controls. At 5°C, glucose and fructose levels were maintained and sucrose was increased by the WB LED treatment. The dark stored controls showed the highest accumulation of antioxidant compounds, but there were no differences in ascorbic acid content except for the last storage day at 5°C, being the WB LED samples which had a slightly higher level ($p < 0.05$). Finally, treated samples showed an increment in the total carotenoid content, mainly during storage at 22°C. According to the results, WB LED treatment would be a feasible and low cost technology to enlarge the postharvest storage of whole broccoli heads.

Keywords: /Broccoli/ /Storage/ /Antioxidants/ /Postharvest/

CABBAGE

Shiina, T., et.al. 2015. Response mechanisms of **cabbage** head to different strength levels of mechanical impact stress. Acta Hort. 1091. 311 - 318.

Abstract

Fresh fruits and vegetables are exposed to various stresses during harvesting and postharvest handling. The responses of fresh produce to mechanical stress such as wounds and mechanical injuries can lead to the onset of physiological disorders and quality deterioration. We previously found that mechanical impact stress affected changes in respiration rate, ethylene production, and compositional properties of fresh produce. Impact stress also induces a wide range of responses through gene expression relating signal transduction and cellular metabolism. In this study, we investigated the effect of different strength levels of mechanical impact stress (dropping treatment; 0, 5, 10, 20, or 40 cm height) on stress-responsive gene expression which is implied to influence the cellular metabolisms and storage quality of postharvest cabbage head. Dropping treatment enhanced the expression of calmodulin (CaM)-encoding gene (*BoCam1*), phospholipase D (PLD)-encoding genes (*BoPLD1* and *BoPLD2*), and ascorbate peroxidase (APX)-encoding gene (*BoAPX2*), lipoxygenase (LOX)-encoding gene (*BoLOX*), and S-adenosyl-methionine (SAMS) encoding gene (*BoSAMS*). However, the highest expression level of each gene was observed differently depending on the impact strength level and time period after dropping application. From overall results, the rapid stress response behavior of *BoCam1* (0.5 h) and *BoAPX2* (1 h) indicated their action at the early stage of stress response metabolism, which are reported to be homologue to the model plants. Delayed response of *BoPLD1* (3 h), *BoPLD2* (3 h), *BoSAMS* (3 h), and *BoLOX* (3 days) demonstrated the downstream cascade of stress responses, possibly affecting the changes in eating quality of cabbage.

Keywords: /Cabbage/

Thammawong, M., et.al. 2015. Oscillations of respiration relating gene expressing in postharvest **cabbage** head under different controlled atmosphere (CA) storage regimes. Acta Hort. 1091: 303 - 310.

Abstract

Exposure of fresh horticultural crops to modified/controlled atmospheres (low O₂ and/or increased CO₂) within the range tolerated by each commodity reduces their respiration rate and cellular

metabolisms. However, outside this range respiration and metabolism of fresh produce can be altered indicating a stress response. This stress can contribute to incidence of physiological disorders and increased susceptibility to decay. In order to understand the response behavior of cabbage under stress such as controlled atmosphere (CA) treatment, gene expression patterns in cabbage tissues which were held in nine regimes with different CO₂ and O₂ concentrations were examined at 24 or 48 h after the treatment. The differential increases in gene expression level of cabbage under CA treatment were clearly observed. Changing pattern of each gene also appeared to depend on different percentages of CO₂ and O₂. Obvious elevated gene expression were detected in the *BoGAPDH* (glyceraldehyde 3-phosphate dehydrogenase (GAPDH)-encoding gene), *BoADH* (alcohol dehydrogenase (ADH)-encoding gene), and *BoCTS* (citrate synthase (CTS)-encoding gene) at 24 h after the treatment. These genes reveal the close relationship to the CA practice. However, the expression of *BoH XK1* and *BoH XK2* (hexokinase (H XK)-encoding gene), and *BoGDH* (glutamate dehydrogenase (GDH)- encoding gene) was observed at low level during investigation period. Additionally, changes in sugar concentration during 2 days of this investigation seemed not to be influenced by CA treatment and gene expression.

Keywords: /Cabbage/ /Controlled Atmosphere Storage/

CAULIFLOWER

Tawema, Pamphile, et.al. 2016. Antimicrobial effects of combined UV-C or gamma radiation with natural antimicrobial formulations against *Listeria monocytogenes*, *Escherichia coli* O157: H7, and total yeasts/molds in fresh cut **cauliflower**. LWT - Food Sci. & Technol. 65: 451 - 456.

Abstract

The aim of this study was to investigate the utilization of low doses of UV-C (5 and 10 kJ/m²) and gamma irradiation (0.5 and 1 kGy) treatments combined with natural antimicrobial formulations (oregano or lemongrass essential oil plus citrus extract and lactic acid), to inhibit the growth of *Listeria monocytogenes*, *Escherichia coli* O157:H7, and total yeasts and molds, on cauliflower. Unlike the usual procedure for this type of combination, irradiation was applied before spraying of natural antimicrobial formulations with 5 ml per 100 g of cauliflower, because this approach had shown better long-term effectiveness. The combination of gamma irradiation at 1 kGy with natural antimicrobials reduced the population of *L. monocytogenes* as well as *E. coli* O157:H7 below the detection limits during the storage period. Yeasts and molds were significantly inhibited by gamma irradiation at both 0.5 and 1 kGy. The spraying of natural antimicrobial formulations following application of UV-C led to a significant inhibition of all target microorganisms.

Keywords: /Cauliflower/ /Food Pathogens/ /Gamma Irradiation/ /Shelf life/

Berardinellia, Annachiara, et.al. 2016. Sanitisation of fresh-cut **celery** and radicchio by gas plasma treatments in water medium. Postharvest Biol. & Technol. 111: 297 – 304.

Abstract

The antimicrobial efficacy of dielectric barrier discharge atmospheric gas plasma (DBD) was tested against *Listeria monocytogenes* and shigatoxin-producing *Escherichia coli* serogroups O157 and O26. Challenge tests were carried out with samples of cut celery and radicchio leaves inoculated with a mix of five strains of *L. monocytogenes* or the two strains of *E. coli* immersed in deionised water. The treatment efficacy was also assessed considering only the contaminated deionised water. For deionised inoculated water alone, a treatment time-dependent strong effect was observed and a pathogens

reduction higher than 6 Log CFU/mL was obtained after 40 min of treatment. With the vegetables presence in the liquid medium, the efficacy appeared reduced and related to the treatment time, microorganism, substrate and storage duration (reduction up to 2.5 and 3.7 Log CFU/cm² for *L. monocytogenes* and *E. coli*, respectively). No significant changes were observed on celery visual attributes, soluble solids content and textural parameters. A significant decrease of the chroma colour parameter during storage was noted in treated radicchio samples respect to control ones.

Keywords: /Celery/ /Quality/ /Storage/

GARLIC

Wu, Cuinan, et.al. 2015. Growth, bolting and yield of **garlic** (*Allium sativum* L.) in response to clove chilling treatment. *Scientia Hort.* 194: 43 – 52.

Abstract

Garlic (*Allium sativum* L.) has been long favored as a seasoning and as a seasonal vegetable all over the world. However, the production of fresh garlic scapes and bulbs is extremely limited by the climate and region, especially the temperature and photoperiod, under natural production conditions, and the uncertainty of the vernalization characteristic of garlic has been a key restriction to the developmental regulation of bolting and bulbing. A thorough understanding of the vernalization conditions for garlic growth should improve our knowledge of the bolting and bulbing processes. This research was conducted to assess the response of the clove to chilling treatment and further demonstrate whether chilling treatment on garlic clove could substitute the vernalization requirements for garlic plant. Before planting, the cloves (cv. G064) were subjected to low temperature (5°C, 10°C, 15°C) for different durations (20 days, 40 days or 60 days) for chilling treatment. The control cloves or plants remained in the 20–22°C regime throughout. Then, the plant growth, bolting and garlic yield were evaluated during field growing. The results indicate that pre-plant chilling treatment significantly affects garlic plant growth and development, and could act as the vernalization and enable the garlic plant to bolt without undergoing chilling during plant growth. Lower temperatures and longer treatment durations significantly enhanced the leaf elongation, shortened the growth period (5°C or 60 days), promoted the rate of one-clove bulbs (5°C or 40 days), stimulated bolting and increased the bolting rate (10°C) compared with the control. However, the bolting rate and low-temperature treatment did not follow a simple linear relation, as lower temperatures (5°C) or higher temperatures (15°C) were not beneficial to garlic bolting. It was found that garlic plants subjected to a treatment of 10°C for 20/40 days or 5°C for 20 days had comparatively higher bolting rates. Nevertheless, the garlic bulb yield and mean bulb weight decreased significantly as a function of the increasing period of the chilling treatment compared with the control. The treatment of 5°C for 20 days had the greatest yield among all the treatments, second only to the control. These findings provide strong evidence for the potential cultivation of garlic of various cultivars in various climates or seasons, making off-season cultivation possible. Other researchers could use a similar methodology to shorten the period needed until harvest or even produce desirable scapes and bulbs in the warm season.

Keywords: /Garlic/ /Chilling Treatment/

CUCUMBER

Adoma, P. and B. K. Maalekuu . 2015. The influence of some postharvest treatments on staked and non staked **cucumber** fruit quality during storage at ambient room temperature. *Acta Hort.* 1091: 133 – 140.

Abstract

Freshly harvested fruits of three cultivars of cucumber ('F₁ Tokyo', 'Market More' and 'Poinsett') (*Cucumis sativus* L.) were subjected to four postharvest treatments, hot water dip, CaCl₂ dip, NaCl dip and tap water wash as a control, and stored under ambient room conditions for fifteen days. During the storage period quality parameters such as general appearance, colour change, total soluble solids fruit firmness, weight loss, decay and dry matter content were assessed. Significant differences were observed among the treatments as well as between the cultivars of staked and non-staked cucumber fruits based on the parameters studied. The results indicated that the cultivar 'Market More' treated with hot water at 45°C for 2 min had the firmest fruits compared to the other treatments and cultivars. CaCl₂ dip was able to reduce the rate of decay in cucumber fruits and, hence, prolong the shelf life as well as maintain fruit quality. A calcium chloride dip and hot water dip were the most effective treatments in maintaining fruit quality. The overall performance of staked fruits was better than that of the non-staked, as staked fruits were firmer, lost less weight, and showed a uniform colour and better general appearance. Cultivar by preharvest staking and cultivar by treatment interactions had significant effects on the quality parameters. These results showed that hot water treatment was effective in controlling postharvest decay organisms and in maintaining the physical and chemical quality of the fruits, and should be considered as a non-chemical control method for the control of decay during storage of cucumber fruits.

Keywords: /Cucumber/ /Chemical Dips/ /Quality/ /Storage/

Mohammadi, Ali, et. al. 2016. Integration between chitosan and *Zataria multiflora* or *Cinnamomum zeylanicum* essential oil for controlling *Phytophthora drechsleri*, the casual agent of **cucumber** fruit rot. LWT - Food Sci. & Technol. 65: 349 - 356.

Abstract

This study reports the efficacy of chitosan (CS) in combination with *Zataria multiflora* (ZEO) or *Cinnamomum seylanicum* (CEO) essential oil to inhibit *Phytophthora drechsleri* in vitro and on artificially infected cucumbers for a storage period of 10 days. The fungal growth significantly was reduced by increasing concentrations of ZEO, CEO and CS that CEO was the most effective. Moreover, combined treatments showed more significant mycelial inhibition results and reduction of the IC₅₀, MIC and MFC values compared with pure EOs or CS ($p < 0.05$). The most effective treatments in reducing mycelia growth were those based on the combination of CS with CEO (CC) or ZEO (CZ). In fruit decay assays, the combined treatments (CC and CZ) were able to reduce fungal decay in the range of 77e85% at day 9, compared with in the control.

Keywords: /Cucumber/ /Fruit Decay/

LETTUCE

Derossi, A., et.al. 2016. Application of multivariate accelerated test for the shelf life estimation of fresh-cut **lettuce**. J. Food Eng. 169: 122 - 130.

Abstract

The aim of this paper was to obtain a more realistic shelf life estimation of fresh-cut lettuce by considering several sensorial, physical and chemical attributes. The Multivariate Accelerated Shelf Life Testing (MASLT) approach was applied, comparing the use of the traditional zero- and first- order

reactions with the Weibullian logistic model in describing score change kinetics over time. A total variance of 79.6% was explained by two principal components (PC): PC1 (68.8%) and PC2 (10.8%). The multivariate degradation kinetics was better described by a zero-order reaction, yielding an r^2 value greater than 0.97, while the temperature dependence of the multivariate rate constant, k_m , was well-fitted by the log logistic model. A cut-off criterion of -1.52 was calculated, leading to shelf life estimations of ~12.4, ~10.4 and ~3.7 days for fresh-cut lettuce stored at 0, 5 and 15 °C, respectively. This method provides an overall and accurate description of the degradation phenomena occurring during the storage of fresh-cut lettuce.

Keywords: /Lettuce/ /Shelf Life/

Oliveira, M., et.al. 2015. Biopreservative methods to control the growth of food borne pathogens on fresh-cut **lettuce**. *Int'l. J. Food Microbiol.* 214: 4–11.

Abstract

Fruits and vegetables can become contaminated by foodborne pathogens such as *Escherichia coli* O157:H7, *Salmonella* and *Listeria monocytogenes*, and it has been demonstrated that current industrial sanitizing treatments do not eliminate the pathogens when present. Chemical control is widely used, but biological control appears to be a better solution, mainly using the native microbiota present on fresh produce. The first objective of this study was to isolate native microbiota from whole and fresh-cut produce and to determine whether these bacteria were antagonistic toward foodborne pathogens. A total of 112 putative antagonist isolates were screened for their ability to inhibit the growth of *Salmonella enterica* on lettuce disks. Five different genera reduced *S. enterica* growth more than 1-log unit at 20 °C at the end of 3 days. When tested against *L. monocytogenes* 230/3, only *Pseudomonas* sp. strain M309 (M309) was able to reduce pathogen counts by more than 1-log unit. Therefore, M309 strain was selected to be tested on lettuce disks at 10 °C against *S. enterica*, *E. coli* O157:H7 and *L. monocytogenes*. M309 strain was only able to reduce *S. enterica* and *E. coli* O157:H7 populations. The second objective was to test different biopreservative methods including M309 strain, *Pseudomonas graminis* CPA-7 (CPA-7), bacteriophages (Listex P100 and Salmorelex) and nisin at conditions simulating commercial applications against *Salmonella* and *L. monocytogenes* on fresh-cut lettuce. The addition of the biopreservative agents did not result in a significant reduction of *Salmonella* population. However, CPA-7 strain together with nisin reduced *L. monocytogenes* numbers after 6 days of storage at 10 °C. The cocktail of *Salmonella* and *L. Monocytogenes* was not markedly inactivated by their respective bacteriophage solutions. This study highlighted the potential of biocontrol, but the combination with other technologies may be required to improve their application on fresh-cut lettuce.

Keywords: /Lettuce/ /Foodborne Pathogens/

Song, Ah Young, et.al. 2015. Cold plasma treatment for microbial safety and preservation of fresh **lettuce**. *Food Sci. & Technol.* 24(5): 1717 – 1724.

Abstract

Cold plasma treatment (CPT) was investigated for inhibition of foodborne pathogens and extension of fresh lettuce storage life. Lettuce samples were treated with CP at 400 W and 900 W for 10 min for assessment of the effects of CPT on inhibition of *Escherichia coli* O157:H7 and *Salmonella* Typhimurium, and on physicochemical and sensory properties of lettuce. N₂, an N₂-O₂ mixture, and He effectively formed CP against both pathogens. CPT inhibited both pathogens on lettuce by up to 2.8 log CFU/g. The

Weibull model adequately described the degree of microbial inhibition using CPT. N2-CPT did not affect the sensory properties of lettuce. N2-CPT resulted in a bacteriostatic effect against growth of *E. coli* O157:H7 but did not affect physicochemical properties of lettuce during storage. CPT demonstrated potential for improving the microbial safety of vegetables without loss of physicochemical or sensory properties.

Keywords: /Lettuce/ /Fresh-Cut/

Vickers, L.H., et. al. 2015. Irrigation affects postharvest discolouration and yield in iceberg **lettuce**. *Acta Hort.* 1091: 254 - 258.

Abstract

Fresh produce is highly perishable and significant wastage can occur from producer to consumer. Lettuce heads and other leafy salads can often suffer non-infectious discolouration disorders, such as pinking. Pinking of lettuce butts and leaves can occur within only a few days of harvest, and this can limit product shelf life and contribute to retail consumer dissatisfaction. It has already been shown that preharvest water stress can have an impact on the yield and postharvest quality of 'Batavia' lettuce. Our aim was to investigate the sensitivity of 'Iceberg' lettuce to water stress pre- and postharvest. A lettuce crop was grown in a polytunnel at Harper Adams University; soil was amended with peat to give two defined uniform soil types; 25% (high OM soil) or 5% (low OM soil) in containers of 180 L volume. By alternating the amount of irrigation a range of different water stress treatments were imposed. Increased irrigation led to greater biomass production, with heads containing a greater proportion of water. Analysis also showed that soil type and irrigation significantly affected the total amount of N (%) in lettuce head dry matter, whilst postharvest scoring revealed that the pinking score after 20 days in cold storage was significantly greater in treatments with increased irrigation.

Keywords: /Lettuce/ /Postharvest/

Wulfkuehler, S., et.al. 2015. Sanitation of process water fresh cut **lettuce** production by means of UV-C. *Acta Hort.* 1091: 327 – 334.

Abstract

During fresh-cut production, the process water represents a major source of cross-contamination, facilitating foodborne pathogen transfer. Therefore, the efficacy of UV-C disinfection to reduce the microbiological load of lettuce wash waters was investigated. Wash water of iceberg and oak leaf lettuce was subjected to different doses of UV-C ranging from 34.8-174.2 J L⁻¹. As shown by the inactivation kinetics of total mesophilic viable counts, UV-C was highly efficient in reducing the microbial load of both lettuce wash waters. At 174.2 J L⁻¹, the initial viable counts were reduced by 3.2 and 2.1 log₁₀ cfu ml⁻¹ in iceberg and oak leaf lettuce process water, respectively. At this highest UV-C dose, members of the *Enterobacteriaceae* family were even reduced by 3.5 log₁₀ cfu ml⁻¹ in oak leaf lettuce wash water, while they were not detected in washing water of iceberg lettuce processing. Microbial loads in oak leaf lettuce wash water were higher than in that of iceberg lettuce processing, which was also reflected by a higher chemical oxygen demand (COD), higher absorption and turbidity. In the second experiment, conducted with iceberg lettuce and endive, UV-C lamps were installed in an industrial tubular washing system. Highly contaminated shredded lettuce was circulated six times in the tubes. Water and lettuce samples were analysed throughout processing. Despite high turbidities of up to 34.5±0.7 NTU, UV-C illumination reduced the viable counts in the water by 2.0 (endive) and 1.9 log₁₀

cfu ml⁻¹ (iceberg lettuce) after the sixth cycle compared to untreated process water. Both experiments proved UV-C treatment to be a promising option for product quality enhancement and sanitation of water during fresh-cut lettuce production, thus reducing the consumption of fresh water and microbial hazards. However, the efficacy of UV-C disinfection was shown to depend on physicochemical parameters, e.g., absorption, turbidity and COD of the water.

Keywords: /Lettuce/ /Fresh cut/

MUSHROOM

Quevedo, R., et.al. 2016. Correlation of the fractal enzymatic browning rate with the temperature in mushroom, pear and apple slices. LWT – Food Sci. & Technol. 65: 406 - 413.

Abstract

A Fractal Kinetic method was applied to characterize enzymatic browning activity in samples from mushrooms, pears and apples. In this study, three independent repetitions were fulfilled to describe enzymatic browning kinetic by using two colorimetric methods: (1) the Mean method, when calculating an averaged intensity color (L* value) and assuming that colors are distributed homogeneously on the fruit surface during browning, and (2) the Fractal Kinetic method, that describes a non-homogenous color distribution on the food surface during the reaction. Samples of apples ('Gala'), pears ('Packham') and mushrooms (*Agaricus bisporus*) were cut and stored at four different temperatures (i.e., 5, 15, 25 and 35°C). Four environmental test chambers, all equipped with a computer system vision, were used. The images were photographed every 15 s during a period of 4 h and saved as a Tiff Format. The results of this study showed that the enzymatic browning kinetic rate was higher when the Fractal Kinetic method was applied. The Arrhenius Law and the log-logistic model were applied in order to establish a relationship between the enzymatic browning rates and the temperature reactions. The results revealed that the Arrhenius law can also be applied when using the Fractal Kinetic method.

Keywords: /Mushroom/ /Pear/ /Apple/ /Enzymatic Browning/

ONION

Vickers, L.H., et.al. 2015. Soil type and irrigation affect onion yield and storability. Acta Hort. 1091: 245 - 252.

Abstract

Although water stress during growth has been shown to reduce yield (Bekele and Tilahun, 2007; De Santa Olalla et al., 2004), there has been some work that suggests under certain conditions a preharvest water stress may increase the postharvest storage life or quality of onions (Leskovar and Agehara, 2012). However, deficit irrigation as an irrigation treatment has not yet been taken up by growers due to the lack of control, limited information and the risk of lower yields. The aim of this work was to investigate the sensitivity of onions to deficit irrigation, and to determine whether deficit irrigation can be used to increase onion marketable yield and storability. An onion crop was grown in a polytunnel at Harper Adams University; soil was amended with peat to give two defined uniform soil types; 25% (high OM soil) or 5% (low OM soil) in containers of 180 L volume. By alternating the timing and amount of irrigation, a range of different water stress treatments were imposed. This work has shown that the water status of the top 30 cm of the soil column is important for onion growth and that

increasing irrigation can increase bulb yield. The effect of the organic matter (OM) amendments was not homogenous across all plant measurements taken. Overall, onions grown in the high OM soil had the least sprouting after 3 months in storage in all irrigation treatments, whilst the well watered irrigation treatment proved the best treatment overall to reduce postharvest sprout length. There was no effect observed for either soil organic matter content or irrigation treatment on the formation of multi growth centres in onion bulbs. This work suggests that deficit irrigation at the intensities used in this study is not suitable to increase storability of onions with regards to early sprouting.

Keywords: /Onion/ /*Allium cepa*/ /Postharvest/ /Sprouting/

RADISH

Lockley, R.A., et.al. 2015. Splitting in **radish** - does preharvest environment influence the response to postharvest handling? Acta Hort. 1091: 245 - 252.

Abstract

Splitting in radish (*Raphanus sativus*) hypocotyls is a problem for growers which occurs both pre- and postharvest. Experiment 1 investigated the effects of timing of irrigation application on splitting and the hypocotyl water content at harvest. Experiment 2 investigated the effects of hypocotyl water content on susceptibility to splitting postharvest. In Experiment 1 *R. sativus* 'Rudi' plants were glasshouse grown, the three treatments were watered for seven days then given two irrigation treatment periods of 10 days each: on-going irrigation (W/W), period of no irrigation followed by irrigation (D/W), and period of irrigation followed by no irrigation (W/D). At harvest the D/W treatment produced fewer splits than the W/D and W/W treatments ($P<0.001$) suggesting a dry period mid-growth results in less splitting. At harvest, treatment W/D had a significantly ($P<0.001$) lower hypocotyls water content on average than W/W and D/W. This suggests that irrigation in the final 10 days prior to harvest determines hypocotyl water content at harvest. In Experiment 2, hypocotyls at a range of water contents between 93 and 97% were tested for susceptibility to splitting as a result of postharvest mechanical damage using impact and puncture tests. Radish hypocotyl water content was found to be negatively correlated with puncture force and an increase in the number of radishes which split after dropping was observed at hypocotyl water contents above 96.5%. In conclusion, the water content of the growing medium during growth influences splitting at harvest, the water content of the growing medium prior to harvest affects the water content of the hypocotyl at harvest and radishes are more susceptible to splitting postharvest from dropping and puncture at high hypocotyl water contents.

Keywords: /Radish/ /Postharvest Handling/

ROCKET SALAD

Bell, Luke, et.al. 2016. Use of TD-GC-TOF-MS to assess volatile composition during postharvest storage in seven accessions of **rocket salad** (*Eruca sativa*). Food Chem. 194: 626 - 636.

Abstract

An important step in breeding for nutritionally enhanced varieties is determining the effects of the postharvest supply chain on phytochemicals and the changes in VOCs produced over time. TD-GC-TOF-MS was used and a technique for the extraction of VOCs from the headspace using portable tubes is described. Forty-two compounds were detected; 39 were identified by comparison to NIST libraries. Thirty-five compounds had not been previously reported in *Eruca sativa*. Seven accessions were

assessed for changes in headspace VOCs over 7 days. Relative amounts of VOCs across 3 time points were significantly different – isothiocyanate-containing molecules being abundant on ‘Day 0’. Each accession showed differences in proportions/types of volatiles produced on each day. PCA revealed a separation of VOC profiles according to the day of sampling. Changes in VOC profiles over time could provide a tool for assessment of shelf life.

Keywords: /Rocket Salad/ /Postharvest/ /Storage/

TOMATO

Aborisade, A. T., et.al. 2015. Effects of polyethylene packaging of heat treated **tomato** fruits. Acta Hort. 1091: 275 – 282.

Abstract

Packaging affects the overall quality, shelf-life and consumer acceptance of fresh produce. Correct prestorage heat treatment controls decay. The objective of this work was to determine the best polyethylene (PE) thickness for storage of tomatoes at different maturity stages under two temperatures. ‘Roma’ tomatoes at mature-green (MG), breaker, turning and pink maturity stages were subjected to hot air treatment at 46°C for 1 h, packed into different grades of PE and stored at 12 or 28°C. The fruits were assessed for ripening and disease incidence at 8 and 15 days of storage. Results showed advancement in colour development in all stages of fruits and in all thicknesses of PE, but the advancement were not statistically significant in fruits stored at 12°C except in turning fruits while it was significant in all at 28°C. The greatest advancement was by MG in 2.5 µm thick polyethylene which ripened beyond light red while the least progress was by the same mature-green in 40 µm thick PE. As the thickness of packaging material increased from 2.5 to 40 µm, colour development reduced. Titratable acidity (TA) increased in all the packages except turning fruits packed in 2.5 and 10 µm which had reduced TA, indicating more ripening in those fruits. Total soluble solids (TSS) increased in pink fruits at 12°C but decreased in the same pink fruits at 28°C. Greatest increase in TSS occurred in turning fruits in 5.0 µm PE. Disease occurred in all maturity stages of fruits in all packages but was lower at 12 than at 28°C. Disease was lowest among MG fruits at both temperatures except fruits in 40 µm thick PE at 28°C, and highest in pink fruits in 10 µm at 12°C and in 40 µm thick PE at 28°C. Tomatoes, in different ripening stages should be packaged in the appropriate PE thickness that best preserves their quality.

Keywords: /Tomato/ /Ripening/ /Ripening/ /Storage/ /Maturity/

Maissa Ben-Jabeur, Maissa, et.al. 2015. Thyme essential oil as a defense inducer of **tomato** against gray mold and fusarium wilt. Plant Physiol & Biochem.94: 35 – 40.

Abstract

The potential of thyme essential oil in controlling gray mold and Fusarium wilt and inducing systemic acquired resistance in tomato seedlings and tomato grown in hydroponic system was evaluated. Thyme oil highly reduced 64% of Botrytis cinerea colonization on pretreated detached leaves compared to untreated control. Also, it played a significant decrease in Fusarium wilt severity especially at 7 days post treatment when it was reduced to 30.76%. To explore the plant pathways triggered in response to thyme oil, phenolic compounds accumulation and peroxidase activity was investigated. Plant response was observed either after foliar spray or root feeding in hydroponics which was mostly attributed to peroxidases accumulation rather than phenolic compounds accumulation, and thyme oil seems to be more effective when applied to the roots.

Keywords: /Tomato/ /Fusarium Wilt/ /Botrytis Cinerea/

Castellanos, Diego A., et.al. 2016. Modelling the evolution of O₂ and CO₂ concentrations in MAP of a fresh product: Application to tomato. J. Food Eng 168: 84 – 95.

Abstract

Through modelling of modified atmosphere packaging (MAP) systems, it is possible to predict evolution of gas composition in the package headspace and ease the selection of favorable packaging conditions for the optimal preservation of the packaged product. However, it is necessary to adequately describe the associated phenomena: product respiration and gas exchange through the package. In this work, a mathematical model was established to describe the evolution of the O₂ and CO₂ concentrations in a MAP system, considering packages with perforations and of variable volume and validated for tomato. Respiration rates of the packed product were described using Michaelis–Menten kinetics while gas exchange through the packaging films and the perforations was described with Fick equations of diffusion. The influence of temperature in these kinetics was considered to follow Arrhenius' law. In order to validate the model proposed, an experiment was conducted packaging tomatoes in PP, PLA and LDPE perforated bags for 12 days at 13.5°C. The prediction capacity of the model agrees with the experimental data, with a coefficient of determination (R²) equal to 0.89–0.98 for O₂ concentrations and 0.83–0.97 for CO₂ concentrations. The model was used to define the required package surface area or perforation diameter to achieve a specific O₂ concentration in the headspace.

Keywords: /Tomato/ /Packaging/ /Respiration/

Dew, R., et. al. 2015. Improvement of tomato product quality by changing temperature conditions during the first 11 days after harvest. Acta Hort 1091: 147 – 154.

Abstract

It is a major challenge for supermarkets to provide the consistently excellent fruit quality required to support high levels of consumption and minimise waste, both during the supply chain and after purchase. Low temperatures are extensively used during transport and storage of fruit, aiming to minimise waste, despite known risks of detrimental effects on fruit quality and nutritional value. Freshly harvested tomatoes, at ripening stage 3, were initially kept at a constant, relatively-high temperature of 23°C (room temperature, RT) and compared with typical supply chain temperatures of 8-12°C (supply chain, SC) before evaluation of nutrient composition and taste. Seven days after harvest, a consumer panel preferred RT tomatoes to SC by 25% (p<0.001). At this stage the RT tomatoes had almost 3-fold higher sum of lycopene levels (p=0.006), 55% more lutein (p=0.028) and 7% more total soluble solids (p=0.021). To assess effects during subsequent storage at home by the consumer, tomatoes from each treatment were then kept for an additional 4 days, either at room temperature (23°C) (as on a kitchen shelf) (SCRT, RTRT), or at 5°C (as in a domestic refrigerator) (SCF, RTF). RTRT tomatoes still had the largest concentration of sum of lycopene (p<0.001), and the three treatments involving room temperature periods achieved similar sensory preference scores, while SCF was least favoured (p<0.001) by up to 42%. SCRT had similar levels of vitamin C to SCF but 55 and 76% more than that of RTRT and RTF (p=0.012). This research demonstrates that substantial improvements in tomato quality can be achieved by optimising the postharvest temperatures, both in the supply chain and during storage in the consumer's home, and that further research is required into optimisation of this aspect of supply chain management.

Keywords: /Tomato/ /Temperature/ /Sensory Evaluation/

Guerra, Igrid Conceicao Dantas, et.al. 2015. Coatings comprising chitosan and *Mentha piperita* L. or *Mentha × villosa* Huds essential oils to prevent common postharvest mold infections and maintain the quality of cherry **tomato** fruit. Int'l J. Food Microbiol. 214: 168 – 178.

Abstract

In this study, we evaluated the efficacy of coatings comprising shrimp chitosan (CHI) and *Mentha piperita* L (MPEO) or *Mentha × villosa* Huds (MVEO) essential oils to control mold infections caused by *Aspergillus niger*, *Botrytis cinerea*, *Penicillium expansum* and *Rhizopus stolonifer* in cherry tomato fruits (*Solanum lycopersicum* L.) during storage at room temperature (25 °C for 12 days) and low temperature (12 °C for 24 days). The effects of the coatings on the physicochemical and sensory characteristics of cherry tomato fruits during storage were also assessed. The minimum inhibitory concentration (MIC) of CHI against all test fungi was 8 mg/mL, whereas the MIC for both MPEO and MVEO was 5 µL/mL. Combinations of CHI at 4 mg/mL and MPEO or MVEO at 2.5 or 1.25 µL/mL strongly inhibited mycelial growth and spore germination of target fungi. The coatings comprising CHI and MPEO or CHI and MVEO at the different tested concentrations delayed the growth of decay-causing fungi in artificially contaminated tomato fruit during storage at either room temperature or low temperature. The assayed coatings preserved the quality of cherry tomato fruit during storage, in terms of physicochemical and sensory attributes. These results indicate that coatings comprising CHI and MPEO or CHI and MVEO represent promising postharvest treatments to prevent common postharvest mold infections in cherry tomato fruit during storage without affecting the quality of the fruit.

Keywords: /Tomato/ /Edible Coating/ /Postharvest Treatment/

Pinheiro, Joaquina, et.al. 2015. Use of UV-C postharvest treatment for extending fresh whole **tomato** (*Solanum lycopersicum*, cv. Zinac) shelf-life. J. Food Sci. Technol. 52(8): 5066 – 5074.

Abstract

The effect of UV-C treatments (0.32, 0.97, 2.56, 4.16 and 4.83 kJ.m⁻² at 254 nm) on the physicochemical properties [colour, texture, total phenolic content (TPC), weight loss (WL)], and mesophytic counts of whole tomato, was evaluated during 15 days at 10 °C. During storage, the Ctr samples acquired faster red colour than all UV-C samples (higher a* and lower °h values). Comparing texture of Ctr and UV-C samples at 15th storage day, an increase of 9 and 8 % on firmness of treated samples at low UV-C intensities (0.32 and 0.97 kJ.m⁻², respectively) was observed. At the end of the storage, Ctr samples showed ca. 4 Log₁₀ of mesophytic load, and the samples treated at 0.97 and 4.83 kJ.m⁻² revealed the lowest microbial load (1.9 and 3.2 Log₁₀, respectively). These results indicate that UV-C radiation, at an appropriate dose, combined with low storage temperature (10 °C) are an effective method to preserve the postharvest life of tomato, without adversely affecting quality parameters.

Keywords: /Tomato/ /Shelf Life/ /Quality/ /Storage/ /UV-C Radiation/

Shouten, Rob E., et. al. 2016. Sugar and acid inter conversion in **tomato** fruits based on biopsy sampling of locule gel and pericarp tissue. Postharvest Biol. & Technol. 111: 83 - 92.

Abstract

This study deals with quantifying sugar and acids levels important for the perceived taste of tomatoes (*Solanum lycopersicum*). Sugar and acids levels were measured repeatedly on the same tomato using tissue samples obtained with a biopsy needle in combination with HPLC protocols. Biopsies of pericarp and locular gel tissue from tomatoes differing in position in the truss, from mature green to ripe red, were taken from a beef- ('Licorossa'), a cocktail- ('Lucino') and a cherry type ('Petit Sweet') cultivar. Tomatoes were stored up to three weeks at three temperatures (12, 19 and 24.5°C) and biopsy samples were taken every few days. A model regarding the most important processes that interconvert sugars and acids (glycolysis, TCA cycle and gluconeogenesis (GNG)) is proposed. Results of the model calibration showed more breakdown of hexoses in red tomatoes and more conversion of malate into hexoses in green tomatoes. More hexose turnover was found in locular gel than in pericarp tissue. GNG was more important in the cherry type cultivar due to faster hexose and malate breakdown. In the round type cultivar malate levels were higher due to faster citrate breakdown and slower malate breakdown. Starch and sucrose levels did not significantly affect postharvest sugar and acid development. Molecular markers that quantify the kinetic parameters of the model might be important to develop genotypes with better taste performance.

Keywords: /Tomato/

ZUCCHINI

Megias, Z, et.al. 2015. Effects of 1-MCP on different postharvest quality parameters in zucchini. Acta Hort. 1091. 83 - 90.

Abstract:

Ethylene can accelerate ripening and other postharvest physiological processes such as softening and development of chilling injury (CI) in both climacteric and non-climacteric fruit. Zucchini is an immature non-climacteric fruit that produces low levels of ethylene during its postharvest storage at different temperatures. However, when fruit is stored at 4°C and then transferred to 20°C, ethylene production is rapidly induced. We have recently found that this cold-induced ethylene is associated to chilling sensitivity. To analyse the potential benefit of inhibiting ethylene perception of zucchini on quality, fruit of five commercial hybrids were treated with 2.4 µl L⁻¹ 1-MCP for 48 h, and then stored for up to 14 days at 4°C. Firmness, weight loss, color, chilling injury incidence and ethylene production of the fruit were evaluated during the storage period. The treatment with 1-MCP was not equally effective in the fruit of all cultivars, it improved chilling tolerance in zucchini, reducing weight loss and delaying the onset of chilling injury in cold stored fruit, These improvements were associated with a delay in the production of cold-induced ethylene. Fruit color and firmness were not affected by 1-MCP.

Keywords: /Zucchini/ /Cucurbita pepo/ /1-MCP/ /Chilling Injury/ /Ethylene/ /Fruit Quality/

Megias, Z., et.al. 2015. Physical and chemical treatments enhancing postharvest fruit quality in zucchini. Acta Hort. 1091. 141 - 146.

Abstract

Chilling injury (CI) is one of the most serious problems that reduce the quality of zucchini after cold storage. In order to alleviate this physiological disorder, we have evaluated the effect of different postharvest treatments on CI and other fruit quality parameters in two contrasting cultivars. Before cold storage at 4°C, fruits of each cultivar were subjected to various treatments, including 2% of calcium chloride, 1% diphenylamine, and warm water at 37°C or 42°C. Other fruits were individually wrapped

with a plastic film, or preconditioned at 12°C for 48 h before cold storage. Treated and control fruits were compared for a number of postharvest fruit quality parameters such as weight loss, firmness and chilling injury. The results demonstrate that the temperature conditioning treatments as well as the individual shrink-wrapping were the most effective treatments to alleviate CI in zucchini squash, also reducing the loss of weight and firmness.

Keywords: /Zucchini/ /*Cucurbita pepo*/ /Chilling Injury/ /Fruit Quality/

TUBERS AND ROOT CROPS

POTATO

Elsherbiny, Elsherbiny A. , Basma H. Aminb, Zakaria A. Bakac. 2016. Efficiency of pomegranate (*Punica granatum* L.) peels extract as a high potential natural tool towards *Fusarium* dry rot on **potato** tubers. *Postharvest Biol. & Technol.* 111: 256 – 263.

Abstract

The efficacy of the methanol extract of pomegranate peels was evaluated for controlling the growth of *Fusarium sambucinum* in vitro and development of dry rot on potato tubers both in curative and preventive applications. The methanol extract exhibited 75.5% inhibition on mycelial growth of *F. sambucinum* and a complete inhibition on spore germination of the pathogen at the concentration of 20 mg/ml. Minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of the extract were determined to be 20 and 120 mg/ml, respectively. Twenty four individual phenolic compounds were identified and quantified in the extract using HPLC analysis, with the total phenol content as 104.6 mg GAE/g extract according to the Folin–Ciocalteu method. Scanning electron microscopy (SEM) observations revealed morphological modification in *F. sambucinum* hyphae including curling, twisting and collapse. Ultrastructural alterations were also observed using transmission electron microscopy (TEM) including cell empty cavity and the disintegration of cytoplasmic organelles. The methanol extract of peels caused a significant reduction in dry rot development on potato tubers inoculated with *F. sambucinum* in curative and preventive applications. The methanol extract of pomegranate peels could be applied as alternative natural products to synthetic fungicides in the biocontrol of dry rot on potato tubers.

Keywords: /Potato/ /Potato Dry Rot/

TURNIPS

Helland, Hakon S., et.al. 2016. Storage of fresh-cut swede and **turnip** in modified atmosphere: effects of vitamin C, sugars, glucosinolates and sensory attributes. *Postharvest Biol. & Technol.* 111: 150 – 160.

Abstract:

Fresh-cut swede (*Brassica napus* L. var. *napobrassica* (L.) Rchb.) and turnip (*Brassica rapa* L. ssp. *rapifera* Metzg.) in modified atmosphere packaging (MAP) were stored for 5 or 10 d, at 5°C or 10°C. Two passive and one active (flushed with 5% O₂ at sealing) modified atmospheres were tested. Vitamin C content was not influenced by the experimental parameters. The content of total sugar decreased during storage for both vegetables, and significant effects of time, temperature and atmosphere were observed for glucose, fructose and sucrose. Total aliphatic and indolic glucosinolates increased in swede

during storage, while for turnip total aliphatic glucosinolates decreased and total indolic glucosinolates increased. Atmosphere composition affected glucosinolates, and the response varied between individual glucosinolates. Taste and flavour were more influenced by time and temperature, than by atmosphere in both vegetables. However, modified atmosphere with low O₂ concentration reduced discolouration related changes, especially for turnip. Positive correlation was observed between sugar content and sweet taste for both vegetables. Sweet and bitter tastes were negatively correlated for swede. Low temperature and short storage time were the most important criteria to prevent changes of appearance, odours, taste and flavours, and contents of sugar and glucosinolates of fresh-cut swede and turnip.

Keywords: /Turnip/ /Fresh-Cut/ /Modified Atmosphere/ /Packaging/

YACON

Vasconcelos, Christiane Mileib, et.al. 2015. Evaluating strategies to control enzymatic browning of minimally processed **yacon** (*Smallanthus sonchifolius*). Food Bioprocess Technol. 8: 1982 – 1994.

Abstract

To control enzymatic browning in minimally processed yacon (*Smallanthus sonchifolius*), strategies combining anti-browning agents and modified atmosphere were investigated. Yacon slices were immersed in anti-browning agent solutions—sodium metabisulfite (0.5 %), L-cysteine (0.5 %), or the acids lactic (1 %), malic (1 %), succinic (1 %), ethylenediaminetetraacetic (EDTA; 1 %), ascorbic (3 %), citric (3 %) or tartaric (3 %), or a control (0.5 % de sugar)—for 5 min, then packaged with air or modified atmosphere (N₂) and stored at 5 °C. Sensory and physical-chemical (soluble solids, phenolic content, peroxidase activity, pH, color, instrumental texture, and mass variation) analyses were performed. For a given anti-browning agent, any significant difference was not found between yacon slices stored under air or N₂. However, when comparing the different antibrowning agents, only ascorbic, citric, and tartaric acids were effective enzymatic browning inhibitors without significantly changing typical sensory attributes of yacon. Among them, tartaric acid is not often reported in literature for controlling enzymatic browning in vegetal products, contrarily to the two others.

Keywords: /Yacon/ /Sensory Quality/ /Enzymatic Browning/ /Minimally Processed/ /Modified Atmosphere/

ORNAMENTALS

CUTFLOWERS

Rihn, A., et.al. 2015. Consumer preference of **cut flower** guarantees. Acta Hort. 1090: 45 – 54.

Abstract

Due to cut flowers perishable nature, postharvest longevity and quality are very important traits to consumers. One means of communicating quality to consumers is through the use of guarantees. The aim of the present study was to investigate the importance of guarantees for different occasions and retail outlets. A survey was used to investigate consumer preferences. The survey was administered in person in Minnesota and Texas and online throughout the greater United States. Results indicate occasion does impact the importance of guarantees. Guarantees are the most important for appreciation/thank you and get well occasions when compared to day brightener/just because

occasions. Additionally, results suggest that guarantees are more important for generalized retail outlets. However, most participants believe the best cut flower guarantees are found at specialty retail outlets such as florists and online sources. The type of retail outlet also impacts consumers' feelings about the ease of redeeming guarantees. Overall, results suggest that occasion and retail outlet both impact consumer preferences for cut flower guarantees.

Keywords: /Cutflowers/ /Longevity/ /Marketing/

GLADIOLUS

Shimizu-Yumoto, Hiroko and Ichimura, Kazuo. 2016. Effects of storage in packaging with oxygen absorbers on the quality of cut gladiolus 'Princess Summer Yellow' spikes. *Postharvest Biol. & Technol.* 111: 191 - 196.

Abstract

Polypropylene film packaging combined with oxygen absorbers was investigated for maintaining the quality of cut gladiolus 'Princess Summer Yellow' spikes after storage for 6 d. Both the oxygen and carbon dioxide concentrations within the polypropylene bags were lower with oxygen absorbers compared to packaging only. In packaging with oxygen absorbers, the number of florets that opened and wilted increased more slowly, and the vase life of cut spikes was longer than those in only packaging after storage at 15°C or 20°C. Both oxygen absorbers and cut gladiolus spikes themselves produced ethylene during storage. The ethylene concentration in the plastic bags tended to be high when they contained two oxygen absorbers, and low after pretreatment with silver thiosulfate complex (STS). Treatment with STS before packaging improved the floret opening ratio per spike after storage at 15°C. These results suggest that plastic film packaging with oxygen absorbers is an easy way to decrease the oxygen concentration and maintain the quality of cut gladiolus spikes, and that pretreatment with STS improves bud opening after suboptimal temperature storage.

Keywords: /Gladiolus/ /Ethylene/ /Pre-treatment/ /Silver Thiosulfate/

ZINNIA

Carlson, Alicia S., et.al. 2015. Bacteria species and solution pH effect postharvest quality of cut Zinnia elegans. *Scientia Hort.* 194: 71 – 78.

Abstract

Bacterial growth in vase solutions can lead to stem vasculature blockage causing petal and leaf wilt, bent neck, or similar symptoms related to water stress that reduce vase life. In these studies we isolated, identified, and evaluated the effects of several bacteria species on the vase life of cut Zinnia elegans 'Benary's Giant Wine'. Nine bacterial species were isolated during postharvest testing of cut zinnia stems: *Pseudomonas fulva*, *Serratia ficaria*, *Rhizobium radiobacter*, *Chryseobacterium* sp., *Pantoea ananatis*, *Bacillus pumilus*, *Chryseobacterium daejeonense*, *Brevundimonas* sp., and *Pseudomonas marginalis* and purecultures of each species were added to the vase solution of cut zinnia stems. *Escherichia coli* K12, a labadapted strain, was also included. Cut flowers inoculated with *P. fulva* and *E. coli* K12 had significantly greater vase lives of 9.5 and 9.4 d, respectively, compared to *P. marginalis*, *P. ananatis*, *R. radiobacter*, or the nutrient broth control (7.0, 6.9, 6.8, or 7.3 d, respectively). The vase lives of the other bacteria treatments were not statistically different from the deionized (DI) water control (8.6 d). There were no significant differences in water uptake or vase water bacteria concentrations at

termination among all treatments. In further studies, sterilized and non-sterilized stems of Zinnia were used to investigate the effects of solution pH and the addition of *P. marginalis* and *E. coli* K12 on number of days to drought stress (DTDS), stem hydraulic conductivity, and bacteria concentrations inside and outside the stem. The non-sterilized stems in control solution with *E. coli* K12 and non-sterilized stems in preservative solution with no bacteria had the most DTDS of 8.0 d. The sterilized stems in the control solution (deionized water) with *E. coli* K12 and sterilized stems in basic solution with no bacteria had the least DTDS of 5.5 d and 5.8 d, respectively. The concentrations of bacteria inside and outside the stems were lowest for stems in the preservative solutions. Of the stems that were sterilized, partial percent loss of conductivity (PPLC) was significantly lower in the acidic solutions (64%) compared to the preservative (87%) and control (83%). This research shows that for Zinnia the bacteria species that has a primary effect on vase life, not necessarily the concentration of bacteria in the vase solution.