

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

GENERAL

CHILLING INJURY

Aghdam, Morteza, Soleiman, et al. 2013. Heat shock proteins as biochemical markers for postharvest **chilling** stress in fruits and vegetables. *Scientia Horti*c. 160: 54 – 64.

Abstract

Fresh fruits and vegetables have a short postharvest life and are prone to postharvest losses due to mechanical injury, physiological causes and decay. Low temperature storage (LTS) is widely used as a postharvest treatment applied to delay senescence in vegetables and ornamentals and ripening in fruits, so upholding their postharvest quality. But the problem of its application to tropical and subtropical fruits and vegetables is the susceptibility of these to chilling injury (CI) at temperatures below 12 °C. Chilling injury is a physiological disorder that greatly reduces fruit quality, frequently rendering the product unsellable. To increase the tolerance of produce to CI and extend storage life, postharvest protocols such as cold storage coupled with heat treatments, temperature preconditioning, intermittent warming, modified and controlled atmosphere storage, ultraviolet (UV) light, and salicylates and jasmonates treatments have been developed. Membrane damage and reactive oxygen species (ROS) production are multifaceted adverse effects of chilling stress in sensitive fruits and vegetables. They have been attributed to the higher CI tolerance of horticultural products to production and accumulation of heat shock proteins (HSPs), suggesting a central role of HSPs in the acquired tolerance to chilling stress. This beneficial action of HSPs is possible thanks to their chaperone activity. Besides chaperone activity, small HSPs (sHSPs) are able to function as membrane stabilizers and ROS scavengers or to act synergistically with antioxidant system. sHSPs play a key role in maintaining membrane quality attributes such as fluidity and permeability under chilling stress. In fact, the analysis of sHSPs could be envisaged as an ideal method for the assessment of fruits and vegetables' tolerance to CI and for evaluating the efficiency of postharvest treatments in avoiding CI incidence. This review discusses HSPs and their language of action in mitigation of CI and their potential use as biochemical markers to optimize the use of postharvest treatments. It bridges the division between basic and applied research, and proposes the use of HSPs as biochemical markers of CI.

Keywords: /Chilling Injury/ /Heat Shock Proetins/ /Postharvest Treatments/

MODIFIED ATMOSPHERE PACKAGING

Chun, Ho Hyun, Kyung Bin Song. 2013. The combined effects of aqueous chlorine dioxide, fumaric acid, and ultraviolet-C with **modified atmosphere packaging** enriched in CO₂ for in activating pre-existing microorganisms and *Escherichia coli* O157:H7 and *Salmonella typhimurium* inoculated on buck-wheat sprouts. *Postharvest Biol. & Technol.* 86: 118 – 124.

Abstract

The combined effects of a sanitizer mixture, ultraviolet-C (UV-C), and modified atmosphere packaging (MAP) on the quality of non-inoculated and inoculated (*Escherichia coli* O157:H7 and *Salmonella typhimurium*) buckwheat sprouts were examined. Buckwheat sprouts were treated with a sanitizer mixture (comprising 100 mg L⁻¹ aqueous ClO₂ and 0.3% fumaric acid) and 2 kJ m⁻² UV-C, packaged under two different conditions (air and CO₂ gas) and storage for 8 d at 4°C. The combination of the sanitizer mixture and UV-C treatment reduced the initial counts of pre-existing microorganisms in the buckwheat sprouts by 1.9 log CFU g⁻¹ and reduced the initial inoculated counts of *E. coli* O157:H7 and *S. typhimurium* on buckwheat sprouts by 3.0 and 2.3 log CFU g⁻¹, respectively. The pre-existing microorganisms and inoculated pathogens in buckwheat sprouts packaged under CO₂ gas were significantly reduced during storage following the combined treatment compared to those of the control by above 95%. Differences in Hunter L*, a*, and b* values among the treatments were negligible. The combined sanitizer mixture and UV-C treatment increased the sprout rutin content by 147%, but there was no significant difference in 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity between treatments during storage. Therefore, the combination of sanitizer mixture made from aqueous ClO₂ and fumaric acid, UV-C irradiation, and MAP can improve the microbial safety and quality of buckwheat sprouts.

Keywords: /Modified Atmosphere Packaging/ / Microbial Hazard / /Foodborne Pathogens/ /Quality/

ORGANIC ACIDS

Toivonen, M.A., Changwen Lu. 2013. Differential quenching of free chlorine by **organic** compounds potentially exuded from injured plant tissues. *Postharvest Biol. & Technol.* 86: 192 – 194.

Abstract

Fresh-cut fruits and vegetables can release significant amounts of metabolites from damaged tissues on cut edges. These metabolites can potentially quench oxidative sanitizers and hence lead to loss of their antimicrobial effectiveness. In this study, the effects of organic acids, carbohydrates, phenolics, other metabolites and hydrogen peroxide on depletion of chlorine were evaluated by quantitative monitoring chlorine loss in simulated wash solutions. Gallic acid, caffeic acid and most amino acids had the greatest capacities for depleting chlorine, requiring concentrations in the range of 10 μ mol L⁻¹ or less to deplete free chlorine by half. Pyruvic, ascorbic, chlorogenic, malonic and oxalic acids had slight lower capacities, with concentrations ranging from 17 to 100 μ mol L⁻¹ leading to half depletion. All nitrogen containing metabolites had relatively high capacity in depleting chlorine at concentrations in the range of 10 μ mol L⁻¹, whereas hydrogen peroxide had a half depletion concentration of 21.3 μ mol L⁻¹. In contrast, all sugars and most carboxylic acids had lower free chlorine depletion capacities. These results demonstrate that not all organic molecules potentially exuded from cut fruit or vegetable tissue had equal or similar potential to quench free chlorine from wash water.

Keywords: /Organic Acids/ /Fresh Cut/ /Chlorine Depletion/

TEXTURE PROFILE ANALYSIS

Chen, Lan, Umezuruike Linus Opara. 2013. Approaches to analysis and modelling texture in fresh and processed foods – a review. J. Food Eng. 119: 497 – 507.

Abstract

Texture analysis and modelling are important techniques in food and postharvest research and industrial practice. A wide range of methods have been used to evaluate instrumental results, which provide time series data of product deformation, thereby allowing a wide range of texture attributes to be calculated from force–time or force–displacement data. Several indices of texture such as the firmness index, crunchiness index and texture index based on “vibration energy density” have been reported, but these are not widely used to quantify food texture. Some modelling and statistical approaches have been adopted to analyze food texture data, including chemical reaction kinetics and the Michaelis–Menton type decay function, mechanistic autocatalytic models based on logistic equation, and the finite element method. However, increasing demand for comprehensive approaches to texture profile analysis, generalized texture indices and fundamental texture models still remain challenges in the food research and industry.

Keywords: /Textural Profile Analysis/ /Texture Index/ /Food Quality/

FRUITS

AVOCADO

Burdon, Jeremy, et al. 2013. A meta-analysis using a logit non-linear mixed effects model for ‘Hass’ avocado postharvest performance data. Postharvest Biol. & Technol. 86: 134 – 140.

Abstract

‘Hass’ avocado fruit quality data collected from storage trials in New Zealand during the 2002, 2003 and 2004 seasons have been assimilated into a model to describe relationships between the postharvest environment (storage temperature and duration), fruit dry matter at harvest, and the incidence of pathological and physiological disorders in fruit after cold storage. Similar or related disorders were grouped into three categories: disorders in unripe fruit, pathological disorders of ripe fruit (rots) and physiological disorders of ripe fruit. A logistic non-linear mixed effects model and its simplified version with normal errors on the logit linear predictor gave a good general description of relationship between postharvest disorders and dry matter at harvest, storage temperature and storage duration, but not for predictions of disorder for individual orchards. The capacity of the model to predict disorder incidence was limited largely by the variability among orchards and seasons. It is concluded that while the mixed effects model does describe well the relationships of the disorder categories with storage temperature, storage duration and dry matter, any predictions of disorder at the orchard level are likely to have large prediction errors because of the high variability among orchards and seasons. The challenge in the future is to determine, and incorporate into the model, those factors that contribute to the large variation among orchards and seasons.

Keywords: /Avocado/ /Storage Disorders/ /Postharvest/

APRICOT

Feng, Jinqun, et al. 2013. Segregation of apricots for storage potential using non-destructive technologies. *Postharvest Biol. & Technol.* 86: 17 – 22.

Abstract

This study was set up to identify critical maturity indices affecting storage potential of apricots and demonstrate the potential for using non-destructive measurements to segregate harvested crops for sequential marketing. Fruit of two apricot (*Prunus armeniaca*) cultivars ('Clutha Gold' and 'Genevieve') were harvested and stored for four weeks at 0°C followed by four days of simulated shelf life at 20°C. Fruit colour, acoustic firmness, impact firmness, flesh firmness (FF0), dry matter content and soluble solids content measured non-destructively at harvest were correlated to the flesh firmness measured at the end of refrigerated storage and simulated shelf life (FFFinal) through stepwise regression. The regression models indicated that FF0 is a predominant factor determining FFFinal. According to the exponential model describing the relationship between FF0 and FFFinal, 'Genevieve' and 'Clutha Gold' could be stored at 0°C for four weeks if harvested at firmness above 47 or 56 N, respectively. Segregation of harvested crops according to FF0 estimated from VNIR would enable sequential marketing of fruit according to storage potential to reduce fruit loss.

Keywords: /Apricot/ /Storage life/ /Firmness/

BANANA

Huang, Hua, et al. 2013. Effect of oxalic acid on antibrowning of banana fruit during storage. *Scientia Hort.* 160: 208 – 212.

Abstract

The effect of anti-browning by application of oxalic acid on banana (*Musa* spp., AAA group, cv. 'Brazil') fruit during storage was investigated. Banana fruit were dipped into solutions of 0 (control), 8 and 20 mM oxalic acid for 10 min and then stored at room temperature (23 ± 2°C, 75–90% relative humidity). The results showed that oxalic acid at 8 and 20 mM obviously delayed the decrease in fruit color, and maximal chlorophyll fluorescence (Fv/Fm) of banana fruit. Furthermore, fruit treated with oxalic acid exhibited higher activity of anti-browning-related enzymes (peroxidase, POD; polyphenol oxidase PPO), which correlated with the reduction in brown coloring of fruit skin as compared to untreated fruit. In addition, the total phenol content decreased slowly and the reducing power of peel was maintained at a higher level after oxalic acid treatment. Overall, oxalic acid could improve the anti-browning activity to ensure a smooth surface and long-term storage of bananas at room temperature.

Keywords: /Banana/ /Oxalic Acid/ /Anti-browning/ /Storage/

Ketsa, Saichol, et al. 2013. Apparent synergism between the positive effects of 1-MCP and modified atmosphere on storage life of **banana** fruits. *Postharvest Biol. & Technol.* 85: 173 – 178.

Abstract

Fruit of cv. Gros Michel banana were treated with 1-MCP (1000 nL L⁻¹ for 4 h at 25°C) and then packed in non-perforated polyethylene (PE) bags for modified atmosphere storage (MAP). The bags were placed in corrugated cardboard boxes and stored at 14°C. Fruit were removed from cool storage and ripened at room temperature using ethephon. The length of storage life was determined by the change in peel color to yellow, after this ethephon treatment. Fruit treated with 1-MCP + MAP had a storage life of 100 days. The storage life of control fruit (no 1-MCP and no MAP) was 20 days. Fruit held in PE bags without 1-MCP treatment had a 40 day storage life, and the same was found in fruit treated with 1-MCP but without PE bags. 1-MCP is an inhibitor of ethylene action, but also inhibited ethylene production, mainly through inhibition of ACC oxidase activity in the peel. MAP inhibited ethylene production mainly through inhibition of ACC oxidase, both in the peel and pulp. The combination of 1-MCP treatment and MAP storage resulted in much lower ethylene production due to inhibition of both ACC synthase and ACC oxidase activity.

Keywords: /Banana/ /1-MCP/ /Ethylene/ /Modified Atmosphere Packaging/ /Storage/

Masilungan, Gloria D. and Wella L. Absulio. 2012. Fruits bilimbi (*Averrhoa bilimbi* L.) as a new source of ethylene for ripening of 'saba' **banana** (*Musa* ba; bisiana BBB). *Philipp. Agric. Scientist.* 95 (4): 406 – 410.

Abstract

Injured and uninjured fruits of bilimbi (*Averrhoa bilimbi* L.) at 0%, 5% and 10% (w/w) were packed with matured green 'Saba' bananas for 24 h and then allowed to ripen in open air. Use of 5% uninjured bilimbi fruits hastened ripening of bananas compared with the control treatment. Increasing the concentration of bilimbi fruits to 10% and injuring them with 5-mm deep punctures or 4-cm long, 1-cm wide and 0.2-cm deep scrape bruises from a piece of stainless steel further hastened ripening of banana. Use of 10% injured bilimbi fruits effectively ripened bananas to table ripe stage after 5d, while the control fruits were just beginning to develop color. Ethylene production of bilimbi fruits was high. Bilimbi fruits stressed by transport and injury evolved as much as 2403.8 nL g⁻¹ h⁻¹ after 24 h. The relatively high amounts of ethylene produced by bilimbi fruits effectively induced the ripening of mature green 'Saba' bananas. Based on the results, bilimbi fruits may be an effective natural source of ethylene for ripening of 'Saba' banana.

Keywords: /Banana/ /Saba Banana/ /Averrhoa Bilimbi/ /Ethylene/ /Natural Ripening Agent/

CHERIMOYA

Cordeiro, Nereida, et al. 2013. Changes in the mesocarp of *Annona cherimola* Mill. 'Madeira' during postharvest ripening. *Postharvest Biol. & Technol.* 85: 179 – 184.

Abstract

Physicochemical changes during postharvest ripening of cherimoya (*Annona cherimola* Mill. 'Madeira'), were investigated to follow the principal modifications occurring during this process and to determine nutritional value. Fruit harvested at the mature green stage were analyzed during ripening using standard methods. Significant ($P < 0.05$) changes in chlorophyll, starch, titratable acidity, total free sugars and uronic acids were obtained, but no significant changes were found in ash, protein, lignin and lipid contents during ripening. The most obvious changes were chlorophyll degradation, an accentuated decrease of starch and an increase in total free sugars, with glucose the predominant sugar in the mesocarp, as revealed by GC analyses. Firmness loss was mainly attributed to depolymerization of pectin and lipid deterioration rather than hemicellulose degradation. Results also showed that the cherimoya variety evaluated in this study is a good source of minerals (mainly potassium), palmitic acid, linoleic acid, α -linolenic acid and sitosterol.

Keywords: /Cherimoya/ /Fruit Ripening/ /Postharvest/

CITRUS

Moscoso- Ramírez, Pedro A., and Lluís Palou. 2013. Evaluation of postharvest treatments with chemical resistance inducers to control green and blue molds on orange fruit. *Postharvest Biol. and Technol.* 85: 132 – 135.

Abstract

Preventive and curative activities of postharvest treatments with selected chemical resistance inducers to control postharvest green (GM) and blue (BM) molds on oranges (cvs. 'Valencia' or 'Lanelate') artificially inoculated with *Penicillium digitatum* and *Penicillium italicum*, respectively, were evaluated. In vivo primary screenings to select the most effective chemicals and concentrations were performed with benzothiadiazole (BTH), β -aminobutyric acid (BABA), 2,6-dichloroisonicotinic acid (INA), sodium silicate (SSi), salicylic acid (SA), acetylsalicylic acid (ASA) and harpin. INA at 0.03 mM, SA at 0.25 mM, BABA at 0.3 mM and BTH at 0.9 mM were selected and tested afterwards as dips at 20 °C for 60 or 150 s with oranges artificially inoculated before or after the treatment and incubated for 7 d at 20 °C. Although it was an effective treatment, SSi at 1000 mM was discarded because of potential phytotoxicity to the fruit rind. Preventive or curative postharvest dips at room temperature had no effect or only reduced the development of GM and BM very slightly. Therefore, these treatments cannot be recommended for inclusion in postharvest decay management programs for citrus packinghouses.

Keywords: /Orange/ /Postharvest Treatments/ /Green Mold/

Lu, Laifeng, et al. 2013. *Rhodosporidium paludigenum* induces resistance and defense-related responses against *Penicillium digitatum* in citrus fruit. *Postharvest Biol. & Technol.* 85: 196 – 202.

Abstract

Induced disease resistance against plant pathogens is a promising non-fungicidal decay control strategy. In this study, a potential biocontrol yeast, *Rhodosporidium paludigenum*, was investigated for its induction of disease resistance against *Penicillium digitatum* in citrus fruit. The results showed that *R. paludigenum* is the most effective yeast among three selected yeasts in stimulating the resistance of citrus fruit to green mold. When *R. paludigenum* was applied 48–72 h before inoculation with *P.*

digitatum, disease incidence and disease severity in citrus fruit significantly decreased. Application of *R. paludigenum* at concentrations of 1×10^8 and 1×10^9 cells mL^{-1} respectively resulted in 49.6% and 52.5% reductions in the percentage of infections. Induction of resistance to *P. digitatum* by *R. paludigenum* treatment significantly enhanced the activities of defense-related enzymes, including β -1,3-glucanase, phenylalanine ammonia-lyase, peroxidase, and polyphenoloxidase, which may be an important mechanism by which the biocontrol yeast reduces the fungal disease of citrus fruit caused by *P. digitatum*.

Keywords: /Citrus/ //Postharvest Biological Control/

Romero, Paco, et al. 2013. Interplay between ABA and phospholipases A2 and D in the response of **citrus** fruit to postharvest dehydration. *Plant Physiol. & Biochem.* 70: 287 – 294.

Abstract

The interplay between abscisic acid (ABA) and phospholipases A2 and D (PLA2 and PLD) in the response of citrus fruit to water stress was investigated during postharvest by using an ABA-deficient mutant from 'Navelate' orange named 'Pinalate'. Fruit from both varieties harvested at two different maturation stages (mature-green and full-mature) were subjected to prolonged water loss inducing stem-end rind breakdown (SERB) in full-mature fruit. Treatment with PLA2 inhibitor aristolochic acid (AT) and PLD inhibitor lysophosphatidylethanolamine (LPE) reduced the disorder in both varieties, suggesting that phospholipid metabolism is involved in citrus peel quality. Expression of CsPLDa and CsPLDb, and CssPLA2a and CssPLA2b was studied by real-time RT-PCR during water stress and in response to ABA. CsPLDa expression increased in mature-green fruit from 'Navelate' but not in 'Pinalate' and ABA did not counteract this effect. ABA enhanced repression of CsPLDa in full-mature fruit. CsPLDb gene expression decreased in mature-green 'Pinalate', remained unchanged in 'Navelate' and was induced in full-mature fruit from both varieties. CssPLA2a expression increased in mature-green fruit from both varieties whereas in full-mature fruit only increased in 'Navelate'. CssPLA2b expression increased in mature-green flavedo from both varieties, but in full-mature fruit remained steady in 'Navelate' and barely increased in 'Pinalate' fruit. ABA reduced expression in both after prolonged storage. Responsiveness to ABA increased with maturation. Our results show interplay between PLA2 and PLD and suggest that ABA action is upstream phospholipase activation. Response to ABA during water stress in citrus is regulated during fruit maturation and involves membrane phospholipid degradation.

Keywords: /Citrus/ //Peel Disorders/ Postharvest Quality/

Vicente, Ariel R. et.al. 2013. Cell wall modifications and ethylene-induced tolerance to non-chilling peel pitting in **citrus** fruit. *Plant Sci.* 210: 46 – 52.

Abstract

Non-chilling peel pitting (NCP), a storage disorder resulting in the formation of depressed areas in the peel of many citrus cultivars, is reduced by ethylene treatments. We hypothesized that this effect may be associated with biochemical changes of cell wall components. Therefore, we extracted cell wall material from albedo and flavedo tissues of 'Navelate' oranges stored in air, conditioned with ethylene (2 L L^{-1}) for 4 days and subsequently transferred to air, or continuously stored in an ethylene-enriched atmosphere (2 L L^{-1}). Uronic acids and neutral sugars were extracted into five fractions enriched in

specific wall polymers namely water-, CDTA-, Na₂CO₃-, and 1 and 4 M KOH-soluble fractions. Pectin in solubilization was found in control fruit at long storage times. Ethylene treatments, alleviating NCPP, increased polyuronide solubility in the albedo and had a slight effect on the flavedo. Ethylene-treated fruit showed greater content of water-soluble neutral sugars and a larger proportion of hemicelluloses readily extractable with 1 M KOH, with a concomitant reduction in the 4 M KOH-soluble fraction. This suggests that the protective role of ethylene on NCPP is associated with an increased solubilization of the wall of albedo cells.

Keywords: /Citrus/ /Physiological Disorder/

DRAGON FRUIT

Ali, Asgar, et.al. 2013. Effectiveness of submicron chitosan dispersions in controlling anthracnose and maintaining quality of **dragon fruit**. *Postharvest Biol. & Technol.* 86: 147 – 153.

Abstract

Conventional chitosan (CC) and submicron chitosan dispersions (SCD) were evaluated for the control of postharvest anthracnose and maintenance of quality of dragon fruit during storage at 10 ± 2°C and 80 ± 5% RH for 28 days. All the chitosan treatments significantly reduced anthracnose symptoms, resulting in a reduction of disease development and thereby maintained the quality of fresh fruit for extended periods. SCD at 1.0% with 600 nm droplet size gave the best result in that it delayed the onset of disease and maintained the quality of dragon fruit for up to 28 days of storage. It can be concluded from the present investigation that SCD have potential to be used as an antifungal agent to control postharvest anthracnose and maintain quality of dragon fruit during storage.

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

FIGS

Kong, Michelle, et al. 2013. Fruit skin side cracking and ostiole-end splitting shorten postharvest life in fresh **figs**, but are reduced by deficit irrigation. *Postharvest Biol. & Technol.* 85: 154 – 161.

Abstract

Side cracking and ostiole-end splitting skin damage affected decay development and the percentage of sound fruit during fresh fig (*Ficus carica* L.) postharvest handling and marketing. Modification of current grading standard tolerances according to cultivar is suggested to protect the consumers and improve marketable yield. The type and degree of skin damage varied among cultivars. For 'Brown Turkey', 'Kadota' and 'Sierra', slight skin-damage prior to cold storage increased decay and reduced postharvest life. In contrast, the postharvest life of 'Black Mission' fig was not significantly affected by a slight degree of skin damage prior to cold storage. Furthermore, postharvest decay incidence was associated with the degree of side cracking and ostiole-end splitting at harvest. Because fruit skin side cracking and ostiole-end splitting occur during fruit growth and development, prevention by regulated deficit irrigation (RDI) with 55% ETC was studied for two years. In both seasons, fruit quality attributes were not affected by RDI, except for 'Brown Turkey', where size decreased by 21% during one

season. RDI significantly reduced fruit skin side cracking and ostiole-end splitting in 'Brown Turkey' and skin side cracking in 'Sierra', increasing marketable fruit by 50% in 'Brown Turkey' and 18% in 'Sierra'.

Keywords: /Figs/ /Shelf life/ /Skin damage/ /Grading standards/

LEMON

Castillo, S. et.al. 2013. The essential oils thymol and carvacrol applied in the packing lines avoid **lemon** spoilage and maintain quality during storage. Food Control. 35: 132 - 136 .

Abstract

The objective of this paper was to study the effect of essential oils (EOs) thymol and carvacrol applied in citrus packing lines in combination with commercial wax on microbial spoilage, lemon decay and quality parameters during postharvest storage and compared with control (tap water), wax and wax þ imazalil as positive control. Results showed that the treatment with wax þ EOs was able to reduce yeast and mould and total aerobic counts on lemon surface and decayed lemons after 8 weeks of storage, the efficacy being similar to that obtained from wax þ imazalil treatment. In addition, lemons coated with Eos or imazalil showed similar quality attributes (weight loss, softening and colour) retention compared with control or waxed fruits.

Keywords: /Lemon/ / Firmness/ /Antimicrobial/ /Fungal Decay/ /Colour/

LONGKONG

Lichanporn, I. and C Techavuthiporn. 2013. The effects of nitric oxide and nitrous oxide on enzymatic browning in **longkong**. Postharvest Biol. & Technol. 86: 62 – 65.

Abstract

The effect of nitric oxide and nitrous oxide on pericarp browning of longkong fruit was studied. The fruit was either dipped for 5 min in 0.25 mM sodium nitroprusside (SNP), a nitric oxide donor, or continually exposed to 90% nitrous oxide (N₂O) vapour for 3 h and was compared to the untreated fruit (control). The fruits were then stored at 13 °C and RH of 90 ± 5%. The fruit treated for 3 h with nitrous oxide vapour had delayed pericarp browning with higher phenolic compounds. However, these fruit showed lower levels of phenylalanine ammonia lyase, polyphenol oxidase and peroxidase than the control fruit and those treated with 0.25 mM SNP. Therefore, we conclude that nitrous oxide delays browning and reduces the activities of browning enzymes in longkong pericarp.

Keywords: /Longkong/ /Browning/ /NPolyphenol Oxidase/

MANGO

Haff, Ronald P., et al. 2013. Automatic image analysis and spot classification for detection of fruit fly infestation in hyperspectral images of **mangoes**. Postharvest Biol. & Technol. 86: 23 –28.

Abstract

Fruit fly infestation of mangos is a major concern for growers and exporters, leading to requirements for quarantine treatments such as vapor heat treatment or irradiation and subsequent reduction in quality and consumer acceptance. An on-line method for detection and removal of infested fruit would thus benefit producers and consumers. An algorithm has been developed to identify spots generated in hyper-spectral images of mangoes infested with fruit fly larvae. The algorithm incorporates background removal, application of a Gaussian blur, thresholding, and particle count analysis to identify locations of infestations. Each of the four algorithm steps involves adjustable parameters which were iteratively tested to find the optimal combination for detection in terms of false positive and false negative results. For algorithm parameters selected to minimize false negative results, a false negative error rate of 1.0% was achieved with 11.1% false positive error and 6.0% overall error in heavily infested samples. For the same sample set, the lowest overall error rate achieved was 2.0%, with 1.0% false positive and 3.0% false negative. For samples with lower infestation rates, the error rates were much higher, the lowest overall error being 12.3%. This therefore demonstrates the feasibility of hyperspectral imaging for fruit fly detection while highlighting the need for technology with improved resolution and signal to noise ratio to allow detection of single larvae.

Keywords: /Mango/ /Fruit Fly/

Razzaq, Kashif, et al. 2013. Ripening period influences fruit softening and antioxidative system of 'Samar Bahisht Chaunsa' mango. *Scientia Hort.* 160: 108 – 114.

Abstract

Increased respiration rate and textural softening in mango during fruit ripening limit its postharvest shelf life with poor quality. Changes in ethylene production, respiration rate, activities of fruit softening [exo-polygalacturonase (exo-PG), endo-polygalacturonase (endo-PG), pectin esterase (PE) and endo-1,4- β -D-glucanase (EGase)], and antioxidative [peroxidase (POX), catalase (CAT) and superoxidedismutase (SOD)] enzymes were studied in mango cv. 'Samar Bahisht Chaunsa' during ripening at ambient conditions ($25 \pm 1^\circ\text{C}$; 60–65% RH). Ethylene production ($0.01\text{--}0.34 \mu\text{mol kg}^{-1}\text{h}^{-1}$) and respiration rate ($1.14\text{--}2.70 \text{mmol CO}_2\text{kg}^{-1}\text{h}^{-1}$) showed quadratic and cubic increase respectively up to day-5 of fruit ripening and later on reduced as the fruit reached to fully ripe stage (day-9). Fruit showed a linear decreasing trend for fruit firmness ($160.6\text{--}4.1 \text{N}$) during the entire ripening period. Fruit exhibited significant linear increase in the activities of endo-PG ($4.11\text{--}8.15$ viscosity changes $\text{mg}^{-1}\text{protein h}^{-1}$), cubic increase for exo-PG ($18.95\text{--}60.3 \mu\text{g gal acid mg}^{-1}\text{protein h}^{-1}$) and EGase ($3.96\text{--}9.52$ viscosity changes $\text{mg}^{-1}\text{protein h}^{-1}$) and cubic decrease in PE ($0.93\text{--}0.19 \text{mM NaOH mg}^{-1}\text{protein h}^{-1}$) enzymes during the entire ripening period. Linear decreasing trend for SOD ($50.71\text{--}26.75 \text{U mg}^{-1}\text{protein}$) and cubic increasing trend for CAT ($37.63\text{--}78.45 \text{U mg}^{-1}\text{protein}$) and POX ($17.11\text{--}82.35 \text{U mg}^{-1}\text{protein}$) enzymes were observed during fruit ripening in 'Samar Bahisht Chaunsa' mango. Fruit showed linear increase in total antioxidant scavenging activities ($766.87\text{--}478.41 \text{IC}_{50}$ value) up to day-7 and later on it decreased. Conclusively, along with the ethylene production and respiration rate, fruit ripening period was well associated with the activities of fruit softening and antioxidative enzymes of 'Samar Bahisht Chaunsa' mango fruit. As the ripening stage advanced, except PE and SOD, activities of fruit softening and antioxidative enzymes significantly increased in 'Samar Bahisht Chaunsa' mango fruit.

Keywords: /Mango/ /Antioxidants/ /Fruit Softening/ /Ripening/

Zhang, Zhengke, et al. 2013. β -Aminobutyric acid induces resistance of mango fruit to postharvest anthracnose caused by *Colletotrichum gloeosporioides* and enhances activity of fruit defense mechanisms. *Scientia Hort.* 160: 78 – 84.

Abstract

The effect of β -aminobutyric acid (BABA) on control of anthracnose caused by *Colletotrichum gloeosporioides* in mango fruit and its possible mechanisms were investigated. The results show that BABA treatments effectively suppressed the expansion of lesion in mango fruit inoculated with *C. gloeosporioides* during storage at 25°C, with the greatest efficacy being obtained using 100 mM BABA. However, BABA at 25–400 mM did not exhibit direct antifungal activity against *C. gloeosporioides* in vitro. Further-more, BABA treatment at 100 mM enhanced the activities of β -1,3-glucanase (GLU), chitinase (CHT) and phenylalanine ammonia lyase (PAL). BABA treatment also contributed to the accumulation of hydrogen peroxide (H₂O₂), while decreasing the rate of superoxide radical (O₂^{•-}) production. Concurrently, BABA increased the activity of superoxide dismutase (SOD), while inhibiting catalase (CAT) and ascorbate peroxidase (APX) activities. These results indicate that increased disease resistance of mango fruit after BABA treatment during storage might be attributed to an elicitation of defense response involving in the enhancement of defense-related enzyme activities and modulation of antioxidant system activities.

Keywords: /Mango/ /Anthracnose/

ORANGE

Moscoso-Ramírez, Pedro A. & Lluís Palou. 2013. Evaluation of postharvest treatments with chemical resistance inducers to control green and blue molds on orange fruit. *Postharvest Biol. & Technol.* 85: 132 – 135.

Abstract

Preventive and curative activities of postharvest treatments with selected chemical resistance inducers to control postharvest green (GM) and blue (BM) molds on oranges (cvs. 'Valencia' or 'Lanelate') artificially inoculated with *Penicillium digitatum* and *Penicillium italicum*, respectively, were evaluated. In vivo primary screenings to select the most effective chemicals and concentrations were performed with benzothiadiazole (BTH), β -aminobutyric acid (BABA), 2,6-dichloroisonicotinic acid (INA), sodium silicate (SSi), salicylic acid (SA), acetylsalicylic acid (ASA) and harpin. INA at 0.03 mM, SA at 0.25 mM, BABA at 0.3 mM and BTH at 0.9 mM were selected and tested afterwards as dips at 20 °C for 60 or 150 s with oranges artificially inoculated before or after the treatment and incubated for 7 d at 20 °C. Although it was an effective treatment, SSi at 1000 mM was discarded because of potential phytotoxicity to the fruit rind. Preventive or curative postharvest dips at room temperature had no effect or only reduced the development of GM and BM very slightly. Therefore, these treatments cannot be recommended for inclusion in postharvest decay management programs for citrus packinghouses.

Keywords: /Orange/ /Postharvest Treatments/ /Green Molds/ /Blue Molds/

McDonald, Heather, et al. 2013. Effect of gamma irradiation treatment at phytosanitary dose levels on the quality of 'Lane Late' navel oranges. *Postharvest Biol. and Technol.* 86: 91 – 99.

Abstract

The objectives of this study were to determine the dose tolerance of 'Lane Late' navel oranges (*Citrus sinensis* L. Osbeck) to irradiation for phytosanitary purposes, identify the sensory attributes that maybe affected by the treatment, and determine which changes, if any, influence consumer liking. 'LaneLate' navel oranges on Carrizo citrange (*C. sinensis* Poncirus trifoliata) rootstock were irradiated at targetdose levels of 200, 400 and 600 Gy (actual absorbed doses were in the range of 100–300, 300–500, and500–700 Gy, respectively) then stored for 1 d at 5°C, 3 weeks at 5°C (to simulate sea shipment to Asia) or4 weeks (3 weeks at 5°C and 1 week at 20°C to simulate distribution to retail following sea shipment).Trained sensory panelists found increased pitting and visual damage in oranges treated at doses of 400and 600 Gy. Consumer liking scores for appearance were significantly lower for oranges treated at 400 Gy, however, their overall liking scores for those same oranges were not significantly different than control. Color, total phenolic content, vitamin C and ORAC (oxygen radical absorbance capacity) values were not affected by irradiation. Dose effects were seen in terms of visual damage, increased weight loss and increased concentration of certain volatiles and as well as decreased SSC (soluble solids concentration) at doses 400 and 600 Gy. The primary effect of irradiation on fruit quality was external damage and pitting at doses of 400 and 600 Gy. Further research should consider pack configuration and/or combination treatments to possibly mitigate negative irradiation effects on appearance of the fruit.

Keywords: /Orange/ /Gamma Irradiation/ /Sensory/ /Quality/

PAPAYA

Ong, Mei, Kyng, et al. 2013. Postharvest profile of a Solo variety 'Frangi' during ripening at ambient temperature. *Scientia Hort.* 160: 12 – 19.

Abstract

Changes in physical, chemical properties and antioxidant levels during postharvest ripening of 'Frangi' papaya (*Carica papaya* L.) were studied over a period of eight days after harvest. In general, a significant increase in weight loss (2.5–8%), lightness value (49.54–63.1), chroma (32.3–59.3), soluble solids concentration (7.9–17.6%), ascorbic acid content (169–322 mg 100 g–1fresh weight (FW)), total phenolic content(0.515–0.686 mg GAE (gallic acid equivalents) g–1FW), ethylene production (5.83–81.3 μ l kg–1h–1), respiration rate (24.5–59.0 ml CO₂kg–1h–1), β -carotene (0.045–0.201 mg 100 g–1FW) and lycopene content(0.08–0.244 mg 100 g–1FW) was observed during storage, whereas there were a reduction in titratable acidity (0.162–0.075%), firmness (108–7.7 N) and hue angle (157–96.8°). 'Frangi' papaya particularly after4 days of ambient storage showed improved antioxidant activity (0.32–1.55 mM Fe(II) g–1FW).

Keywords: /Papaya/ /Antioxidant/ /Respiration Rate/ /Ripening/

PERSIMMON

Jeong, Mijin, et.al. 2013. Master packaging system for sweet **persimmon** applicable to produce supply chains. *Postharvest Biology and Technology* 86 (2013) 141–146

Abstract

Modified-atmosphere-packaged sweet persimmons experience significant quality loss due to temperature fluctuations in the food supply chain, which cause an imbalance between respiration and package gas permeation. This imbalance results in the package atmosphere deviating from the tolerable range. In this study, a master packaging system was designed to maintain a suitable modified atmosphere around the fruit during pre-sale chilled storage and during retail display to preserve freshness. A 50- μm -thick low-density polyethylene (LDPE) outer liner bag containing 46 individual fruit packages (30- μm -thick oriented polypropylene (OPP) film bag with a micro-perforation of about 60 μm) was placed within a corrugated paperboard box. Master packaging systems with and without the absorbent sachets were stored for 122 d at 0°C and were periodically opened to remove and store the individual primary package units for 10 d at 10°C to simulate retail display conditions. The master packaging systems were compared to 10-kg bulk packages containing individual fruit inside a 50- μm -thick LDPE film bag in terms of package atmosphere and fruit quality. Individual fruit packages consisting only of 30- μm -thick, micro-perforated OPP films without an outer liner bag were subjected to the pre-sale 0°C storage for comparison. The master packaging systems maintained an atmosphere with O₂ concentrations of 0.8–3.9% and CO₂ concentrations of 8.4–15.0% around the fruit during storage at 0°C and during display at 10°C. The high-temperature retail display, after chilled storage at 0°C, resulted in a drastic decline in quality, even with some alleviation offered by the master packaging system. The overall benefits were reduced weight loss, reduced physiological deterioration (e.g., flesh softening and surface blackening) and better retention of firmness and ascorbic acid during the chilled storage and/or the display conditions.

Keywords: / Persimmon/ /Packaging/ /Supply Chain/

PEACH

Lovisetto, Alessandro, et al. 2013. Characterization of a bZIP gene highly expressed during ripening of the **peach** fruit. *Plant Physiol. & Biochem.* 70: 462 – 470.

Abstract

A ripening specific bZIP gene of peach was studied by ectopically expressing it in tomato. Two lines, with either a mild or a strong phenotype, respectively, were analyzed in detail. Transgenic fruit morphology was normal, yet the time spent to proceed through the various ripening stages was longer compared to wild type. In agreement with this finding the transgenic berries produced less ethylene, and also had a modified expression of some ripening-related genes that was particularly evident in berries with a strong phenotype. In particular, in the latter fruits polygalacturonase and lipoxygenase genes, but also genes coding for transcription factors (TFs) important for tomato ripening (i.e. TAGL1, CNR, APETALA2a, NOR) did not show the expected decreased expression in the red berries. As regards the RIN gene, its expression continued to increase in both mild and strong lines, and this is in agreement with the dilated ripening times. Interestingly, a metabolomic analysis of berries at various stages of ripening showed that the longer time spent by the transgenic berries to proceed from a stage to another

was not due to a slackened metabolism. In fact, the differences in amount of stage-specific marker metabolites indicated that the transgenic berries had a very active metabolism. Therefore, the dilated ripening and the enhanced metabolism of the berries over-expressing the bZIP gene suggest that such gene might regulate ripening by acting as a pacemaker for some of the ripening metabolic pathways.

Keywords: /Peach/ /Fruit Ripening/

POMEGRANATE

Caleb, O.J. et.al. 2013. Transpiration rate and quality of **pomegranate** arils as affected by storage conditions. *CyTA – J. Food.* 1 – 9.

Abstract

This study investigated the transpiration rate (TR) of pomegranate (*Punica granatum* L.) arils under various combinations of temperature (5, 10 and 15°C) and relative humidity (RH) (76, 86 and 96%) during storage. Transpiration rate TR ranged from 1.14 to 16.75 g/kg day across the various combinations of RH and temperature studied. Relative humidity RH had the most significant impact on TR ($p < 0.05$). Transpiration rate TR increased six-fold when RH was reduced from 96 to 76%, and correlated well with water vapour pressure deficit (WVPD) ($R^2 = 96.1\%$). Aril weight loss increased at higher WVPD. After 8 days of storage, losses in quality attributes of arils were higher with increasing storage temperature and lowering RH. A mathematical model to predict TR as a function of temperature and RH was developed and successfully validated at 8°C. The target water vapour transmission rate of packaging materials for pomegranate arils was found to be 33 to 68 g/m² day.

Keywords: /Pomegranate/ /Food Packaging/ /Transpiration Rate/ /Relative Humidity/Fresh-Cut/

Mayuoni-Kirshinbaum, Lina Avinoam Daus¹ & Ron Porat. 2013. Changes in sensory quality and aroma volatile composition during prolonged storage of 'Wonderful' **pomegranate** fruit. *Int'l. J. Food Sci. Technol.* 48: 1569 – 1578.

Abstract

Flavour acceptance tests of 'Wonderful' pomegranate arils during prolonged storage under commercial modified atmospheres conditions yielded high preference scores during the first 12 weeks of cold storage at 7 °C, but sensory quality decreased remarkably after 16 and, especially, 20 weeks. Descriptive flavour analyses by a trained sensory panel revealed that the decrease in fruit flavour preference resulted mainly from a decrease in typical pomegranate flavour and increases in 'overripe' and 'off-flavour' odours. GCMS analysis of aroma volatile contents revealed high correlations ($r^2 > 0.9$) between accumulation of the ethanol fermentation products ethanol and ethyl acetate and the observed decrease in fruit flavour preference. In addition, we observed relatively high correlations ($r^2 > 0.7$) between the accumulation of various sesquiterpene volatiles and the decrease in flavour preference. According to these findings, it is suggested that the decrease in flavour preference most likely resulted from massive accumulation of ethanol fermentation products and sesquiterpene volatiles.

Keywords: /Pomegranate/ /Quality/ /Storage/

Fawole, Olaniyi Amos, Umezuruike Linus Opara . 2013. Effects of storage temperature and duration on physiological responses of **pomegranate** fruit. *Industrial Crops & Products*. 47: 300 – 309.

Abstract

Pomegranate fruit (cv. 'Bhagwa' and 'Ruby') harvested at commercial maturity were stored at 5 ± 0.3 °C, 7 ± 0.5 °C and 10 ± 0.4 °C with $92 \pm 3\%$ relative humidity (RH), and at 22 °C ($65 \pm 5.5\%$ RH) for 16 weeks during which fruit respiration, physico-chemical attributes, antioxidant capacities and incidence of physiological disorders were measured at 4-week intervals. Results showed that the physiological responses and quality of fruit were affected by storage condition, with the maximum levels of respiration occurring at higher temperature and extended storage duration. Fruit color and antioxidant capacity varied slightly among storage temperatures, with total soluble solids and titratable acidity decreasing gradually over time at different temperatures. Although storage at 5 °C significantly reduced the total phenolic content of fruit when stored beyond 8 weeks, levels of antioxidant activity in the fruit were not affected. Weight loss was particularly high in fruit stored at 22 °C for 4 weeks, ranging between 20 and 25% for both cultivars. Furthermore, the severity and occurrence of physiological disorders were lower in fruit stored at low temperature but increased with extended storage duration. Considering that fruit stored at 5 °C and 92% RH had significantly reduced weight loss, low incidence of physiological disorders and best results in maintaining flavor attributes (TSS and TA, TSS:TA ratio), it is recommended that the investigated cultivars be stored at 5 °C and >92% RH for 8–12 weeks.

Keywords: /Pomegranate/ /Antioxidant/ /Fruit Quality/ /Postharvest/ /Physico-chemical/

Peña, Maria E.et.al. 2013. Effect of sustained deficit irrigation on physicochemical properties, bioactive compounds and postharvest life of **pomegranate** fruit(cv. 'Mollar de Elche'). *Postharvest Biol. & Technol.* 86: 171 – 180.

Abstract

In this study, the influence of sustained deficit irrigation (SDI; 32% of reference evapotranspiration (ET₀)) on physicochemical and sensory quality and bioactive compounds of pomegranates stored for 30, 60 and 90 days in air at 5°C + 4 days at 15°C, at each storage period, was studied and compared to a control (100%ET₀). Fruit from SDI had higher peel redness and greater firmness, soluble solids contents, vitamin C (27%), phloretin (98%) and protocatechuic acid (10%) levels, and total antioxidant capacity (TAC) (46%) than the control. Cold storage and shelf-life did not induce significant changes in soluble solids, pH, titratable acidity, and chroma and Hue. SDI fruit had retarded development of chilling injury (CI) symptoms, which appeared after 60 days of storage in comparison to 30 days in the controls. Anthocyanins, catechin, phloretin and protocatechuic, caffeic, p-coumaric and caffeic acids contents had greater increases in SDI fruit than in controls throughout the postharvest life. TAC was significantly ($P < 0.05$) correlated to anthocyanins, gallic acid and total vitamin C contents. Generally, after long term storage, the fruit grown under SDI showed higher sensory and nutritional quality, more health attributes and a longer shelf-life (up to 90 days at 5°C + 4 at 15°C) than fruit irrigated at 100% ET₀.

Keywords: /Pomegranate/ /Chilling Injury/ /Postharvest Life/

Teixeira da Silva, Jaime, A. et al. 2013. **Pomegranate** biology and biotechnology: A review. Scientia Hort. 160: 85 – 107.

Abstract

Pomegranate (*Punica granatum* L.) is one of the oldest known edible fruit tree species, originating in Central Asia, but with a wide geographical global distribution, reflecting its adaptation to a wide range of climatic conditions. It is important for its nutritional, medicinal and ornamental properties and its high consumption and industrial value. In a bid to better utilize and improve the current genetic resources, there is a need to understand and appreciate studies related to the use, centre of origin and diversity, as well as the characterization, evaluation and conservation, taxonomy and systematics of the genus *Punica*. In addition to understanding the basic biology of the plant, how biotechnological tools, including cell and tissue culture and micropropagation (i.e. somatic embryogenesis, organogenesis, synthetic seeds, somaclonal variation, mutagenesis, haploidy, and in vitro conservation), genetic transformation and marker technology, have been used to improve pomegranate germplasm are all topics that have been covered in this review.

Keywords: /Pomegranate/ /Biology/ /Biotechnology/

Zhang, Lu, and Michael J. McCarthy. 2013. Effect of controlled atmosphere storage on **pomegranate** quality investigated by two dimensional NMR correlation spectroscopy. LWT - Food Sci. & Technol. 54: 302 – 306.

Abstract

Pomegranate fruit was studied by two dimensional NMR correlation spectroscopy during 25 weeks of controlled atmosphere (CA) storage. The proton T1T2 correlation spectrum provided rich information on the characteristics of the environment of water in sub cellular compartments. Three relaxation components were identified in the pomegranate arils, which could be assigned to the vacuole, cytoplasm, and cell wall. The results showed that water transferred out of the vacuole to other compartments during storage. Shrinkage of the vacuole was expected as a result of the significant loss of water. The soluble solids content and titratable acidity of the pomegranate decreased during the controlled atmosphere storage, but they were not the major contributor to the change in the relaxation rate of water in the sub cellular compartments of the aril tissue. The change in the aril was gradual and not uniform across the tissue in response to CA storage. The variation in the response of the arils to CA diminished at longer storage time.

Keywords: /Pomegranate/ /Quality/ /Controlled Atmosphere Storage/

STONEFRUIT

Sisquella, M. et al. 2013. Continuous microwave treatment to control postharvest brown rot in **stone fruit**. Postharvest Biol. and Technol. 86: 1 – 7.

Abstract

Monilinia spp. are the most important causes of brown rot in stone fruit and no chemical fungicides are allowed in the European Union to be applied to stone fruit after harvest. From

preliminary studies, microwave (MW) treatments at 17.5 kW for 50 s and 10 kW for 95 s were selected as effective conditions to control brown rot. Both treatments were investigated to control *Monilinia fructicola* in fruit with different weights and maturity levels and in naturally infected fruit. Fruit weight only had a significant effect on microwave efficacy in 'Placido' peaches treated by MW at 10 kW for 95 s in which better brown rot control was observed in small than large fruit. Maturity level did not have a significant effect on efficacy of MW treatments in any of the varieties evaluated. When both MW treatments were studied in naturally infected peaches and nectarines, brown rot incidence was significantly reduced to less than 14% compared with untreated fruit where brown rot incidence was higher than 45%. The effect of both treatments on fruit quality was also evaluated. Fruit firmness was not negatively affected in the varieties tested and even a delay of fruit softening was observed. However, internal damage around the stone was observed, especially in the smallest fruit in which high temperature is achieved at the end of both MW treatments.

Keywords: /Stone Fruit/ /Postharvest/ /Brown Rot/ /Heat Treatments/ /Disease Control/

STRAWBERRY

Concha, Cristóbal M., et al. 2013. Methyl jasmonate treatment induces changes in fruit ripening by modifying the expression of several ripening genes in *Fragaria chiloensis* fruit. *Plant Physiol. and Biochem.* 70: 433 – 444.

Abstract

To investigate the role of jasmonates (JAs) in the ripening of *Fragaria chiloensis* fruit, two concentrations of methyl jasmonate (MeJA, 10 and 100 mM) were evaluated at 2, 5 and 9 d using an in vitro ripening system. Fruit quality parameters; the contents of anthocyanin, lignin and cell wall polymers; and the transcriptional profiles of several ripening-related genes were analyzed. MeJA accelerated fruit ripening by means of a transitory increase in the soluble solid content/titratable acidity ratio, anthocyanin accumulation and an increase in softening at day 5. The expression of several phenylpropanoid-related genes, primarily those associated with anthocyanin biosynthesis, was increased under MeJA treatment, which correlated with an increased accumulation of anthocyanin. MeJA also altered the expression profiles of some cell wall-modifying genes, namely, EG1 and XTH1, and these changes correlated with a transient reduction in the firmness of MeJA-treated fruits. MeJA-responsive elements were observed in the promoter region of the EG1 gene. MeJA also increased the expression of LOX, AOS and OPR3, genes involved in the biosynthesis of JAs, and these changes correlated with the transient activation of fruit ripening observed. Conversely, the expression of ethylene and lignin biosynthesis genes (ACS, ACO, CAD and POD27) increased in MeJA-treated fruits at day 9. The present findings suggest that JAs promote the ripening of non-climacteric fruits through their involvement in anthocyanin accumulation, cell wall modification and the biosynthesis of ethylene and JAs.

Keywords: /Strawberry/ /Fruit Ripening/

Gol, Neeta B., et al. 2013. Improvement of quality and shelf-life of strawberries with edible coatings enriched with chitosan. *Postharvest Biol. and Technol.* 85: 185 – 195.

Abstract

Strawberry fruit have a very short shelf-life and senescent period due to their high degree of perishability and infection caused by several pathogens that can rapidly reduce fruit quality. The aim of this study was to determine the efficacy of carboxymethyl cellulose (CMC), hydroxypropylmethyl cellulose (HPMC) and composites with chitosan (CH) coatings on the shelf-life and overall quality of strawberry fruit. Strawberry fruit dipped for 2 min in solutions of CMC (1%), HPMC (1%), CMC (1%) + CH (1%) and HPMC (1%) + CH (1%) were stored at $11 \pm 1^\circ\text{C}$, 70–75% RH, while the uncoated fruit served as controls. Fruit coated with edible coatings showed significant delays in the change of weight loss, decay percentage, titratable acidity (TA), pH, total soluble solids (TSS) and ascorbic acid content as compared to uncoated control fruit. In addition, the edible coatings had a positive effect on maintaining higher concentrations of total phenolics and total anthocyanins, which decreased in control fruit due to over-ripening and senescence processes. Compared to the controls, all the coatings had positive effects on the inhibition of cell wall degrading enzymes and among all the tested coatings, CMC + CH and HPMC + CH was superior in inhibiting enzyme activity. These findings suggest that the use of CMC 1% + CH 1% and HPMC 1% + CH 1% coatings are useful for extending the shelf-life and maintaining quality of strawberry fruit.

Keywords: /Strawberry/ /Edible Coatings/ /Quality/ //Shelf-life/

SWEET CHERRIES

Serradilla, Manuel, Joaquín, et. al. 2013. Study of microbiological quality of controlled atmosphere packaged 'Ambrunés' sweet cherries and subsequent shelf-life. *Int'l J. Food Microbiol.* 166: 85 – 92.

Abstract

The objectives of this study were to evaluate the effect of different controlled atmospheres, containing 3% O₂ + 10% CO₂, 5% O₂ + 10% CO₂ and 8% O₂ + 10% CO₂, on changes in microbial population of 'Ambrunés' sweet cherries throughout storage during 30 days and subsequent shelf-life, as well as to identify the main genera of yeast, mould, lactic acid bacteria, *Staphylococcus* spp., *Pseudomonas* spp., *Enterobacteriaceae* spp., and coliforms. The results indicated that controlled atmospheres with 5% O₂ + 10% CO₂ and 8% O₂ + 10% CO₂ were highly effective to control the growth of mesophilic aerobic bacteria, psychrotrophs, *Pseudomonas* spp., yeasts, and moulds after 15 days of storage, showing, in the case of yeasts and moulds, counts that ranged between b_1 and 1.75 log CFU/g. The genera of yeasts, moulds, lactic acid bacteria, *Enterobacteriaceae* spp., and coliforms identified were *Aureobasidium* spp., *Penicillium* spp., *Leuconostoc* spp., and *Rahnella* spp., respectively. In addition, the genera *Staphylococcus* spp. and *Pseudomonas* spp. were also identified. On the other hand, cherries of Stage 3 ripening presented the highest counts for all microbial groups.

Keywords: /Sweet Cherries/ /Ripening Stage/ /Fruit Quality/ /Microbial Quality/ /Controlled Atmospheres/ /Postharvest/ / Storage/

TABLE GRAPE

Jiang, Chunmei, et. al. 2013. Inhibition of *Aspergillus carbonarius* and fungal contamination in **table grapes** using *Bacillus subtilis*. *Food Control*. 35: 41 – 48.

Abstract

Aspergillus carbonarius is a major producer of ochratoxin A in grapes, causing fungal decay and posing a significant threat to human health. *Bacillus subtilis* CCTCC M 207209 was used to inhibit the growth of *A. carbonarius* CCTCC AF 2011004, an ochratoxin A-producing strain previously isolated from grapes. The inhibition effect in vitro was tested in potato dextrose agar medium (PDA), while in vivo effects were examined in grape berries of three different grape cultivars: Thompson Seedless, Kyoho, and Red Earth. Inhibitory effects were evaluated according to colony size in PDA and rotten spots in grape berries when *A. carbonarius* and *B. subtilis* were inoculated simultaneously and cultivated at 0 °C, 25 °C, or 30 °C. *B. subtilis* liquid cultures with and without cells and volatile products were used in the analyses. Significant inhibition of *A. carbonarius* was observed in all samples treated with *B. subtilis* liquid cultures, especially those subjected to cell-free culture treatment. No inhibition was observed for *A. carbonarius* treated with the volatile products of *B. subtilis*. The inhibition was the most significant in Red Earth grapes, followed by the Kyoho then Thompson Seedless varieties, when the same fraction of *B. subtilis* culture was used. Significant inhibition was also observed for other fungal contaminants in grapes when *B. subtilis* liquid culture supernatant was used. This study reveals the potential of *B. subtilis* for inhibiting contamination of OTA-producing *A. carbonarius* and other fungi in table grapes.

Keywords: /Table Grapes/ /*Aspergillus Carbonarius*/

Liu, Yong-Biaol. 2013. Controlled atmosphere treatment for control of **grape** mealybug, *Pseudococcus maritimus* (Ehrhorn) (Hemiptera: Pseudococcidae), on harvested table grapes. *Postharvest Biol. & Technol.* 86: 113 – 117.

Abstract

Controlled atmosphere (CA) treatments with ultralow oxygen (ULO) alone and in combinations with 50% carbon dioxide were studied to control grape mealybug, *Pseudococcus maritimus* (Ehrhorn) on harvested table grapes. Two ultralow oxygen levels, 30 and <0.01 $\mu\text{L L}^{-1}$, were tested in both ULO and ULO + 50% CO₂ treatments. The ULO treatments with the lower oxygen level were more effective than the ULO treatments at the higher oxygen level. The ULO + 50% CO₂ treatments were more effective than the ULO treatments. Grape mealy bug eggs were significantly more tolerant of ULO and ULO + CO₂ treatments than nymphs and adults. A 14 day ULO treatment with 30 $\mu\text{L L}^{-1}$ O₂ at 2°C did not achieve 100% mortalities of any life stage. In the presence of 50% CO₂, the 14 d treatment achieved complete mortality of all life stages of the grape mealybug. A 3 d ULO treatment with <0.01 $\mu\text{L L}^{-1}$ O₂ at 2°C resulted in 93.3% mortality of nymphs and adults. The 3 d ULO treatment in combination with 50% CO₂ treatments, however, achieved complete control of grape mealybug nymphs and adults and caused 70.5% relative egg mortality. Complete egg mortality was achieved in a 10 d ULO + 50% CO₂ treatment with <0.01 $\mu\text{L L}^{-1}$ O₂ at 2°C. Both the 14 d CA treatment with 30 $\mu\text{L L}^{-1}$ O₂ and 50% CO₂ and the 10 d CA treatment with <0.01 $\mu\text{L L}^{-1}$ O₂ and 50% CO₂ were tested on table grapes and grape quality was evaluated after two weeks of post-treatment storage. The CA treatments did not have a significant negative impact on grape quality and were safe for table grapes. The study indicated that CA treatments have potential to be developed for postharvest control of grape mealy bug on harvested table grapes.

Keywords: /Table Grapes/ /Controlled Atmosphere/ /Postharvest Pest Control/

Segade, Susana, Río, et al. 2013. Impact of different advanced ripening stages on berry texture properties of 'Red Globe' and 'Crimson Seedless' table grape cultivars. *Scientia Hort.* 160: 313 - 319.

Abstract

The impact of different ripening stages on berry texture properties of sorted 'Red Globe' and 'Crimson Seedless' table grapes was evaluated. Density sorting at different harvest dates was utilised to obtain homogeneous samples for each ripening stage. At the same ripening stage, 'Red Globe' berries were more firm, cohesive, springy, chewy and resilient but less hard and gummy than 'Crimson Seedless'. Particularly for cv. Red Globe, the choice of the ripening stage at harvest could be a determinant for the berry quality because riper berries were associated with higher skin thickness values (+25%). The berry hardness and gumminess of 'Crimson Seedless' decreased significantly during ripening (-50%), and these parameters were most influenced by the berry size. Conversely, berry cohesiveness can be used as a ripeness predictor of table grapes because the changes during the ripening process were independent of berry size. The peduncle detachment resistance of the berry in the Crimson Seedless grapes decreased to values lower than 3.4 N, negatively affecting the quality attributes of the berry.

Keywords: /Table Grape/ /Texture Analysis/ /Ripening/

VEGETABLES

ASPARAGUS

Sánchez, María-Teresa, et al. 2013. NIRS technology for fast authentication of green asparagus grown under organic and conventional production systems. *Postharvest Biol. & Technol.* 85: 116 – 123.

Abstract

This study sought to evaluate the ability of near-infrared reflectance spectroscopy (NIRS) to classify intact green asparagus as a function of growing method (organic vs. conventional) during postharvest refrigerated storage, and as a function of harvest month and postharvest cold storage duration. It also sought to identify the portion of the spear best suited for this purpose. A total of 300 green asparagus spears (*Asparagus officinalis* L., cv 'Grande'), were sampled after 7, 14, 21 and 28 d of refrigerated storage (2°C, 95%RH) and at commercial harvest time. Three commercially available spectrophotometers were evaluated for this purpose: a scanning monochromator (scanning range 400–2500 nm), a diode-array Vis/NIR spectrophotometer (range 400–1700 nm) and a handheld MEMS spectrophotometer (range 1600–2400 nm). Models constructed using partial least squares 2-discriminant analysis (PLS2-DA) correctly classified 91% of samples by growing method using the diode array instrument, between 86% and 91% using the scanning monochromator and between 82% and 84% using the handheld spectrometer. The tip and the middle portion of the spear proved to be the most suitable for this purpose employing the MEMS instrument. Using similar models, the diode array instrument correctly classified 100% of samples by harvest month, compared with between 97% and

98% using the scanning monochromator and between 87% and 96% using the handheld instrument. Models also correctly classified between 66% and 97% of samples by postharvest storage time, depending on the instrument used. The results indicate good performance of the prediction models, particularly for predicting harvest month and growing method, determination of the latter being of considerable importance for the authentication of organic asparagus at industrial level.

Keywords: /Asparagus/ /Green asparagus/ /Organic Agriculture/ /Shelf-life/

BABY SPINACH

Gómez-López, Vicente M., et al. 2013. Generation of trihalomethanes with chlorine-based sanitizers and impact on microbial, nutritional and sensory quality of baby spinach. *Postharvest Biol. & Technol.* 85: 210 – 217.

Abstract

The potential generation of trihalomethanes (THMs) during washing of vegetable products as a consequence of the use of chlorine has become one of the main concerns for researchers, industry and regulatory agencies. However, only scarce information is known about the actual THM formation in process wash water and in the final product to establish the real risks associated with it. The aim of this work was to evaluate the THM formation in process wash water after washing baby spinach with chlorine-based sanitizers such as sodium hypochlorite and electrolyzed oxidizing water with and without the addition of salt (EOW + NaCl and EOW, respectively). Additionally, the impact of these chlorine-based sanitizers on the microbial, nutritional and sensory quality of baby spinach was compared with a non-chlorine based sanitizer such as peroxyacetic acid. The total THM levels of the process wash water treated with sodium hypochlorite and EOW + NaCl were over the authorized limit fixed by the European legislation and USEPA (100 and 80 $\mu\text{g L}^{-1}$, respectively) for drinking water. However, the THM levels after treatment with EOW did not exceed these established limits. In baby spinach, THMs were detected in low levels in sodium hypochlorite and EOW washed samples because the rinsing step reduced them to levels below the detection limit. Chlorine and non-chlorine based sanitizers such as peroxyacetic acid, did not affect the quality and shelf-life of the product. After washing and during storage in modified atmosphere pack-aging, similar headspace gas concentrations, microbial and sensory quality, instrumental texture and colour measures and electrolyte leakage were observed for all sanitizers. The results provide evidence that, under these specific experimental conditions, chlorine-based sanitizers do not represent a risk for THM formation during baby spinach leaf processing. In our opinion, current experimental data does not support banning the use of chlorine-based sanitizers in the fresh-cut vegetable industry because of THM generation in commodities such as spinach.

Keywords: /Baby Spinach/ /Sensory Quality/

Xu, Wenqing. 2013. Decontamination of Escherichia coli O157:H7 on green onions using pulsed light (PL) and PL–surfactant–sanitizer combinations. *Int'l. J. Food Microbiol.* 166 : 102 – 108.

Abstract

Imported green onion has been associated with three large outbreaks in the USA. Contamination has been found on both domestic and imported green onions. The objective of our study was to investigate Escherichia coli O157:H7 inactivation efficacy of pulsed light (PL) as well as its combination

with surfactant and/or sanitizers on green onions. Green onions were cut into two segments, stems and leaves, to represent two different matrixes. Stems were more difficult to be decontaminated. Spot and dip inoculation methods were compared and dipped inoculated green onions were found to be more difficult to be decontaminated. Results showed that 5 s dry PL (samples were not immersed in water during PL treatment) and 60 s wet PL (samples were immersed in water and stirred during PL treatment) treatments provided promising inactivation efficacy (N4 log₁₀ CFU/g) for spot inoculated stems and leaves. For dip inoculated green onions, 60 s wet PL treatment was comparable with 100 ppm chlorine washing, demonstrating that PL could be used as an alternative to chlorine. To further increase the degree of microbial inactivation, combined treatments were applied. PL combined with surfactant (SDS) was found to be more effective than single treatments of PL, SDS, chlorine, citric acid, thymol, and hydrogen peroxide, and binary combined treatments of PL with one of those chemicals. Addition of chlorine or hydrogen peroxide to the PL–SDS combination did not further enhanced its microbial inactivation efficacy. The combination of PL and 1000 ppm of SDS reduced the *E. coli* O157:H7 populations dip inoculated on the stems and leaves of green onions by 1.4 and 3.1 log₁₀ CFU/g, respectively. Our findings suggest that PL could potentially be used for decontamination of *E. coli* O157:H7 on green onions, with wet PL added with SDS being the most effective PL treatment.

Keywords: /Green Onions/ /Escherichia coli O157:H7/

LEEK

Bernaert, Nathalie, et al. 2013. Antioxidant changes during postharvest processing and storage of leek. *Postharvest Biol. & Technol.* 86: 8 – 16.

Abstract

The evaluation of the impact of postharvest processing and storage on the health benefits of vegetables is of great practical importance. Reports on their effect on the antioxidant capacity, polyphenol and S-alk(en)yl-L-cysteine sulfoxide (ACSO) content, i.e. isoalliin and methiin of the white shaft of leek (*Allium ampeloprasum* var. *porrum*), however, are limited. This study determined the levels of the antioxidant properties of leek from postharvest processing at the farm until refrigerated storage of 13 days at the consumer. Two cases were investigated, (1) leek sold as an entire plant and (2) leek with a large part of the green leaves removed, where the shafts are sold in a plastic package. The antioxidant capacity and the total content of phenolic compounds in the white shaft of the entire and packaged leek was stable during 13 days of refrigerated storage. A significant increase in the concentration of isoalliin was observed. Comparing the entire and processed/packaged leek, significant differences could be observed in antioxidant properties. The ACSO content in the white shaft of packaged leek was significant lower than the content in the white part of the entire leek. Therefore, the minimal processing step of cutting the green leaves and roots had an influence on the levels of antioxidant properties.

Keywords: /Leek/ /Postharvest / /Storage/

LETTUCE

Goñi, M.G., et al. 2013. Application of tea tree and clove essential oil on late development stages of Butter head lettuce: impact on microbiological quality. *LWT - Food Sci. & Technol.* 54: 107 – 113.

Abstract

Two essential oils (tea tree and clove) were applied as preharvest sanitizers on late development stages of Butterhead lettuce and its effect during postharvest storage was analyzed. The essential oils were applied in vitro (3 MIC) and proved to be effective to inhibit native microflora of Butterhead lettuce. In vivo, the essential oils were applied in a single dose (14, 10, 7, 3 and 0 days before harvest) and in successive applications. Both essential oils showed significant reductions in mesophyllic bacteria and total coliforms when applied at harvest and in successive applications. Clove showed no significant reductions in psychrophilic, yeast and molds counts. The sensorial quality of the product was assessed by a panel of trained judges. No significant differences were found between control and treated samples. After 5 days of refrigerated storage, lettuce treated with tea tree was able to reduce microbial counts after storage (2 log) without affecting sensorial characteristics. Application of clove resulted in no significant reduction on postharvest microbial counts. These results may indicate absence of long term antimicrobial activity of clove on the native microflora of Butterhead lettuce.

Keywords: /Lettuce/ /Preharvest/ /Postharvest/ /Organic/

MUSHROOM

Fernandes, Angela, et.al. 2013. Study of chemical changes and antioxidant activity variation induced by gamma-irradiation on wild **mushrooms**: comparative study through principal component analysis Food Res. Int'l. 54 : 18 – 25.

Abstract

Mushrooms are especially sensitive to senescence, browning, water loss and microbial attack. Furthermore, wild species are characterized by their seasonality, demanding the development of suitable preservation technology. Gamma-irradiation was previously tested in wild *Lactarius deliciosus*, being verified that its application up to 1 kGy did not imply significant changes in chemical parameters. Herein, the effects of higher gamma-irradiation doses, typically used in natural food matrices like fruits or vegetables, were assessed in *Boletus edulis* Bull.: Fr. and *Hydnum repandum* L.: Fr. by checking for changes in nutritional parameters, free sugars, tocopherols, fatty acids, organic acids and antioxidant activity indicators. To have representative samples, the used carpophores were collected in different maturity stages, using the same number of specimens for each stage and also for each mushroom species. The specific effects of each tested irradiation were evaluated in an integrated manner through principal component analysis. The correspondent biplots indicate that differences caused by gamma-irradiation are enough to separate irradiated and non-irradiated samples of both mushrooms. Nevertheless, nutritional profiles were not affected in high extension, indicating that gamma-irradiation, up to the doses used in this work, might represent a useful mushroom conservation technology.

Keywords: / Mushrooms/ /Gamma Irradiation/ /Antioxidant/

ONIONS

Xu, Wenqing, et al. 2013. Decontamination of *Escherichia coli* O157:H7 on green **onions** using pulsed light (PL) and PL–surfactant–sanitizer combinations. Int'l J. Food Microbiol. 166: 102 – 108.

Abstract

Imported green onion has been associated with three large outbreaks in the USA. Contamination has been found on both domestic and imported green onions. The objective of our study was to investigate Escherichia coli O157:H7 inactivation efficacy of pulsed light (PL) as well as its combination with surfactant and/or sanitizers on green onions. Green onions were cut into two segments, stems and leaves, to represent two different matrixes. Stems were more difficult to be decontaminated. Spot and dip inoculation methods were compared and dipped inoculated green onions were found to be more difficult to be decontaminated. Results showed that 5 s dry PL (samples were not immersed in water during PL treatment) and 60 s wet PL (samples were immersed in water and stirred during PL treatment) treatments provided promising inactivation efficacy ($N_4 \log_{10}$ CFU/g) for spot inoculated stems and leaves. For dip inoculated green onions, 60 s wet PL treatment was comparable with 100 ppm chlorine washing, demonstrating that PL could be used as an alternative to chlorine. To further increase the degree of microbial inactivation, combined treatments were applied. PL combined with surfactant (SDS) was found to be more effective than single treatments of PL, SDS, chlorine, citric acid, thymol, and hydrogen peroxide, and binary combined treatments of PL with one of those chemicals. Addition of chlorine or hydrogen peroxide to the PL–SDS combination did not further enhanced its microbial inactivation efficacy. The combination of PL and 1000 ppm of SDS reduced the E. coli O157:H7 populations dip inoculated on the stems and leaves of green onions by 1.4 and 3.1 \log_{10} CFU/g, respectively. Our findings suggest that PL could potentially be used for decontamination of E. coli O157:H7 on green onions, with wet PL added with SDS being the most effective PL treatment.

Keywords: /Onions/ /Green Onions/ /E. coli O157:H7/

SPINACH

Lara, M.A., et al. 2013. Monitoring spinach shelf-life with hyperspectral image through packaging films. J. Food Eng. 19: 353 – 361.

Abstract

Different procedures for monitoring the evolution of leafy vegetables, under plastic covers during cold storage, have been studied. Fifteen spinach leaves were put inside Petri dishes covered with three different plastic films and stored at 4 °C for 21 days. Hyper spectral images were taken during this storage. A radiometric correction is proposed in order to avoid the variation in transmittance of the plastic films during time in the hyper spectral images. Afterwards, three spectral pre-processing procedures (no pre process, Savitsky–Golay and Standard Normal Variate, combined with Principal Component Analysis) were applied to obtain different models. The corresponding artificial images of scores were studied by means of Analysis of Variance to compare their ability to sense the aging of the leaves. All models were able to monitor the aging through storage. Radiometric correction seemed to work properly and could allow the supervision of shelf-life in leafy vegetables through commercial transparent films.

Keywords: /Spinach/ /Shelf Life/

TOMATO

Aguiló-Aguayo, Ingrid, et al. 2013. Pulsed light effects on surface decontamination, physical qualities and nutritional composition of **tomato** fruit. *Postharvest Biol. & Technol.* 86: 29 – 36.

Abstract

Pulsed light (PL) is a nonthermal food technology with a potential as postharvest decontamination strategy for fruit and vegetables. The feasibility of PL in extending shelf-life of food products while assuring appropriate quality is still under investigation. The effect of pulsed light (PL) on surface decontamination (natural and inoculated microorganisms), physical (colour, texture and weight) and nutritional quality (ascorbic acid and major carotenoids) was investigated in red-ripe tomatoes during 15 days of storage at 20°C. The application of PL treatments at fluences of 2.68 and 5.36 J/cm² reduced microbial loads during storage of whole tomatoes. One log₁₀ reduction on the microflora present in both skin and peduncle scar parts of the tomato was obtained with a fluence of 4 J/cm². Fluences of 2.2 J/cm² allowed a 2.3 log₁₀ reduction of *Saccharomyces cerevisiae* inoculated onto the tomato surface. Softening, increased loss of weight, and wrinkles on the tomato surface appeared after 3 days on PL treated tomato fruit. Ascorbic acid levels remained unchanged during storage. Total lycopene, α-carotene and β-carotene contents and lycopene isomerisation percent were higher in tomato extracts prepared with fresh tomato fruit treated with a high PL dose of 30 J/cm². An increase in the bio-accessibility of lycopene was observed in hot-break purees prepared with fresh tomatoes treated at 5.36 J/cm² and stored 15 days. In conclusion, PL treatment of fresh tomato would result in a reduction in microbiological contaminants without compromising the nutritional value; but it did induce some appearance defects.

Keywords: /Tomato/ /Quality/ /

Estornell, Leandro, Hueso, et al. 2013. A VIN1 GUS::GFP fusion reveals activated sucrose metabolism programming occurring in interspersed cells during **tomato** fruit ripening. *J. Plant Physiol.* 170: 1113 – 1121.

Abstract

The tomato is a model for fleshy fruit development and ripening. Here we report on the identification of a novel unique cell autonomous/cellular pattern of expression that was detected in fruits of transgenic tomato lines carrying a GFP GUS driven by the fruit specific vacuolar invertase promoter VIN1. The VIN1 promoter sequence faithfully reproduced the global endogenous VIN expression by conferring a biphasic pattern of expression with a second phase clearly associated to fruit ripening. A closer view revealed a salt and pepper pattern of expression characterized by individual cells exhibiting a range of expression levels (from high to low) surrounded by cells with no expression. This type of pattern was detected across different fruit tissues and cell types with some preferences for vascular, sub-epidermal layer and the inner part of the fruit. Cell ability to show promoter activity was neither directly associated with overall ripening – as we find VIN+ and – VIN– cells at all stages of ripening, nor with cell size. Nevertheless the number of cells with active VIN-driven expression increased with ripening and the activity of the VIN promoter seems to be inversely correlated with cell size in VIN+ cells. Gene expression analysis of FACS-sorted VIN+ cells revealed a transcriptionally distinct subpopulation of cells defined by increased expression of genes related to sucrose metabolism, and decreased activity in protein synthesis and chromatin remodeling. This finding suggests that local micro

heterogeneity may underlie some aspects (i.e. the futile cycles involving sucrose metabolism) of an otherwise more uniform looking ripening program.

Keywords: /FACS/ /Invertase/ /Protoplasts/ /Ripening/ /Tomato/

Li, Zhiguo. 2013. The effect of compressibility, loading position and probe shape on the rupture probability of **tomato** fruits. *J. Food Eng.* 119: 471 – 476.

Abstract

In this study, factors affecting the rupture probability of tomato fruits were investigated. The experiments were carried out at five compressibility levels (4%, 8%, 12%, 16% and 20%), four loading positions and two probe shapes. The fruit size, shape and mass did not have a significant effect on the rupture probability. The compressibility was the most important independent variable affecting the rupture probability of tomato fruits in the model. The rupture probability of quadrilocular tomato fruit loaded from the cross-wall tissue was the highest, and the odds of being ruptured was 14.5 times higher for quadrilocular tomato fruit loaded from the cross-wall tissue compared to the locular tissue. The curved probe was much more sensitive than the plate probe for rupturing of tomato fruits during the compression tests. It is clear that these investigated factors need to be considered carefully in design and control of tomato harvesting equipment.

Keywords: /Tomato/ /Harvesting/

Liplap, Pansa, et al. 2013. **Tomato** shelf-life extension at room temperature by hyperbaric pressure treatment. *Postharvest Biol. & Technol.* 86: 45 – 52.

Abstract

The effect of hyperbaric treatments on major hydrophilic and lipophilic antioxidants and antioxidant activity in tomato fruit, using ORAC and TEAC assays, was studied. Early breaker stage greenhouse grown tomatoes were subjected to different pressure and temperature conditions, including 0.1 (ambient atmospheric pressure, control), 0.3, 0.5, 0.7 and 0.9 MPa at 20°C, and 0.1 MPa at 13°C (cold treatment) for 4 days, followed by ripening at 20°C for 5 and 10 days. Hyperbaric treatment significantly affected lycopene content by inhibiting, then enhancing its accumulation during treatment and ripening, respectively. In general, ascorbic acid and total phenolic contents increased as time progressed but generally were not affected by hyperbaric pressure treatment. All antioxidants were found in lower concentrations in tomatoes treated at 13°C. The trend in antioxidant activity obtained from both ORAC and TEAC assays was generally similar. No significant effect of hyperbaric treatment on lipophilic antioxidant (LAA) and hydrophilic antioxidant (HAA) was observed compared with control tomatoes at 13 and 20°C. However, the ORAC assay showed that hyperbaric treated tomatoes had significantly higher HAA than 13°C treated tomatoes. Overall, hyperbaric treatment at 20°C has potential to extend tomato shelf-life during short treatment durations without adverse impact on quality during ripening.

Keywords: /Tomato/ /Storage/ /Shelf-life/ /Physiological Stress/

Yana, Rui, et.al. 2013. Characterization of ripening-associated genes using a **tomato** DNA macroarray, 1-methylcyclopropene, and ripening-impaired mutants. *Postharvest Biol. & Technol.* 86 : 159 – 170.

Abstract

Using a tomato (*Solanum lycopersicum*) DNA macroarray consisting of 11,520 genes, we identified 419 ripening-associated genes (224 up regulated, 195 down regulated). Treatment with 1-methylcyclopropene (1-MCP) at the turning stage restored expression to levels of the mature green (MG) stage in 159 up regulated and 45 down regulated genes, suggesting a strong dependence on ethylene signaling during ripening. Among 194 ethylene up regulated genes, 143 genes in ripening inhibitor (rin) fruit and 140 genes in non-ripening (nor) fruit responded poorly to exogenous ethylene, suggesting the necessity of RIN and NOR signals for their expression. In contrast, 36 and 70 genes responded to ethylene in rin and nor fruit, respectively, to a similar extent as in wild-type fruit, suggesting a clear independence of RIN and NOR signals for their response to ethylene. Ripening-associated expression of number of genes involved in respiratory, lipid and energy metabolism, and ethylene were upregulated during ripening under strong control of an ethylene signal. Large number of photosynthesis-related genes were down regulated during ripening in an ethylene-independent manner, whereas decreased expression of a few genes such as chloroplast thiazole biosynthetic protein and phosphoenolpyruvate carboxylase, was overturned by 1-MCP treatment, suggesting ethylene dependent regulation. Ripening-associated expression of several transcription and signal transduction factors, such as TDR4, GRAS, S-adenosyl-L-homocysteine hydrolase, BNK1, bZip, and BTB showed clear ethylene dependency, suggesting their involvement in regulation of fruit ripening downstream of ethylene signaling.

Keywords: /Tomato/ /Fruit Ripening/ /Ethylene/ /1-MCP/

HERBS & SPICES

ARTICHOKES

Ricci, Ilde, et al. 2013. Influence of pre-cutting operations on quality of fresh-cut **artichokes**: effect of storage time and temperature before cutting. *Postharvest Biol. and Technol.* 85: 124 – 131.

Abstract

The effect of pre-processing storage time and temperature on post-cutting quality of two artichoke cultivars ('Catanese' and 'Violetto Foggiano') was studied. Artichoke heads were harvested in January 2010 for 'Catanese' and in March 2011 for 'Violetto Foggiano' from commercial plantations. Freshly harvested artichoke heads were stored at 0, 5, and 12°C in a humidified flow of air. Initially, and after 3 and 7 days of storage, respiration rate, weight loss, and electrolytic leakage were monitored. Moreover, at each sampling, artichokes were cut in quarters and stored for additional 3 days at 5°C. On cut artichokes, soon after cutting and after post-cutting storage, visual appearance, color attributes (on outer bract surface, on cut bracts, and on cut receptacle surface) and phenol content were determined. Time and temperature of storage influenced quality attributes of cut artichokes, but to a different extent depending on the cultivar, whereas temperature did not affect the phenol content. 'Violetto Foggiano' artichokes benefited from pre-cutting low storage temperature (0°C), whereas 'Catanese' showed physiological injuries on outer bract surfaces, where brown spots occurred. In both cases low temperatures during pre-cutting storage (5 and 0°C) reduced the browning rate of the cut surface which maintained a higher L* value, compared to artichokes stored at 12°C. Moreover, pre-cutting storage at 12°C resulted in a reduction of quality of artichokes due to growth of floral primordia in the form of

reddish tissues at the base of the receptacle for both cultivars. Management of storage conditions before cutting is therefore critical in fresh-cut processing operations of artichokes.

Keywords: /Artichokes/ /Fresh Cut/ /Appearance/ /Color/ /Storage/ /Quality/

BASIL

Costa, Lorenza, et al. 2013. Application of low intensity light pulses to delay postharvest senescence of *Ocimum basilicum* leaves. *Postharvest Biol. & Technol.* 86: 181 – 191.

Abstract

Fresh basil (*Ocimum basilicum* L.) is a highly perishable leafy green vegetable with a storage life of 4–5 d at room temperature. Exposure of basil leaves to temperatures below 12°C during storage results in chilling injury; therefore, refrigeration cannot be used to extend postharvest life of basil. Typically, leafy vegetables are stored in darkness or extremely low irradiance. Darkness is known to induce senescence, and the initial phase of senescence is reversible by exposure to light. In this work, we studied the effects of low-intensity white light pulses at room temperature on postharvest senescence of basil leaves. Daily exposure for 2 h to 30–37 $\mu\text{mol m}^{-2}\text{s}^{-1}$ of light was effective to delay postharvest senescence of basil leaves. Chlorophyll and protein levels decreased, ammonium accumulated and leaves developed visual symptoms of deterioration (darkening) during storage in darkness. Light pulses reduced the intensity of these senescence symptoms. The photosynthesis light compensation point of basil leaves was 50 $\mu\text{mol m}^{-2}\text{s}^{-1}$, i.e., higher than the intensity used in this study, and the effect of treatment with red-light was the same as with white light, while far red light was ineffective. Light pulses exerted a local effect on chlorophyll loss, but the effect on protein degradation was systemic (i.e., spreading beyond the illuminated parts of the leaf blade). The results of this study indicate that daily treatment for 2 h with low intensity light (30–37 $\mu\text{mol m}^{-2}\text{s}^{-1}$ every day) during storage at 20°C is an effective treatment to delay postharvest senescence of basil leaves. The delay of postharvest senescence by low intensity light pulses seems to be mediated by phytochromes, and it is systemic for protein, and partially systemic for chlorophyll degradation.

Keywords: /Basil/ /Postharvest/ /*Ocimum basilicum*/

PARSLEY

Guillaume, Carole, et al. 2013. Gas transfer properties of wheat gluten coated paper adapted to eMAP of fresh *parsley*. *J. Food Eng.* 119: 362 – 369.

Abstract

Gas transfer properties of wheat gluten (WG) coated paper and their ability to fulfil the requirements in eMAP of fresh parsley were studied. Permeation of gases through WG-paper was demonstrated to be RH dependent and closely related to structural modification in the WG layer. Formation of micro-cracks was evidenced in dry conditions; but when increasing RH, plasticisation occurs within the protein layer and micro-fractures were reduced until disappearance. This reversible phenomenon allowed the WG-layer to recover its integrity at RH higher than 70%, and the WG character to be expressed in such conditions. When used at 20 °C and 80% RH as part of the packaging of parsley, modified atmosphere was created and a steady state of 11 kPa O₂ and 4.5 kPa CO₂ was reached after

45 h. In such conditions, the overall quality of parsley leaves remained acceptable during 8 days, with only 28% loss of chlorophyll.

Keywords: /Parsley/ /Modified Atmosphere Packaging/

ORNAMENTALS

PETUNIA

Colquhoun, Thomas A., et al. 2013. Light modulation of volatile organic compounds from **petunia** flowers and select fruits. *Postharvest Biol. & Technol.* 86: 37 – 44.

Abstract

Light intensity, duration, direction, and wavelength are informative to plants. The biochemical circuits that connect specific light wavelengths to expression of specific genes and the metabolic networks they govern have been well defined. However, little emphasis has been placed on how discrete wavelengths of light, alone or in combination, may be applied to manipulate postharvest qualities of high-value horticultural crops. Using narrow-bandwidth LED light we test the hypothesis that discrete light wavelengths can affect the accumulation of volatile compounds known to affect aroma or taste in select flower and fruit products. Volatile benzenoid/phenylpropanoid emission from petunia flowers could be altered with light application. Levels of a key floral volatile, 2-phenylethanol, increased with a red and far-red light treatment. Similar experiments demonstrated that fruit volatile profiles of tomato, strawberry, and blue-berry can be manipulated with specific light treatments. These results suggest that compounds affecting sensory qualities of flowers and fruits can be modified by adjustment of ambient light conditions. These findings open new areas of inquiry about how the fragrance and flavor of flowers and fruits may be improved with simple changes in postharvest light conditions.

Keywords: /Flavor/ /Flowers/ /Fruits/ /Light/ /Smell/ /Volatiles/

TUBERS & ROOTCROPS

POTATO

Chung, Yong Suk, et.al. 2013. The effect of long term storage on bacterial soft rot resistance in potato *Am. J. Potato Res.* 90 (2): 93 – 206.

Abstract

Bacterial soft rot is a serious disease in potato (*Solanum tuberosum* L.), causing rapid tuber tissue maceration and, consequently, marketable yield loss. Soft rot bacteria, including *Pectobacterium carotovorum* subsp. *carotovorum* (Pbc), are favored by moist conditions, which are prevalent in large potato storage facilities. However, although most potatoes in North America are stored before use, there are no published surveys of soft rot resistance in cultivars exposed to long-term storage conditions. Thus, we tested 65 cultivars and 13 breeding lines for soft rot resistance after 6 months of storage. There was a significant effect of cultivar and production environment on soft rot resistance score. During 6 months of storage, tuber soft rot resistance in resistant clones did not change, while it

changed in susceptible clones. The three most resistant cultivars to soft rot were Freedom Russet, Anett, and Alaska Red Eye.

Keywords: /Potato/ /(Solanum tuberosum L.) / /Bacterial Soft Rot/ /Storage/

SUGARBEETS

Fugate, Karen, Klotz, et al. 2013. Postharvest salicylic acid treatment reduces storage rots in water-stressed but not unstressed sugarbeet roots. *Postharvest Biol. & Technol.* 85: 162 – 166.

Abstract

Exogenous application of salicylic acid (SA) reduces storage rots in a number of postharvest crops. SA's ability to protect sugarbeet (*Beta vulgaris* L.) taproots from common storage rot pathogens, however, is unknown. To determine the potential of SA to reduce storage losses caused by three common causal organisms of sugarbeet storage rot, freshly harvested roots were treated with 0.01, 0.1, 1.0 or 10 mM SA, inoculated with *Botrytis cinerea*, *Penicillium claviforme*, or *Phoma betae*, and evaluated for the severity of rot symptoms after incubation at 20 °C and 90% relative humidity. Roots were obtained from plants that received sufficient water or were water-stressed prior to harvest. Roots from water-stressed plants were included since water-stress increases sugarbeet root susceptibility to storage rot and SA mitigates drought effects in other plant species. SA at concentrations of 0.01–10 mM had no effect on the severity of storage rot caused by *B. cinerea*, *P. claviforme*, or *P. betae* in roots from plants that received sufficient water prior to harvest. However, SA at these same concentrations reduced the severity of rot symptoms for all three pathogens in roots from plants that were water stressed before harvest. For water-stressed roots, all concentrations of SA produced statistically equivalent reductions in the weight of rotted tissue for each pathogen, and on average, SA reduced rot severity due to *B. cinerea*, *P. claviforme*, and *P. betae* by 54, 45, and 58%, respectively. SA reduced rot from all three pathogens by reducing lesion size, but did not affect the incidence of infection. The ability of SA to reduce rot severity in water-stressed roots, but not in roots that received sufficient water before harvest suggests that SA alleviated the negative impact of water stress but did not directly protect sugarbeet roots against storage rots.

Keywords: /Sugarbeet/ /Postharvest/ /Salicylic Acid Treatments/ /Storage Rots/