

**SELECTIVE DESSIMINATION OF INFORMATION (SDI)
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GENERAL

BIOLOGICAL CONTROL

Janisiewicz, W. J. 2013. **Biological control** of postharvest diseases: hurdles, success and prospects. Acta Hort: 1001, 273 – 284.

Abstract

Research has accelerated recently on biological control of postharvest diseases and has resulted in the development of several commercial products for controlling decays of temperate and subtropical fruits. The demand for alternatives to synthetic fungicides is much greater than the supply provided by these new technologies, including biological control. The development of a postharvest disease biocontrol product is a lengthy process involving many steps. The need for alternatives to synthetic fungicides and opportunities for biological control under controlled environmental conditions in storage have been the driving forces for research in this area. Research around the world has proven the effectiveness of biological control of postharvest diseases and, at the same time, identified its limitations. Many of these limitations result from knowledge gaps that can be addressed by additional research to better understand the mechanisms of biocontrol on fruit, microbial ecology of the fruit surfaces, and the survival of antagonists under adverse conditions. Additional research is also needed to prolong the shelf life of antagonists, determine the compatibility of biocontrol with other alternative treatments, and adapt biocontrol to various postharvest handling practices, and to new production technologies, such as mechanical harvesting, that may predispose fruit to decay. The greater use of biological control of postharvest diseases can be achieved by expanding the application of available products to new commodities and different pathogens. The products currently available were developed to control decays originating from wound infections; however, significant postharvest losses on various fruits may also occur from decays originating from latent infections that develop before harvest. Controlling these decays has become the new frontier for biological control. New approaches utilizing natural fruit wax and artificial membranes were developed to find antagonists effective in controlling latent infections under laboratory conditions. The high cost of tests required for registration prohibited the commercial development of several effective biocontrol agents. A new framework is needed for streamlining the registration of low risk biocontrol agents without known deleterious effects to human health. This is especially relevant for those agents that are consumed with foods in large quantities (e.g., in apple cider, fruit juices, or with various cultured food products (probiotics)). Biological control of postharvest diseases has been accepted by the fruit industry as a viable alternative to synthetic fungicides, and products registered in the United States can be used on organically-labeled fruit.

Keywords: /Biocontrol/ /Fruit Decays/ /Pome fruits/

GAMMA RADIATION

Gosh, S. & Das, M.K. 2014. Attenuation coefficients and absorbed **gamma radiation** energy of different varieties of potato, mango and prawn at different storage time and physiological condition. Food Chem. 145: 694 – 700.

Abstract

Attenuation coefficients of different varieties of gamma irradiated potato (Kufri Chandramukhi, Kufri Jyoti, and Kufri Sindhuri), mango (Himsagar, Langra, Dashehri and Fazli) and prawn (Tiger prawn and Fresh water prawn) of different storage time and physiological stages were determined. After six months storage attenuation coefficient of Kufri Chandramukhi was decreased by 30.8% with decrease of density and moisture content. Decreasing trend of attenuation coefficient during storage was more prominent (almost 50%) in other two varieties of potato. On the other hand in all four varieties, unripe mango consisted of significantly less ($p < 0.05$) attenuation coefficient (around 11–14%) than the ripe one due to changes in physiological properties and density. Different varieties of prawn had different attenuation coefficients due to subtle differences in their proximate composition. Due to having different attenuation coefficients, different food components, even different varieties of same food component absorbed different gamma radiation energy though exposed to same radiation dose.

Keywords: /Gamma Radiation/ /Potato/ /Mango/

MALEIC ENZYME

Blach, M., Rosales, R., et al. 2013. NADP-**malic enzyme** and glutathione reductase contribute to glutathione regeneration in *Fragaria vesca* fruit treated with protective high CO₂ concentrations. Postharvest Biol. & Technol. 86: 431 – 436.

Abstract

Treatment of harvested strawberries (*Fragaria vesca* L. *Mara des Bois*) with high concentrations of CO₂ is an effective means of limiting fungal decay and avoiding disorders caused by low temperature storage. In the present study, we investigated the role of NADP-ME gene expression and activity in lowering malic acid contents and in the provision of NADPH required for the regeneration of the reduced form of glutathione (GSH). We also measured glutathione reductase (GR: EC 1.6.4.2) activity in strawberries treated with different high CO₂ concentrations (0, 20 and 40% for 3 days) during storage at 0°C. A decrease in malic acid content in fruit exposed to 20% CO₂ was primarily mediated by the stimulation of NADP-ME activity, rather than associated with changes in the expression of cytosolic NADP-ME genes. Moreover, malic acid decarboxylation was associated with a marked increase in GR activity, which may account for the increased levels of glutathione in fruit following exposure to 20% CO₂. This chain of events was not observed in untreated fruit stored in air or in fruit treated with 40% CO₂, suggesting that the unique cellular redox status of 20% CO₂-treated fruit plays an important role in detoxification and protection from damage during storage. Based on these findings, we propose that NADP-ME activation in fruit exposed to 20% CO₂ provides NADPH for glutathione regeneration by GR, thereby conferring protection against the cellular damage caused by low temperatures or excessive high CO₂ levels.

Keywords: /Malic enzyme/

POSTHARVEST DEVELOPMENTS

Prange, R.K. 2013. Recent postharvest developments in organic fruits: the positive, the negative and the debatable. Acta Hort. 1001: 215 – 220.

Abstract

This is an overview, with examples, of some recent developments related to organic fruits after they are harvested. In general, this overview also applies to organic vegetables. The positive: there is an assumption, somewhat justified, that organic postharvest methods to control pests and maintain product value are not effective enough. However, there is now evidence that some organic postharvest methods are not only being successfully adopted by the organic fruit industry but also by the non-organic industry as well. A recent example would be the total replacement of the postharvest pesticide, diphenylamine (DPA), by the apple industry in Italy using organically-acceptable methods. The negative: there is an incorrect, and potentially dangerous, assumption that organic postharvest methods for controlling pests, by definition, are safe for humans and the environment. The development and eventual withdrawal of the EPA-approved and OMRI-approved biocontrol fungus, *Muscador albus*, will be discussed as an example of the fallacy of this assumption. The debatable: there is an on-going debate about the nutritional value and safety of organic fruits (and vegetables). Some of the most contentious aspects will be discussed and critiqued. The critique will question the relevance of the debate, the validity of the information being quoted and illustrate how horticultural factors need to be incorporated if the debate is to progress beyond rhetoric.

Keywords: /Postharvest Developments/ /Superficial Scald/ /Organic Fruit/

POSTHARVEST QUALITY

Lara, I., Belge, B. & Goulao, L.F. 2014. The fruit cuticle as a modulator of postharvest quality. Postharvest Biol. & Technol. 87: 103 - 112.

Abstract

The composition and structure of fruit surface tissues have a noticeable influence on the postharvest storage potential of fruit, inasmuch as they behave as a barrier against drying, chemical attack, mechanical injuries and microbial infection. The cuticle is made of cutin, a biological insoluble polyester, embedded in an impermeable wax complex, and its inner side interacts intimately with the underlying epidermal cell walls. The cuticle plays a decisive role in plant development, being the first communication system with the surrounding biotic and abiotic environment. Published reports on the composition and biosynthesis of fruit cuticles are comparatively scarce, and many knowledge gaps exist on the part cuticles play in quality determination and postharvest performance. This review aims at collecting available information in relation to the role of the fruit cuticle as a determinant factor of some important traits related to postharvest quality, including water loss, susceptibility to physical and biological stresses, and decreased fruit firmness. To the best of our knowledge, this is the first published work focusing on the fruit cuticle as a major modulator of postharvest quality and interlinking existing dispersed literature on this topic. A deeper understanding of cuticle structure and function will be of help in understanding postharvest biology and in designing new technological solutions.

Keywords: /Postharvest Quality/ /Decay/ /Disorders/ /Firmness/ /Water loss/

POSTHARVEST TECHNOLOGY

Hewett, E.W. 2013. **Postharvest innovation**: current trends and future challenges in the global market. Acta Hort. 989: 1 – 14.

Abstract

The ability of a country to ensure adequate and consistent food supplies for citizens is of major political, social and economic importance. Food losses/wastage in the supply chain from farmer to consumer can be 1.3 billion tons annually. Most food wastage occurred in developed countries at the retail/consumption end of the chain, while in developing countries high losses occur at the production/processing end. Such losses could be ameliorated by enhanced postharvest research, development, education and training; however <5% of funds allocated to agricultural research over the past 2 decades was directed towards postharvest science, technology and outreach. Postharvest science and technology aims to provide underpinning information for industries to deliver safe, nutritious and safe fresh horticultural products to consumers at the end of the supply chain from farm to mouth. This presentation aims to highlight some key preharvest and postharvest factors that are important or have potential, to contribute to product quality and safety and hence to the future success of horticultural systems producing for both local and export markets. Plant breeding and selection are key disciplines successful for introducing novel product types with important factors conferring precocity, productivity, size, pest and disease resistance/tolerance, phytonutrient content and consumer appeal. Innovative and imaginative growing systems have been developed to optimize productivity of attractive, tasty and nutritious fruit and vegetables including: crop management; harvest indices and optimal maturity; manipulation of ethylene; integrated pest and disease management. Postharvest achievements have occurred in high-speed non-destructive segregation systems; novel packaging; storage and transport systems; pests and disease control for market access; senescence control; supply chain optimisation; and track and trace systems to ensure delivery of premium quality products to discriminating markets. Future success will only occur with further R&D devoted to understanding the genetic and molecular basis of quality traits including stress resistance; resistance to postharvest diseases and pests; integrating available technologies (bio-, info- and nanotechnology) through a systems biology approach to overcome postharvest food quality and safety issues; as well as to enhance specific health conferring components in fresh and processed products; use of robotics for harvesting, packing and handling of individual through bulk items; managing logistics and supply chains effectively and efficiently; using bioregulators and/or biostimulants to manage productivity and quality; and to understand and hence manipulate the underlying metabolic systems controlling physiological and biochemical systems regulating product deterioration and senescence.

Keywords: /Postharvest Innovation/ /Postharvest Technology/

FRUITS

ACAI

Aguiar, F., Menezes, V. & Rogez, H. 2013. Spontaneous postharvest fermentation of **acai** (*Euterpe oleracea*) fruit. Postharvest Biol. & Technol. 86: 294 - 299.

Abstract

Acai (*Euterpe oleracea*) fruit (EOF) are widely commercialized in the Brazilian Amazon. These fruit contain a high bacterial load and are transported on boards stowed inside or outside the holds of small boats. In this context, postharvest parameters were assessed under conditions that simulated these two methods of EOF transport: stowage in closed polystyrene boxes, simulating the inside of cargo holds, i.e., transport in a closed system; and open baskets, simulating transport in an open environment, i.e., transport in the prow or bow of the boat. EOF suffered spontaneous fermentation of alcoholic, acetic, and lactic types in the closed system, which is the most common type of transportation of this fruit. In the closed system, there was a predominance of lactic acid bacteria over acetic acid bacteria, with 82% and 95% of the initial content of d-glucose and d-fructose being consumed, respectively, after 27 h of experiment. The weight loss reached 1.7% and there was a logarithmic decrease of the major phenolic compounds of the fruit in the closed system, with losses of 78% of cyanidin-3-rutinoside, 88% of cyanidin-3-glucoside, 78% of homorientin, and 72% of orientin after 27 h, which was higher than in the open system (58%, 66%, 73% and 62%, respectively). Analyses on EOF stowed in a closed system indicated that the respiratory rate was characteristic of a non-climacteric fruit, i.e., it showed a logarithmic decay in the production of CO₂ ($R^2 = 0.995$; $P < 0.05$). Thus, transport in a closed system results in more drastic nutritional and functional changes on EOF than when transport is carried out in an open system, suggesting that transportation in continuous aerobic conditions and a short period of time between picking and processing are preferable.

Keywords: /Acai/ /*Euterpe oleracea*/ /Spontaneous fermentation/ /Transport/ /Respiration Rate/

APRICOTS

Feng, J., 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/

AVOCADO

Burdon, J., 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/

BANANA

Bugaud, C., et al. 2014. Bruise susceptibility of banana peel in relation to genotype and post-climacteric storage conditions. *Postharvest Biol. & Technol.* 87: 113 - 119.

Abstract

The aim of this study was to understand the genotypic factors and post-climacteric storage condition that affect bruise susceptibility of banana peel. Putative physicochemical indicators of bruise susceptibility, including peel electrolyte leakage (PEL), total polyphenolic content, hardness, water content, and peel thickness, were investigated. Bruise susceptibility is the lowest impact energy needed to produce visible bruising by an object dropped on post-climacteric banana fruit from a pre-determined height, converted into impact energy (20–200 mJ with a 20 mJ increment). The bananas were stored either at 18°C throughout ripening or at 13°C between the 2nd and 6th day after ethylene induction. Five cultivars with contrasting susceptibility to impact bruises were used. Neither Grande Naine nor hybrid Flhorban925 bruised at the maximum impact energy (200 mJ) during ripening whatever the storage conditions. A gradient in bruise susceptibility was observed among the other cultivars: French Corne > Fougamou > hybrid Flhorban916. Bruise susceptibility increased during ripening and was higher in bananas stored at 18°C. The lower ripening temperature resulted in a two-day delay to fruit maturity as well as in bruise susceptibility. Bruise susceptibility was positively correlated with PEL ($R = 0.78$) and to a lesser extent negatively correlated with hardness ($R = -0.45$), and was not correlated with polyphenolic content. In conclusion, membrane permeability provides the first clue to understanding bruise susceptibility.

Keywords: /Banana/ /Impact Bruising/ /Polyphenol/ /Cold storage/

BLUEBERRY

Lobos, G.A, Callow, P. & Hancock, J.F. 2014. The effect of delaying date on fruit quality and storage of late highbush **blueberry** cultivars (*Vaccinium corymbosum* L.). Postharvest Biol. & Technol. 87: 133 – 139.

Abstract

The effect of delaying harvest on fruit quality and storage life was measured for the late-season highbush blueberry cultivars 'Aurora', 'Elliott' and 'Liberty'. In all three cultivars as fruit ripened, there was a steady decline in TA while SS remained stable, indicating that the fruit were becoming sweeter. This was supported by taste panel perceptions of greater sweetness associated with later harvested fruit. There was also a significant overall reduction in fruit firmness and storage life as the percentage of blue fruit at harvest increased; however, a significant interaction for storage life between crop ripeness and cultivar was observed, indicating that the fruit of some cultivars were less influenced by overall crop ripeness than others. The storage life of 'Elliott' was significantly affected negatively by crop ripeness, while 'Aurora' and 'Liberty' were not. 'Liberty' produced the highest percentage of sound fruit of the three cultivars and its fruit stored the longest, suggesting that 'Liberty' and 'Aurora' fruit can be left longer on the bush before harvesting than 'Elliott' without significantly damaging storage life. This would allow 'Aurora' to develop a sweeter flavor before shipping. The physicochemical and sensory evaluations were highly correlated, suggesting that TA, SS and firmness can be used as predictors of consumer preferences.

Keywords: /Blueberry/ /Quality/ /Maturity/ /Storage/

CHERRY

Holb, I.J. & Kunz, S. 2013. Integrated control of brown rot blossom blight by combining approved chemical control options with *Aureobasidium pullulans* in organic **cherry** production. Crop Protection. 54: 114 - 120.

Abstract

In a 3-year study, the effectiveness of copper hydroxide, lime sulphur, and their combinations with *Aureobasidium pullulans* were investigated for blossom blight control in organic sour cherry production. The effect of treatments on phytotoxicity on spur-leaf clusters and yield was also determined. A major aim was to evaluate the integrated control approach of the combined *A. pullulans* treatments to reduce allowed chemical damage on spur-leaf clusters. Among fungicide treatments suitable for organic production, copper hydroxide and lime sulphur alone were most effective for blossom blight control when applied three times (at closed blossom, full bloom, and petal fall) during bloom. Both treatments were not as effective as the conventional standard, caused more damage on spur-leaf clusters, but significantly increased crop yield compared to the untreated control. *A. pullulans* treatments, applied three times during bloom (at closed blossom, full bloom, and petal fall), resulted in significantly higher blossom blight incidence but lower phytotoxicity compared to copper hydroxide or lime sulphur treatments applied alone. All *A. pullulans* treatments controlled blossom blight significantly

better in all years and increased crop yield in two out of three years compared to the untreated plots. The need for an integrated approach to improve blossom blight management in organic sour cherry production is discussed. This is the first in-depth study on the multiyear effects of A. pullulans applications on blossom blight control in comparison with organically approved plant protection compounds of copper or lime sulphur for organic sour cherry production.

Keywords: /Cherry/ /Brown Rot/ /Chemical Control/

CITRUS

Defraeye, T., Lambrecht, R., et al. 2014. Forced-convective cooling of citrus fruits: cooling conditions and energy consumption in relation to package design. J. Food Eng. 121: 118 – 127.

Abstract

The performance of an existing container for orange fruit and two new designs, stacked on a pallet, has been evaluated for forced-convective precooling using computational fluid dynamics. The focus was on the fruit cooling rate and the system energy consumption in relation to cooling conditions (airflow rate and cooling temperature). The new package designs both showed an improved cooling rate and cooling uniformity, although this improvement is to some extent dependent on the cooling system that is used, which should also be taken into account when evaluating package design. The energy required to maintain airflow through the containers during the precooling process was also less for the new containers due to their lower aerodynamic resistance. These new containers seem a cost-effective way for improving forced-convective precooling of orange fruit with respect to throughput, fruit quality and operational cost of the system. In this study, basic information on the containers was obtained to guide future cold-chain design decisions and changes to existing cooling protocols or cooling systems.

Keywords: /Citrus/ /Precooling/ /Cold Chain/

Lorente, D., et al. 2013. Early decay detection in citrus fruit using laser-light backscattering imaging. Postharvest Biol. & Technol. 86: 424 - 430.

Abstract

Early detection of fungal infections in citrus fruit still remains one of the major problems in postharvest technology. The potential of laser-light backscattering imaging was evaluated for detecting decay in citrus fruit after infection with the pathogen *Penicillium digitatum*, before the appearance of fruiting structures (green mould). Backscattering images of oranges cv. Navelate with and without decay were obtained using diode lasers emitting at five different wavelengths in the visible and near infrared range for addressing the absorption of fruit carotenoids, chlorophylls and water/carbohydrates. The apparent region of backscattered photons captured by a camera had radial symmetry with respect to the incident point of the light, being reduced to a one-dimensional profile after radial averaging. The Gaussian–Lorentzian cross product (GL) distribution function with five independent parameters described radial profiles accurately with average R2 values higher or equal to 0.998, pointing to differences in the parameters at the five wavelengths between sound and decaying oranges. The GL parameters at each wavelength were used as input vectors for classifying samples into sound and decaying oranges using a supervised classifier based on linear discriminant analysis. Ranking and combination of the laser wavelengths in terms of their contribution to the detection of decay resulted in

the minimum detection average success rate of 80.4%, which was obtained using laser light at 532 nm that addresses differences in scattering properties of the infected issue and carotenoid contents. However, the best results were achieved using the five laser wavelengths, increasing the classifier average success rate up to 96.1%. The results highlight the potential of laser-light backscattering imaging for advanced citrus grading.

Keywords: /Citrus/ /Decay/

Youssef, K., et al. 2014. Sodium carbonate and bicarbonate treatments induce resistance to postharvest green mould on **citrus** fruit. *Postharvest Biol. & Technol.* 87: 61 - 69.

Abstract

The aim of this study was to investigate the ability of two salts, sodium carbonate and bicarbonate, to activate defence mechanisms in citrus fruit against postharvest green mould caused by *Penicillium digitatum*. In particular, once there was confirmed salt antifungal activity in the absence of direct contact with the pathogen, changes in enzyme activity and expression levels of chitinase, β -1,3-glucanase, peroxidase and phenylalanine ammonia lyase (PAL), and phytoalexin (scoparone, scopoletin, umbelliferone) and sugar (glucose, fructose, sucrose) contents in treated oranges were analyzed. Overall, sodium carbonate and bicarbonate increases the activity of β -1,3-glucanase, peroxidase, and PAL enzymes in orange tissues. Gene expression analyses confirmed PAL up-regulation particularly 12 h after treatment application. HPLC analyses of peel extracts showed increased amounts of the sugars and phytoalexins, compared to control tissues, with sucrose and scoparone being the most represented. The results suggest that, although salts exert a direct antifungal effect on *P. digitatum*, they are also able to induce citrus fruit defence mechanisms to postharvest decay. The defence response seems correlated with the up regulation of the phenyl propanoid pathway, which has a role in the adaptation to various stresses. This response could result in natural reaction to wounding and pathogen attack in citrus, enhancing its protective effect. As a consequence, the fruit might have a better chance of successful defence against the decay.

Keywords: /Citrus/ /Postharvest Diseases/ /*Citrus sinensis*/ /Green Mould/

DRAGON FRUIT

Ali, A., 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 $10 \pm 2^\circ\text{C}$ and $80 \pm 5\%$ 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 Activity/ /*Colletotrichum gleosporioides*/ /Postharvest Quality/ /Respiration/

Kammapana, L., Buanong, M., et al. 2013. SEM studies on the morphology of 'White Pulp' **dragon fruit**. Acta Hort. 989: 85 – 90.

Abstract

Dragon fruit (*Hylocereus undatus*) is one of the new focuses for the next source of nutritional composition in Thailand. It is a good source of dietary fiber, β - carotene, magnesium, calcium, potassium mucilage, and total phenol. However, dragon fruit rapidly loses visual quality due to chlorophyll degradation of the bract or scales. Thus, the study of yellowing in the bract of dragon fruit is very important in solving the problem of loss due to yellowing. To understand the cause of bract yellowing, morphology of the fruit peel and bract were studied. At different stages of fruit development (10, 20, 30, and 40 d after anthesis), both peel and bract were sampled and observed with Scanning Electron Microscopy (SEM) at 100 \times . Both were evaluated for density of the stomata. The results showed that the bract of dragon fruit at all stages of fruit development showed significantly higher density of stomata than that of the fruit peel, by about 3-4 times. As a result, water transpired via the stomata located on the bract faster than the fruit peel. Thus, bract of dragon fruit showed rapid loss of visual quality and became unacceptable. Moreover, differences in the morphology of the fruit tissue could be related to changes at the physiological level in dragon fruit at different stages of fruit development.

Keywords: /Dragon Fruit/ /Morphology/

KIWIFRUIT

Burdon, J., et al. 2014. Shivel development in **kiwifruit**. Postharvest Biol. & Technol. 87: 1 - 5.

Abstract

Shivel is a potential storage quality problem for kiwifruit. 'Zesy003' (commonly called Gold9) is a newly released, yellow-fleshed *Actinidia chinensis* cultivar that tends to shrivel more than other commercialised cultivars. Water loss and shrivel in Gold9 fruit were investigated during storage at 1°C for up to 14 weeks and shelf-life at 20°C. In addition, the water status of ripe fruit was quantified by magnetic resonance imaging and the capacity of a crude outer pericarp cell wall extract to swell. Shrivelled Gold9 fruit had 1–6% weight loss, although 6% weight loss did not always result in shrivel. Three weeks of storage resulted in fruit taking longer to shrivel during shelf-life, with a concomitant higher weight loss by the time the fruit was shrivelled. In contrast, 14 weeks of storage resulted in fruit that shrivelled more rapidly in shelf-life at a lower weight loss. At any given time after harvest, fruit with more severe shrivel tended to be softer than less shrivelled fruit. Shivel therefore appears associated with fruit softening. Outer pericarp tissue from ripe Gold9 fruit had lower water mobility and a greater capacity to swell than pericarp from other kiwifruit cultivars. It is concluded that shrivel is not determined simply by an absolute amount of water loss. The development and ease of expression of shrivel in Gold9, and possibly other kiwifruit, is influenced by softening and the water characteristics of the fruit outer pericarp when soft.

Keywords: /Kiwifruit/ /Shivel/ /Water loss/ /Texture/ /Firmness/

Terasaki, S., et al. 2013. A new descriptive method for fruit firmness changes with various softening patterns of kiwifruit. Postharvest Biol. & Technol. 86: 85 - 90.

Abstract

We have proposed a new interpretation of fruit softening. This was accomplished by generating a hypothesis that probabilities of decay of fruit structure obey the Weibull probabilistic model that has been used in the field of reliability engineering. The elasticity of individual kiwifruit after harvest was continually and non-destructively measured until decomposition by using a laser Doppler vibrometer. The obtained decreasing pattern of elasticity of individual fruit was complex, diverse, and inhomogeneous. Nonetheless, it was satisfactorily explained by a tandem combination of 2 Weibull models involving 4 types of parameters: "shape" related to probability; "scale," to velocity of decay; "location," to time lag; and "mixing ratio," to contribution of the 2 models. Averages of location, shape, and mixing ratio parameters obtained by the measurement of 33 fruit were significantly different between the 2 models, but the scale parameter was not. The results suggested that the complex softening patterns of individual kiwifruit could be described using the tandem model of Weibull distribution, and that the softening process of kiwifruit consisted of at least 2 independent decay phases that are characterized by 2 of 5 parameters: location and mixing ratio. Commencement of the first decay phase could be caused by ethylene treatment after harvest, and the second one spontaneously triggered after a certain time lag.

Keywords: /Kiwifruit/ /Fruit Softening/ /Ethylene/ /Shelf-life/

LOQUAT

Cao, S., Cai, Y., et al. 2014. Effect of MeJA treatment on polyamine, energy status and anthracnose rot of loquat fruit. Food Chem. 145: 86 – 89.

Abstract

The effect of methyl jasmonate (MeJA) on changes in polyamines content and energy status and their relation to disease resistance was investigated. Freshly harvested loquat fruit were treated with 10 $\mu\text{mol l}^{-1}$ MeJA and wound inoculated with *Colletotrichum acutatum* spore suspension (1.0×10^5 spores ml^{-1}) after 24 h, and then stored at 20 °C for 6 days. MeJA treatment significantly reduced decay incidence. MeJA treated fruit manifested higher contents of polyamines (putrescine, spermidine and spermine) compared with the control fruit, during storage. MeJA treatment also maintained higher levels of adenosine triphosphate, and suppressed an increase in adenosine monophosphate content in loquat fruit. These results suggest that MeJA treatment may inhibit anthracnose rot by increasing polyamine content and maintaining the energy status.

Keywords: /Loquat/ /Anthracnose/ /Polyamines/

MANDARIN

Magwaza, L.S., et al. 2013. Canopy position affects rind biochemical profile of 'Nules Clementine' mandarin fruit during postharvest storage. Postharvest Biol. & Technol. 86: 300 - 308.

Abstract

This study was conducted to investigate the effects of preharvest canopy position and bagging treatments on rind physiological and biochemical properties of 'Nules Clementine' mandarin (*Citrus reticulata* Blanco) fruit. Before storage, the respiration rate of unbagged outside fruit was significantly higher (21.6 mL CO₂kg⁻¹h⁻¹) than of bagged inside fruit (16.3 mL CO₂kg⁻¹h⁻¹). Unbagged fruit outside the canopy had 1.4-fold higher carbohydrates, and 1.1-fold higher dry matter (DM) content than bagged inside fruit. Bagged fruit inside the canopy had higher (24%) weight loss than outside sun-exposed fruit (14%). This corresponded with a higher rind breakdown (RBD) index for bagged inside fruit, compared to sun-exposed fruit which did not develop the disorder. During postharvest storage, rind fructose levels of bagged fruit inside the canopy increased from 62.4 mg/g DM at harvest to 81.3 mg/g DM after 8 weeks, while those of unbagged outside fruit increased from 97.9 to 108.4 mg/g DM. Concomitant with the increase in fructose, sucrose in rind tissue of bagged inside fruit decreased from 42.6 to 27.7 mg/g DM and from 49.3 to 33.4 mg/g DM for unbagged outside fruit. Rind glucose of unbagged inside fruit decreased from 90.6 to 76.2 mg/g DM. Ascorbic acid concentrations remained almost constant during storage, with levels between 3.3 and 6.7 mg/g DM for inside bagged and unbagged outside fruit, respectively. Hesperidin was the major flavanone detected, with concentrations between 35 and 45 mg/g DM followed by narirutin (1.1–2.8 mg/g DM). At harvest, rind of fruit harvested from outside the canopy had lower hesperidin concentration (38.1 mg/g DM) compared to shaded fruit (44.2 mg/g DM). Overall, the results suggest that variations in microclimatic conditions inside the tree canopy during the growing season affect the biochemical profile of the fruit rind, which in turn influences fruit response to postharvest stresses associated with senescence and susceptibility to RBD.

Keywords: /Mandarin/ /Citrus/ /Senescence/ /Physiological Disorder/ /Rind breakdown/

Amin, M., Malik, A.U., Khalid, M.S & Anwar. R. 2013. Fruit harvest maturity indicators for mango cultivars 'Sindhri' and 'Samar Bahisht Chaunsa'. *Acta Hort.* 992: 561 – 568.

Abstract

The storage life and quality of mango fruit is significantly influenced by the stage of harvest maturity. Fruit harvest maturity indicators for the Pakistani mango cultivars have not been scientifically determined so far. Present studies were targeted to determine different fruit harvest maturity indices for two commercial mango cultivars ('Sindhri' and 'Samar Bahisht (S.B.) Chaunsa' of Pakistan. Significant interaction was found between panicle emergence and fruit maturation (harvest date) regarding fruit pulp dry matter contents in both cultivars. In 'S.B. Chaunsa' mangoes, significant interaction was found between panicle emergence and maturation with respect to specific gravity, TSS, shoulder position and pulp colour. Both 'Sindhri' and 'Chaunsa' mangoes were found to have light yellow pulp colour near the stone at the onset of maturity. Mature 'Sindhri' fruit had <1.0-1.02 specific gravity, 6.0-7.5°Brix TSS, 17-20% pulp dry matter and drooping to levelled shoulders. The fruit of 'S.B. Chaunsa' had 1.02-1.04 specific gravity, 9.0-11.0°Brix TSS, 18-21% pulp dry matter and levelled to raised shoulders at maturity.

Keywords: /Mango/ /*Mangifera indica*/ /Maturation/ /Fruit quality/ /Maturity index/

Chen, Q.B. 2013. Perspective on the mango industry in Mainland China. *Acta Hort.* 992: 25 – 36.

Abstract

China is one of the 94 countries producing mango in the world. Cultivation of mango in China dates back to 1000 years ago. However, large commercial production of mango did not begin until the 1960s, particularly the 1980s. In mainland China, Hainan Province is the largest producer of mango, followed by Guangxi Autonomous Region, Guangdong Province, Yunnan Province, Sichuan Provinces and Fujian Province. The area under mango trees in mainland China is estimated about 120,000 ha in 2008 with the total production of 800,000 MT. Some 260 MT of the mango output in 2008 was exported while over 20,000 MT imported. Therefore China is rather a big mango consuming country than a producing country. China's import of mango is chiefly in the form of fresh mango fruit mainly from the Philippines, Thailand, Vietnam, Indonesia, Myanmar, Australia, India, Peru and Pakistan. Although China possesses endemic wild mango species, most of the mango cultivars are exotic origin, including Carabao, Nang Klangwan, Dashehari, Okrong, Irwin, Haden, etc. National and regional research institutions and universities in mainland China have made great efforts in selection and breeding programme and cultural practices for high quality and higher return mango production by challenging various unfavourable environmental constraints and pests and diseases.

Keywords: /Mango/ /*Mangifera indica* Linn./ /Import/ /Export/

Chongchatuporn, U., Ketsa, S. & van Doorn, W.G. 2013. Chilling injury in mango (*Mangifera indica*) fruit peel: relationship with ascorbic acid concentrations and antioxidant enzyme activities. *Postharvest Biol. & Technol.* 86: 409 - 417.

Abstract

We investigated the degree of chilling injury (CI) in mango (*Mangifera indica*) fruit stored at 4°C or 12°C, in relation to peel ascorbic acid concentrations, total antioxidant capacity, and the activities of four antioxidative enzymes. In cv. Nam Dok Mai fruit exposed to 4°C, CI (peel browning) was found after 5 days, whilst CI in cv. Choke Anan fruit started after 10 days and did not reach the same degree. When held at 27–28°C, following various periods of exposure to 4°C, peel browning in both cultivars increased, but that in cv. Nam Dok Mai remained higher than in cv. Choke Anan. An inverse correlation was found between peel browning and ascorbic acid concentrations, and between peel browning and total antioxidant capacity, measured using the FRAP method. In cv. Nam Dok Mai, the superoxide dismutase (SOD) and catalase (CAT) activities were lower during storage at 4°C than during storage at 12°C, while such a difference was not found in cv. Choke Anan. When compared to cv. Choke Anan, lower activities of ascorbate peroxidase (APX) and of guaiacol peroxidase (POX) were found in the peel of cv. Nam Dok Mai. However, no difference was observed in APX and in POX activities in the peel of cv. Nam Dok Mai stored at 4°C or 12°C. This means that the relationships between CI and APX and POX activities were weak.

Keywords: /Mango/ /Chilling Injury/ /Browning/

Haff, R.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/ /Infestation/

Hu, M.J., Gao, Z.Y., et al. 2013. Resistance of *Botryodiplodia theobromae* to Carbendazim and the fungicides screening for mango stem end rot control. *Acta Hort.* 992: 407 – 414.

Abstract

86 isolates of *Botryodiplodia theobromae* Pat., causing mango stem end rot, were obtained from 3 regions in Hainan province of China and tested for their resistance to carbendazim (MBC) in laboratory. The toxicity of 23 fungicides to 2 isolates of carbendazim-resistant and 2 isolates of carbendazim-sensitive *B. theobromae* was tested by mycelium growth rate methods, and analyzed by the EC50 value, the EC90 value and the cross-resistance to each other. The results showed that the carbendazim-resistant isolates had been found in Danzhou, Ledong and Sanya, Hainan province. 10 fungicides including sporgon, propiconazole, flusilazole, prochloraz, iprodione, difenoconazole, tebuconazole, myclobutanil, pyraclostrobin and validamycin A were recommended for choices for controlling mango stem end rot disease. In addition, the fungicides of chlorothalonil and mancozeb could also be chosen. The resistance to thiophanate-methyl, kresoximmethyl and diniconazole was appeared in the tested pathogens. In cross-resistance test, the results showed that carbendazim, kresoxim-methyl and diniconazole had crossresistance each other, while kresoxim-methyl and validamycin A had negative crossresistance each other. To avoid the resistance of the pathogen to the fungicides, such fungicides should be used by turns.

Keywords: /Mango/ /Stem End Rot/

Lechaudel, M., Damour, G., et al. 2013. Chlorophyll fluorescence as an indicator of when to harvest mango 'Cogshall' fruit according to the market (export or domestic). *Acta Hort.* 992: 159 – 166.

Abstract

A non-destructive technique to predict the harvest date of mango according to the market (domestic or export), combined with the traditional criterion is presented. Changes in chlorophyll fluorescence of mango skin as an indicator for maturity were evaluated at different maturity stages. Maximal (Fm), minimal (Fo), variable (Fv), variable to maximal ratio (Fv/Fm) chlorophyll fluorescence, fruit size, density, total soluble solids content in flesh, and respiration rate were evaluated at three harvest dates (106, 120 and 132 days after full bloom, the latest corresponding to the traditional date of harvest, according to changes in fruit appearance). No difference in Fv/Fm values was found, regardless

of the harvest date, while the three maturity stages were differentiated using Fm, Fo and Fv values. These chlorophyll fluorescence parameters declined with the maturation process. The respiration rate increased with harvest date, especially for fruit from the latest harvest in which the climacteric crisis had begun. Total sugar content and fruit density increased as chlorophyll fluorescence parameters decreased. Chlorophyll fluorescence appeared to be a helpful, non-destructive technique to predict harvest date before visible changes in fruit appearance occurred, especially for the export market, whereas the traditional criterion could be used as an indicator of when to harvest 'Cogshall' mango for the domestic market in which it is not necessary to store fruit.

Keywords: /Mango/ /*Mangifera indica* L./ /Maturity/ /Quality/

Li, L., Wang, S.B., et al. 2013. Characterizations of major antioxidants at harvest-maturity and edible-ripening stages of three mango (*Mangifera indica* L.) cultivars. Acta Hort. 992: 529 – 536.

Abstract

The contents and their dynamic arrangements of six antioxidants and total antioxidant capacity in the three mango (*Mangifera indica* L.) cultivars, 'Tainong No.1' ('Haden' × 'Irwin'), 'Yuexi No.1' (the progeny of 'Carabao') and 'Chunhuang' ('White' × 'Keitt'), were estimated at fruit harvest-maturity (harvesting stage) and edible-ripening stages in South China. The results showed that, both at fruit harvesting and edible-ripening stages, total carotenoid contents and total antioxidant capacity were in the order: 'Yuexi No.1' > 'Tainong No.1' > 'Chunhuang'; the ascorbic acid (AA) content was 'Tainong No.1' > 'Yuexi No.1' > 'Chunhuang'; total polyphenol content was 'Yuexi No.1' > 'Chunhuang' > 'Tainong No.1'; reduced glutathione (GSH) content was 'Tainong No.1' > 'Chunhuang' > 'Yuexi No.1'. At fruit harvesting stage, total flavonoid content was 'Tainong No.1' > 'Chunhuang' > 'Yuexi No.1' and α -tocopherol content was 'Yuexi No.1' > 'Tainong No.1' > 'Chunhuang'. And at fruit edible-ripening stage, total flavonoid content was 'Yuexi No.1' > 'Tainong No.1' > 'Chunhuang' and α -tocopherol content was 'Tainong No.1' > 'Yuexi No.1' > 'Chunhuang'. In addition, total flavonoid content at edible-ripening stage was significantly higher than that at harvesting stage in each cultivar, and 'Yuexi No.1' possessed a conspicuous high level at this stage.

Keywords: /Mango/ /Antioxidant/ /Maturity/ /Ripening/

Mahto, R., & Das, M. 2013. Effect of gamma irradiation on the physico-chemical and visual properties of mango (*Mangifera indica* L.), cv. 'Dushehri' and 'Fazli' stored at 20°C. Postharvest Biol. & Technol. 86: 447 – 455.

Abstract

The effect of γ -irradiation doses (0.3, 0.5, 0.7, 1.0, 6.0, 10.0 kGy) on different physico-chemical and visual properties of two Indian cultivars of mango, cv. 'Dushehri' and 'Fazli' was observed during storage at 20°C for the evaluation of delayed ripening and extension of shelf-life. Visually all the irradiated fruit showed greener peel and lighter pulp throughout the storage, however, radiation injuries were present in 'Dushehri' treated with 6–10 kGy and in 'Fazli' with 1–10 kGy. Loss of fruit due to rotting was less in the irradiated samples, treated up to 1 kGy of both the cultivars. Irradiated fruit of both the cultivars at high doses (6–10 kGy) showed increased sugar content from 0 d, however, all the treated fruit registered a slower rate of increase of sugars with storage compared to the respective

controls and those treated with the lower doses of 0.5 and 0.7 kGy attained peak sugar concentration later. Significant ($p \leq 0.05$) textural deterioration could be detected immediately after irradiation, in 'Dushehri' at doses ≥ 1 kGy and in 'Fazli' at doses ≥ 0.7 kGy. However, low dose treated fruit (0.3–1 kGy) of both the cultivars softened at a considerably slower rate during storage and registered significantly greater fruit firmness (compression strength) throughout the storage period. Similarly, 'Dushehri' treated with 0.3–0.7 kGy and Fazli treated with 0.7 kGy registered significantly greater flesh firmness (shear strength). 'Dushehri' treated with 0.3–1 kGy and 'Fazli' with 0.5–1 kGy also registered significantly harder and tougher peel, as determined by puncture test, throughout the storage. Scanning electron microscopy (SEM) performed on 3rd and 2nd d of storage of 'Dushehri' and 'Fazli' respectively, revealed microstructural breakdown at and above 1 kGy in both cultivars. Cell separation could be observed in 'Fazli' even at 0.7 kGy. SEM also revealed that the control fruit were in a more advanced stage of ripening than the low dose treated fruit. The study showed the feasibility of low dose γ -irradiation on 'Dushehri' (0.3–0.7 kGy) and 'Fazli' (0.5 and 0.7 kGy) that induced useful delay in ripening and extension of shelf-life by a minimum of 3 and 4 d, respectively.

Keywords: /Mango/ /Gamma Irradiation/ /Rotting/ /Texture/

Mehta, V.B., Haldankar, P.M., et al. 2013. Use of a soft x-ray imaging system for on-line detection of spongy tissue in 'Alphonso' mango fruit. Acta Hort. 992: 575 – 578.

Abstract

A collaborative research project was conducted during the 2007-08 and 2008-09 mango season with an objective to develop a non-destructive method to identify and sort spongy tissue affected 'Alphonso' mango fruits using a soft X-ray imaging system, designed and developed by CEERI, Chennai, in collaboration with Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli. A batch of 'Alphonso' mango fruits having different ripening stages as a treatments viz., T1 – 2 days after harvest, T2 – 3 days after harvest, T3 – 4 days after harvest, T4 – 5 days after harvest were exposed repeatedly to the X-ray imaging machine, calibrated by computing different algorithms, using base line data regarding physico-chemical properties of spongy tissue and healthy pulp of 'Alphonso' mango fruit. The machine could best detect and sort spongy tissue affected fruits from treatment (T3), followed by T4 and T2, but was less successful for T1. The machine could also detect fruit with air pockets.

Keywords: /Mango/ /Alphonso Mango/ /Non destructive Method/ /Sorting/

Motomura, Y., Nishizawa, T., et al. 2013. Effects of 1-MCP and DPA on the changes in sesquiterpene and total phenol contents associated with superficial browning in ripe mango skins. Acta Hort. 989: 61 – 68.

Abstract

Mango (*Mangifera indica* L.) fruit is highly susceptible to superficial scald, which manifests as brown and/or black patches on the fruit skin. In apples and pears, a similar symptom is thought to be the result of cell damage induced by the accumulation of volatile sesquiterpenes such as (E,E)- α -farnesene (AF) and conjugated trienes (CTs), an oxidized form of AF. In this study, sesquiterpenes in ripe mango fruit were extracted from the cuticle layers using hexane, and AF and CTs were measured using specific UV absorption (232 nm and 269 nm for AF and CTs, respectively). The browning score and the CTs/AF ratio were highest and lowest in fruits treated with DPA (diphenylamine) and 1-MCP (1-

methylcyclopropene), respectively. In some other fruits, surface browning is often associated with changes in the content of phenolic substances. Total phenol content in the yellow area of ripe mango skin was higher than that in the brown area, regardless of treatment. The relationships between changes in the CTs/AF ratio in hexane extract, total phenol content in the peel and the severity of browning are discussed.

Keywords: /Mango/ /*Mangifera indica* L./ /1-MCP/ /Superficial Browning/

Protacio, C.M. 2013. Towards a good agricultural practice (GAP)-compliant **mango** production system in the Philippines. *Acta Hort.* 992: 69 – 74.

Abstract

The Philippine system of producing mangoes based on big trees has so many disadvantages and has to be revamped. Constraints in the present production system include low yield on a per unit area basis, cultural operations in big trees are hazardous to worker safety and health, and big tree size prevents conduct of good agricultural practices (or GAP). If GAP can be practiced, savings in chemical usage will be realized, worker safety will be safeguarded, and better quality fruits can be produced. Moreover, the fruits produced can gain entry to the markets worldwide. A high density system using small trees has to be established so that Good Agricultural Practices can be fully implemented. However, tree size must be maintained and not allowed to exceed allotted space. Pruning must be done to maintain size. Pruning also synchronizes production and when combined with paclobutrazol, makes off-season fruiting more predictable and productive. The GAP-compliant mango production system eliminates biennial bearing of mango because the whole production cycle can fit in just 12 months.

Keywords: /Mango/ /*Mangifera indica*/ /Good Agricultural Practices/

Rajan, S., Sahu, T.K. & Yadava, L.P. 2013. **Mango** resources information system: an open access portrayal of phenotypic, genetic and chemical information on mango. *Acta Hort.* 992: 99 – 104.

Abstract

Mango Resources Information System was developed for management of phenotypic, genetic, molecular, chemical and other available information on indigenous and exotic mango cultivars. The information system is enriched with 682 accessions with the details of fruit, leaf and other characteristics. It has a collection of 26 expressed sequence tag (EST) and 285 nucleotide sequences present in mango varieties which contains complete and partial genomic sequences having the molecular type, generally genomic DNAs, m-RNAs and unassigned DNAs. The protein information section is enriched with a collection of proteins present in different cultivars of mango. A user friendly web interface is designed to search the proteins, ESTs, nucleotides, chemicals, field gene bank holdings and cultivars. A description of various chemical components of different *Mangifera* species and cultivars are included in this information system. Besides all these, published information and links, including research papers, reports, proceedings, journals, authors etc. from 1972 to 2008 are present in its references section. An interactive discussion forum is developed to discuss major problems and solutions related to mango. The Information System is based on relational database modeling with records in interconnected tables. The information system is developed in MySQL on a Linux Platform. The information system is web enabled by Hyper Text Markup Language designing the web page and Preprocessor Hypertext (PHP 5.2.1) as a server scripting language for insertion and retrieval of

information the related MySQL database management system. Java script is used for client side applications and customizations. As the system provides quick access to information; serve as a quick method for extracting information from a massive data set. In case of mango varieties, information systems on various aspects like genetic resource information, molecular data, protein, nucleotides, chemical constituents etc., are vital from breeding and Intellectual Property Rights (IPR) point of view.

Keywords: /Mango/

Subedi, P., Walsh, K. & Purdy, P. Determination of optimum maturity stages of mangoes using fruit spectral signatures. *Acta Hort.*, 992: 521 – 528.

Abstract

A purpose designed hand-held spectroscope (“Nirvana”, Integrated Spectronics) was used to assess mango fruit pigmentation (flesh and skin) and flesh dry matter content. Fruit dry matter content and flesh colour was assessed of fruit on the tree, and used as indices of fruit maturity. Dry matter of fruit at harvest was also closely related to total soluble solids of fully ripe fruit, and thus eating quality. The calibration model was robust across growing regions for dry matter ($R > 0.96$ with RMSECV $< 0.6\%$ DM), but regional models were required for flesh colour. The units were used to: (i) non-invasively monitor fruit on tree at weekly intervals from stone hardening stage, allowing a gauge of time to harvest; (ii) describe variation in fruit maturity in relation to canopy architecture, and thus inform selective picking procedures; (iii) assess average fruit maturity across blocks, allowing maturity zoning across the production area; (iv) relate dry matter content of hard green fruit to later ripening behaviour and eating quality (Brix and flavour).

Keywords: /Mango/ /Non-invasive/ /Maturity/

Tian, S., Li, B., et al. 2013. Postharvest disease control of mango fruit and the regulating mechanisms. *Acta Hort.* 992: 493 – 498.

Abstract

Mango (*Mangifera indica* L.) is a typical climacteric fruit with an obvious change in physiology and quality after harvest, including rapid ripening, physiological disorder and serious decay, resulting in quality deterioration and short postharvest life. Postharvest decay caused by anthracnose (*Colletotrichum gloeosporioides*) is also serious in mango fruit. Recently, some chemical compounds have received increasing attention for the control of diseases in mango fruit. We found that application of exogenous oxalic acid is effective in decreasing ethylene production and controlling decay of mango fruit during storage periods, and pre-harvest borate spray can also effectively reduce postharvest anthracnose. These results demonstrate that application of oxalic acid and borate is a promising method to suppress post-harvest deterioration and extend the shelf-life of mango fruit. We have proved that oxalic acid treatment has a combination of physiological effects associated with delaying the ripening process and inhibiting fungal pathogens. Borate is effective at inhibiting spore germinability of *C. gloeosporioides* due to delaying nuclear division, impairing endocytosis, and damaging ultrastructure of the fungal spores under borate repression.

Keywords: /Mango/ /Postharvest Disease Control/

Wei, C., Wu, H., et al. 2013. Studies on aroma volatile constituents from four varieties of ripe mango in China. Acta Hort. 992: 505 – 512.

Abstract

The aroma volatiles of four varieties of mango (*Mangifera indica* L.) ('Guire 82', 'Tainong 1', 'Mallika' and 'Hongmang 9') cultivated in Zhanjiang, Guangdong province were obtained by solid-phase microextraction (SPME) and analyzed by GC/MS in the skin and pulp at the fully ripe stage. The Total Soluble Solid (TSS) and color of skin and pulp were also studied. The aroma volatiles with the highest content in the four varieties were: (Z)- β -ocimene (43.02%), Terpinolene (68.37%), DLimonene (54.91%) and 3-Carene (49.951%) in the skin and (Z)- β -ocimene (82.32%), Terpinolene (67.84%), Cinene (68.33%) and 3-Carene (67.86%) in the pulp. There were 22 and 7 volatiles detected in the skin and pulp of 'Guire 82', respectively. The numbers of volatiles obtained from the skin and pulp of 'Mallika' and 'Hongmang 9' were (30, 32) and (12, 10), respectively.

Keywords: /Mango/

Wu, H.X., Wang, X.W. et al. 2013. Effect of bagging on fruit quality in mango. Acta Hort. 992: 587 – 592.

Abstract

'Zill' mango was bagged with four types of bags: adhesive-bonded fabric bag, yellow/black double layer bag, single white layer bag and single yellow bag. The results showed that bagging with single white bag significantly reduced contents of chlorophylls and carotenoids and significantly increased contents of anthocyanins and flavonoids in peel than those of other treatments, and also showed higher peel lightness, chroma and hue angle than those of other treatments. All these changes after single white bagging resulted in purple-red in maturity green periods and pink in ripe periods. Fruit bagged with single white bag had highest contents of vitamin C, titratable acids, soluble solids, sucrose, glucose and fructose, while those bagged with yellow/black double layer bags had significantly lower contents of chlorophylls, carotenoids, anthocyanins, and flavonoids than those of other treatments. Though peel lightness and chroma were remarkable higher, hue angle was significantly lower than those of other treatments. Therefore, yellow/black double layer bags tended to produce fruits with light yellow peel color in maturity green periods and orange yellow peel in ripe periods and also worse internal quality fruits. The results showed that single white bag could be a promising practice for mango production.

Keywords: /Mango (*Mangifera indica* L.)/ /Bagging/ /Internal Quality/

Singh, Z. 2013. Nitric oxide fumigation delays mango fruit ripening. Acta Hort. 992: 543 -550.

Abstract

Hard mature green 'Kensington Pride' mango fruit were fumigated with 0, 5, 10, 20 and 40 $\mu\text{L.L}^{-1}$ NO gas for 2 h and allowed to ripen at ambient temperature ($21\pm 1^\circ\text{C}$) to evaluate its effects on fruit ripening. NO-fumigation treatments significantly ($P \leq 0.05$) suppressed ethylene production and respiration rates during fruit ripening. NO treatments (20 and 40 $\mu\text{L.L}^{-1}$) retarded fruit softening (hand firmness) and delayed fruit ripening by 2-days as compared to all other treatments. NO-fumigated (40 $\mu\text{L.L}^{-1}$) ripe fruit exhibited significantly higher pulp cohesiveness, springiness and chewiness as

compared to all other treatments. NO fumigation retarded fruit color development (visual colour, L*, a*, b*, C*) and delayed the reduction of h^o during fruit ripening. The concentrations of SSC, total sugars, glucose and fructose in the ripe fruit were significantly reduced in response to NO treatments. In conclusion, the postharvest fumigation of NO (20 µL.L⁻¹) suppressed climacteric ethylene production, respiration rate, retarded colour development, softening consequently delayed mango fruit ripening.

Keywords: /Mango/ /*Mangifera indica*/ /Ethylene/ /Respiration/ /Ripening/ /Quality/

Zhao, J., Wang, J., et al. 2013. Effect of bagging on the composition of carbohydrate, organic acid and carotenoid contents in mango fruit. Acta Hort. 992: 537 – 542.

Abstract

The effect of fruit bagging on the content of carbohydrate, organic acid and carotenoid in ripening mango of cvs. 'Chinhuang', 'Baixiangya', 'Hongyu' and 'Guifei' was investigated by high performance liquid chromatography (HPLC). Fruit bagging enhanced the contents of both total carbohydrate and total carotenoid, but reduced the content of total organic acid in fruit of all the tested varieties. The composition of carbohydrate, carotenoid and organic acid were not affected by fruit bagging. Bagged fruits of all the tested varieties had higher content of ascorbic acid, uinin acid, β-carotene, xanthophyll and lycopene and each constituent of carbohydrate than the control fruit. The proportions of ascorbic acid, quinin acid, β-carotene and lycopene were all raised by fruit bagging. Content and/or proportions of other compositions of carbohydrate, organic acid and carotenoid in mango fruit varied with tested cultivars and constituent types. The resulted suggested that fruit bagging can improve the internal quality of mango.

Keywords: /Mango/ /*Mangifera indica* L./ /Bagging/ //Fruit Quality/

MELON

Goncalves, C.X., et al. 2013. Putative role of cytokinin in differential ethylene response of two antisense ACC oxidase cantaloupe melons. Postharvest Biol. & Technol. 86: 511 - 519.

Abstract

Two transgenic lines of 'Cantaloupe' melon derived from the same wild type genotype were previously generated using ACC oxidase antisense constructs from melon (pMEL1AS) and apple (pAP4AS). Both lines yielded fruit with reduced ethylene production and low ACC oxidase (ACCO) expression. ACCO anti sensefruit also exhibited lower expression of ACC synthase genes, ACCS1 and ACCS3, indicating that these genes are positively regulated by ethylene and participate in the autocatalytic ethylene production process. In contrast, a higher expression of ACCS5 was observed in antisense lines when compared to the wild type indicating a negative feedback regulation of ACCS5 by ethylene. Fruit of both transformed lines exhibited delayed ripening and reduction in ester volatile production but differed in their response to exogenous ethylene supply. While postharvest ethylene application fully restored the ripening process in pMEL1ASmelon, it only restored flesh softening of pAP4AS melon but not rind color change or aroma volatile production. Up-regulation of lipoxygenase pathway associated genes (hydroxyperoxide lyase, lipoxygenase, and alcohol acyl transferases 1, 3 and 4) occurred in ethylene-treated pMEL1AS fruit but not in pAP4ASmelons. Polygalacturonase1 gene transcript accumulation increased in pMEL1AS and pAP4AS fruit upon ethylene supply. Zeatin and zeatin

riboside content of roots and fruit (rind and flesh) of pAP4AS plants were 5-fold higher than the wild type and pMEL1AS counterparts. Higher relative transcript accumulation of a gene involved in the cytokinin synthesis and a gene involved in cytokinin response were also found in the roots and fruit of pAP4AS. In addition, polyamines, which are known to reduce sensitivity to ethylene, remained unchanged in all fruit. Collectively the results suggest a putative role for the increased endogenous cytokinin content in counteracting ethylene action in some aspects of the fruit ripening process.

Keywords: /Melon/ /*Cucumis melo*/ /Fruit Quality/ /Aroma/

Jin, Y.Z., et al. 2013. Ethanol vapor treatment maintains postharvest storage quality and inhibits internal ethylene biosynthesis during storage of oriental sweet **melons**. *Postharvest Biol. & Technol.* 86: 372 - 380.

Abstract

In order to evaluate the effect of ethanol vapor treatments (0.5 mL/kg and 3 mL/kg) on postharvest storage at 23 °C, quality of oriental sweet melons, and to clarify the mechanism of the inhibition of senescence, we investigated physiological and quality changes induced by ethanol vapor, decay incidence, inter-nal ethylene concentration (IEC) and ethylene-related enzymes activities as well as gene expression. Both ethanol vapor treatments, irrespective of concentration, significantly ($P < 0.5$) delayed skin color changes, retarded softening and suppressed fruit decay in ethanol vapor-treated fruit. Between the two treatments, 0.5 mL/kg of ethanol vapor maintained better quality in storage than that of 3 mL/kg. Compared with the control, both ethanol vapor treatments resulted in different profiles and composition of aromatic volatile compounds of fruit during storage, and a significant increase of ethyl esters, including ethyl acetate, ethyl butanoate, ethyl hexanoate, ethyl 2-methylbutanoate, 3-(methylthio) propionate and 2-phenethyl acetate, and five new ethyl esters were also detected. Both treatments increased alcohol acyl-transferase (AAT) activity levels, which peaked earlier than in the control, but there were no significant differences in activities of alcohol dehydrogenase (ADH). Both treatments significantly ($P < 0.5$) suppressed internal ethylene concentrations (IEC) during storage at 23 °C, which was evident from reducing 1-aminocyclopropane-1-carboxylic acid (ACC) synthase (ACS) and ACC oxidase (ACO) activities, and inhibiting ACC biosynthesis, and the effect of the 0.5 mL/kg treatment was better than that of 3 mL/kg. Real-time quantitative PCR (Q-PCR) analysis showed that the expression patterns of CM-ACO1, CM-ACO2, CM-ACS1 and CM-ACS2 were consistent with ethylene production during storage. These results suggest that postharvest ethanol vapor treatments markedly delayed the senescence of harvested oriental sweet melons, maintained better quality in storage and improved levels of volatile aroma compounds, especially the ethyl esters, through suppressing the expression of particular members of ethylene-forming enzyme gene families as well as ethylene biosynthesis, and the effect is dose dependent.

Keywords: /Melon/ /Ethanol/ /Storage Quality/ /Ethylene Biosynthesis/

ORANGES

McDonald, H., et al. 2013. Effect of gamma irradiation treatment at phytosanitary dose levels on the quality of 'Lane Late' navel **oranges**. *Postharvest Biol. & 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 target dose levels of 200, 400 and 600 Gy (actual absorbed doses were in the range of 100–300, 300–500, and 500–700 Gy, respectively) then stored for 1 d at 5°C, 3 weeks at 5°C (to simulate sea shipment to Asia) or 4 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 400 and 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: /Oranges/ /Gamma Irradiation/ /Sensory/ /Quality/

Njombolwana, N.S., et al. 2013. Effects of citrus wax coating and brush type on imazalil residue loading, green mould control and fruit quality retention of sweet oranges. *Postharvest Biol. & Technol.* 86: 362 - 371.

Abstract

Wax application plays an important role in prolonging fruit quality, and the addition of imazalil (IMZ) furthermore protects fruit against green mould caused by *Penicillium digitatum*. The objectives of this study were to evaluate green mould control and quality preservation effects of carnauba or polyethyl-ene citrus coatings supplemented with IMZ, as well as the effect of synthetic or horsehair brush types used on sweet orange fruit. Single applications of IMZ at 3000 µg mL⁻¹ at rates of 0.6, 1.2 and 1.8 L t⁻¹ resulted in residues that increased with increasing coating loads on navel oranges (1.31 to 3.32 µg g⁻¹) and Valencia oranges (3.22 to 6.00 µg g⁻¹). Coating with IMZ generally provided poorer curative control (≈14%) than protective control (≈58%), with less sporulation in treatments using horsehair (≈59%) than synthetic brushes (≈64%). More fruit weight and firmness losses were found in fruit treated with the polyethylene coating (≈1.18 and ≈0.93 ratios of treated vs. untreated, respectively) and lower in carnauba treated fruit (≈0.76 and ≈0.74 ratios, respectively). However, polyethylene coatings resulted in shinier fruit before (≈10.85 shine ratio) and after storage (11.60), whereas carnauba coatings resulted in lower shine ratios (≈7.45 and 10.15, respectively). Gas (CO₂) exchange ratios remained similar for both waxes (≈0.67). Higher polyethylene coating loads (1.8 L t⁻¹) resulted in off-tastes similar to uncoated control fruit (≈2.21 rating on a 5-point scale) and higher than the rating for carnauba coated fruit (≈1.82) at this rate. Scanning electron micrographs showed an amorphous crystallised natural wax layer with uncovered stomatal pores on the surface of uncoated fruit. The thickness of the applied wax layer increased with increasing coating load. A single application of IMZ in wax provided good protective green mould control and sporulation inhibition, with differing effects on some fruit quality parameters due to coating and brush types.

Keywords: /Oranges/ /Citrus/ /*Penicillium digitatum*/ /Carnauba/ /Green Mould Control/ /Fruit Quality/

PAPAYA

Li, X., Zhu, X., et al. 2013. Effects of hot water treatment on anthracnose disease in papaya fruit and its possible mechanism. *Postharvest Biol. & Technol.*, 86: 437 – 446.

Abstract

Harvested papaya fruit are perishable due to rapid ripening and softening and susceptibility to biotic or abiotic stresses. Hot water treatment (HWT) can preserve fruit quality by reducing decay. The present study investigated effects of HWT on controlling fungal pathogens of papaya fruit and the possible mechanism by which HWT induced disease resistance. HWT (54 °C, 4 min) of papaya fruit had a pronounced effect on reducing the carrier rate of *Colletotrichum gloeosporioides* (*C. gloeosporioides*) in fruit peel, significantly inhibited the incidence of anthracnose and stem-end rot, effectively delayed fruit softening, but slightly promoted the rate of fruit coloring. HWT reduced the anthracnose index and fruit ripeness to a certain extent and induced changes in the wax arrangement on the surface of treated fruit, causing the wax to melt. The cracks and most stomata appeared to be partially or completely plugged by the melted wax, thereby providing a mechanical barrier against wound pathogens. HWT induced the expression of CpPGIP and promptly induced the expression of CpNPR1, and then regulated the expression of the CpPR1 gene, which may enhance the resistance of the fruit to anthracnose disease and reduce the decay rate. Together, these results confirm that HWT could reduce disease incidence and induce resistance, and thus maintain postharvest quality during storage and prolong the shelf-life of papaya fruit.

Keywords: /Papaya/ / Hot Water Treatment/ /Fruit Ripening/ /Anthracnose/

Ong, M.K., 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⁻¹ fresh weight (FW)), total phenolic content (0.515–0.686 mg GAE (gallic acid equivalents) g⁻¹ FW), ethylene production (5.83–81.3 µl kg⁻¹ h⁻¹), respiration rate (24.5–59.0 ml CO₂ kg⁻¹ h⁻¹), β-carotene (0.045–0.201 mg 100 g⁻¹ FW) and lycopene content (0.08–0.244 mg 100 g⁻¹ FW) was observed during storage, whereas there was a reduction in titratable acidity (0.162–0.075%), firmness (108–7.7 N) and hue angle (157–96.8°). 'Frangi' papaya particularly after 4 days of ambient storage showed improved antioxidant activity (0.32–1.55 mM Fe(II) g⁻¹ FW).

Keywords: /Papaya/ /Ripening/ /RespirationRate/ /Ethylene Production/

PEACH

De Cal, A., et al. 2013. Role of gluconic acid and pH modulation in virulence of *Monilinia fructicola* on peach fruit. *Postharvest Biol. & Technol.* 86: 418 - 423.

Abstract

Colonization of nectarines and peaches fruit by *Monilinia fructicola* was accompanied by local acidification of the host tissue. The fungus acidified the host tissue in peaches and nectarines from pH 4.5 and 4.45, to pH 3.75 and 3.9, respectively. Analysis of the acidification process in colonized fruit and secondary inducing media showed that gluconic acid was the main organic acid accumulated at the infection site and under liquid-culture conditions. When comparing a nectarine cv. Big Top and peach cv. Plácido with differing sensitivities to *M. fructicola*, a 250% higher accumulation of gluconic acid was observed in the susceptible peach cultivar than in the less susceptible nectarine cultivar. Under liquid conditions, at pH 3.6–3.7, the relative expression of transcripts of *mfp2* and *mfp3*, encoding for two polygalacturonase genes of *M. fructicola*, increased 12-fold and 6-fold, respectively, suggesting the importance of acidification for the secretion of pathogenicity factors by *M. fructicola*. Our results indicate that ambient pH is a regulatory cue for processes linked to pathogenicity of postharvest pathogens, and that specific genes contributing to pathogenicity are expressed as a result of the environmental pH created by the pathogen.

Keywords: /Peach/ /Quiescent infections/ /Brown rot/ /Postharvest diseases/

Shinya, P., et al. 2013. **Peach** ripening: Segregation at harvest and postharvest flesh softening. *Postharvest Biol. & Technol.* 86: 472 - 478.

Abstract

The peach melting flesh cultivars 'Ryan Sun' and 'Sweet September' and the non-melting, 'Kakamas' were harvested according to their visually assessed ground color and divided into four, ripeness classes (M1, M2, M3, and M4). The following aspects were determined: fruit mass, soluble solids content (SSC), ground skin hue angle (h°) and chroma (C^*), the absorbance difference at 670 nm and, 720 nm index (IAD), and the texture (fruit firmness measured with a needle, flesh firmness measured, with a 7.9 mm plunger, and uniaxial compression strength). Considering that in peaches, the h° of the ground color and the IAD are maturity indicators closely associated with ripeness and particularly with, flesh firmness, the texture parameters and their relationship to h° and IAD were examined. The visual, assessment of the ground color was validated as the criterion for sorting the ripeness levels in peaches, as confirmed by h° and IAD. Fruit firmness assessed with the needle and that with the 7.9 mm plunger, were highly correlated with each other and with the h° and IAD, whereas the compression strength, exhibited less correlation with the optical properties of the skin. The non-melting 'Kakamas' showed, the poorest correlation between texture and h° and IAD. Comparing both optical properties, the IAD, showed a higher correlation with texture features than the h° . In a second experiment, fruit from the M3 ripeness class was maintained in a ripening chamber (20°C, and 80% RH) until the flesh was softened for consumption. During postharvest, the first two principal, components of a principal component analysis explained 85% of the total variance of the texture, components and the optical properties of the skin. PC1 (67.2%) was defined positively by the texture, parameters and IAD. The h° of the ground color was negatively related to all texture parameters, and, IAD. PC2 (17.8%) was associated positively with the juice content, and this parameter proved to be, independent of all others.

Keywords: /Peach/ /Texture/ /Flesh firmness/ /Maturation/ /Stone fruit/ /Harvest Index/

Sisquella, M., et al. 2014. Effect of host and *Monilinia* spp. variables on the efficacy of radio frequency treatment on peaches. Postharvest Biol. & Technol. 87: 6 - 12.

Abstract

Brown rot caused by *Monilinia* spp. is the most important postharvest disease of stone fruit. Currently, no chemical fungicides are allowed in the European Union to be applied to stone fruit after harvest. In previous work, radio frequency (RF) treatment for 4.5 min applied with fruit immersed in water at 40°C was very promising for the control brown rot on peaches and nectarines. In the present study, the efficacy of this radio frequency treatment was studied employing different infection times, inoculum concentrations, fruit maturity levels and in naturally infected fruit. Generally, infection time and maturity level of fruit did not have a significant effect on the RF treatment efficacy and brown rot incidence was significantly reduced in fruit inoculated 0, 24 or 48 h before treatment and at all maturity levels evaluated in both peaches and nectarines. RF treatment significantly reduced brown rot incidence at all inoculum concentrations evaluated (103, 104, 105 and 106 conidia mL⁻¹). However, in peaches, the treatment efficacy was slightly less when the inoculum concentration was increased to 105 or 106 conidia mL⁻¹. In naturally infected fruit, brown rot incidence was significantly reduced from 92% among control fruit to less than 26% in peaches and complete brown rot control was achieved in nectarines. RF treatment did not have an effect on fruit firmness in the varieties tested, and even a delay of fruit softening was observed. Moreover, both external and internal fruit appearance was not affected by the treatment.

Keywords: /Peach/ /*Monilinia fructicola*/ /Nectarines/ /Heat treatment/ /Brown rot/

Wang, K., et al. 2013. The metabolism of soluble carbohydrates related to chilling injury in peach fruit exposed to cold stress. Postharvest Biol. & Technol. 86: 53 - 61.

Abstract

In order to elucidate the metabolism of soluble carbohydrates related to chilling injury (CI) in peach fruit (*Prunus persica* L. Batsch cv. Yulu) exposed to cold storage, we systematically investigated the changes in soluble carbohydrate content, transcript levels for genes encoding related enzymes, and the ascorbic acid (AsA) regeneration cycle in fruit stored at 0°C and 5°C for 28 days. At 0°C, sucrose levels gradually increased up to day 21 before declining, but no significant changes of reducing-sugar levels (glucose and fructose) were observed during this time. However, the levels of sucrose decreased sharply and reducing-sugar levels increased during storage at 5°C. Thus, fruit stored at 0°C showed significantly higher levels of sucrose and lower levels of glucose and fructose than fruit stored at 5°C. This difference was primarily due to lower transcription levels for neutral invertase 2 (NI/2), acid invertase (AI) and sucrose synthase (SS) and lower activities of NI and AI, and higher levels for sucrose phosphate synthase 1 (SPS/1). Both groups of fruit displayed an early, dramatic increase in the transcription levels of sorbitol and sorbitol dehydrogenase (SDH). Additionally, stable membrane permeability, a lack of CI symptoms and a regular AsA cycle were observed throughout the test period in fruit stored at 0°C. On the other hand, membrane permeability increased sharply in fruit stored at 5°C, which caused severe internal browning and stimulated AsA cycle activity later in storage. These results suggest that the higher levels of sucrose, resulting from the balance between its degradation and biosynthesis, contribute to membrane stability and enhanced chilling tolerance in peach fruit. Additionally, higher levels of glucose may have provided more reducing power and served as a substrate for AsA biosynthesis, which resulted in enhanced AsA cycle activity in chilling-sensitive fruit.

Keywords: /Peach/ /*Prunus persica*/ /Cold Storage/ /Chilling Injury/

PEAR

Chiriboga, M.A., et al. 2013. Effect of cold storage and 1-MCP treatment on ethylene perception, signalling and synthesis: Influence on the development of the evergreen behaviour in 'Conference' pears. *Postharvest Biol. & Technol.* 86: 212 - 220.

Abstract

To further understand the response of 'Conference' pears to 1-methylcyclopropene (1-MCP) treatment and their ability to restore ripening after prolonged periods of cold storage, fruit were treated with 0,300 nL L-11-MCP or 300 nL L-1exogenous ethylene plus 600 nL L-11-MCP prior to storage. Changes in ethylene, ethylene precursors (ACC, MACC), ethylene-related enzyme activities (ACS, ACO) together with their transcript levels, and the expression of four ethylene receptors and one Raf kinase protein from the ethylene signalling pathway, were monitored before and after cold storage and during subsequent ripening at 20°C. 1-MCP treatment acted on the ethylene pathway in two differentiated phases. In a first initiation occurring during cold storage, the 1-MCP treatment limited the up-regulation of both PcACS1 and PcACO1 observed in control fruit and promoted an up-regulation of PcETR1 leading to a complete inhibition of ACO activity during cold storage. These regulations resulted in fruit unable to produce ethylene upon removal and promoted the second phase (maintenance phase). This second phase was characterized by a down-regulation of PcACS1 and PcACS4 as well as PcACO1 together with a clear up-regulation of PcETR5 and better maintenance of PcCTR1 transcript levels, which were partially reversed with exogenous ethylene treatment. All these different regulations led in turn to a complete inhibition of the ripening processes, which may partially explain the occurrence of the evergreen behaviour in 'Conference' pear during shelf-life.

Keywords: /Pears/ /1-MCP/ /Chilling/

Mattheis, J., Felicetti, D. & Rudell, D. R. 2013. Pithy brown core in 'd'Anjou' pear (*Pyrus communis L.*) fruit developing during controlled atmosphere storage at O₂ determined by monitoring chlorophyll fluorescence. *Postharvest Biol. & Technol.* 86: 259 - 264.

Abstract

Physiological responses and fruit quality of 'd'Anjou' pear fruit from five orchard lots were evaluated after cold storage in air or controlled atmospheres (CA) with the O₂ concentration based on assessment of fruit chlorophyll fluorescence (CF) or standard conditions (1.5 kPa O₂). The pCO₂ for all CA fruit was 0.5 kPa. Softening, acid loss, and peel degreening of all lots were delayed at one or more evaluation dates (2, 4, 6, 8 months) by previous storage at the CF pO₂ compared with fruit stored in 1.5 kPa O₂ or in air. Superficial scald developed on fruit previously stored in air but not on fruit stored in a CA. Pithy brown core developed on fruit from all lots stored at the CF pO₂ and on fruit stored at 1.5 kPa in 3 of the 5 lots. Pithy brown core incidence decreased with advanced harvest maturity. Post-storage ethylene and CO₂ production were in most instances lowest for fruit stored at the CF pO₂. A significant relationship between fruit ethanol content and pithy brown core incidence was observed. Results indicate low pO₂ storage based on CF monitoring slows fruit ripening relative to fruit stored at 1.5 kPa

O₂, prevents superficial scald development compared with fruit stored in air, however, development of pithy brown core in fruit stored at the CF pO₂ was not accompanied by a change in CF.

Keywords: /Pear/ /Fruit Ripening/ /Physiological Disorders/ /Ethanol/ /Fruit Quality/ /Firmness/

Syamaladevi, R.M., et al. 2014. UV-C light inactivation kinetics of *Penicillium expansum* on **pear** surfaces: Influence on physicochemical and sensory quality during storage. Postharvest Biol. & Technol. 87: 27 - 32.

Abstract

UV-C inactivation kinetic data of *Penicillium expansum* on intact and wounded pear disks were determined. *P. expansum* conidia (0.5 mL, 1.6 × 10⁷CFU/mL) were spot inoculated onto intact and wounded pear tissue with skin (excised disks), treated with UV-C doses ranging 0.101–3.06 kJ/m² at 23°C and surviving conidia were enumerated. Changes in selected physicochemical parameters and sensory quality following UV-C treatment of whole pears were determined immediately after treatment, and 4 and 8 weeks of storage at 4°C. A greater UV-C intensity was required for similar inactivation levels of *P. expansum* populations on wounded pear disks (3.1 kJ/m² for 2.7 log reduction) compared to intact pear disks (1.7 kJ/m² for 2.8 log reduction). No significant difference in % weight loss, or soluble solids content and texture was observed between UV-C treated and untreated pears. However, browning was observed on UV-C treated pear surfaces after 4 and 8 weeks along with changes in flavor and texture. An increase in consumer preference was noticed for the untreated control pears after 4 weeks storage.

Keywords: /Pear/ /Sensory Quality/ /Storage/ /Texture/

Xiao, C.L. & Boal, R.J. 2013. Biological control of *phacidiopycnis* rot in 'd'Anjou' **pears**. Acta Hort. 1001: 255 – 258.

Abstract

Phacidiopycnis rot, caused by *Phacidiopycnis piri*, is a recently reported postharvest fruit rot disease of pears (*Pyrus communis*) in the US, and a major disease of 'd'Anjou' pears grown in Washington State. *Phacidiopycnis* rot can originate from infection of wounds on the fruit. In this study, two biocontrol agents, BioSave (a *Pseudomonas syringae* strain) and *Cryptococcus laurentii* strain 87-108, were compared with the conventional fungicide thiabendazole (TBZ) for their efficacy in controlling *Phacidiopycnis* rot. 'D'Anjou' pear fruit were surface disinfected, wounded with a finishing nail head, treated with one of the biocontrol agents or TBZ, and inoculated with conidial suspension of *P. piri*. An untreated control where fruit were inoculated with the pathogen was also included in the trial. The experiment was conducted twice using fruit from different orchards where no fungicides were used. Each treatment contained four 20-fruit replicates. Inoculated fruit were placed on fiber fruit trays wrapped with perforated bags and stored in cardboard boxes at 0°C for three months, at which time decay was assessed. Over 92% of the fruit in the untreated control developed *Phacidiopycnis* rot. BioSave and *C. laurentii* significantly reduced incidence of *Phacidiopycnis* rot by 96-98 and 38-45%, respectively, compared with the control. BioSave was more effective than *C. laurentii*. No decay was observed on TBZ treated fruit, but there was no statistical difference in decay incidence between BioSave and TBZ treatments. The results suggest that BioSave is effective in controlling *Phacidiopycnis* rot originating from wound infections by *P. piri* and can provide a level of control of *Phacidiopycnis* rot comparable with that of TBZ.

Keywords: /Pear/ /Biocontrol/ /Postharvest disease/ /Fruit Decay/ /Biofungicides/

PERSIMMON

Ghidelli, C., et al. 2013. Effect of antioxidants in controlling enzymatic browning of minimally processed persimmon 'Rojo Brillante'. Postharvest Biol. & Technol. 86: 487 - 493.

Abstract

'Rojo Brillante' is an important variety of persimmon that after removal of the astringency with high levels of CO₂, maintains firmness and sweetness, making possible its commercialization as a fresh-cut commodity. However, the commercial success of the product is limited mainly by enzymatic browning. This work presents the effect of a wide range of antioxidants on enzymatic browning of 'Rojo Brillante' persimmon combining in vitro (extracts and precipitates) and in vivo (cut tissue) studies. Preliminary screening of the antioxidants, determined by absorbance and color measurements of persimmon extracts and pellets, showed that 4-hexylresorcinol (Hexyl), citric acid (CA) and calcium chloride (CaCl₂) were effective at controlling browning at 10 mM; whereas, ascorbic acid (AA) required a higher concentration (25 mM). Peracetic acid, cyclodextrin, cysteine, and hexametaphosphate were not effective at controlling browning, even at a concentration of 50 mM. In in vivo studies, AA (1.12%) and CA (0.21%) were the most effective treatments to control enzymatic browning of fresh-cut material, reaching the limit of marketability in 5–7 days, whereas, Hexyl and CaCl₂ did not reach 1 day of storage. The results showed that optimum concentrations in cut tissue did not always correlate with the in vitro studies, indicating that antioxidants have an effect not only in browning reactions, but also in metabolic activity and cell wall changes during wound-induced reactions. The results provide relevant information for further development of minimally processed 'Rojo Brillante' persimmon during storage at 5°C.

Keywords: /Persimmon/ /Fresh-Cut/ /Enzymatic Browning/ /Antioxidants/

Itamura, H., Nakatsuka, A., et al. 2013. Effect of ascorbate on prolonging shelf life of persimmon (*Diospyros kaki Thunb.*) fruit. Acta Hort. 989: 131 – 138.

Abstract

Persimmon fruit soften easily and have a shorter shelf life than other fruit. Fruit softening is closely related to ethylene synthesis and cell wall degradation. In this study, persimmon fruit were treated with ascorbate after harvest, and the fruit softening and ethylene production rates were determined. Ascorbate treatment lowered ethylene production and prolonged the shelf life of persimmon fruit, compared with a water treatment and the control. Ascorbate may function to decrease ethylene production, thereby prolonging the shelf life of the fruit. We analyzed expressed sequence tags from three cDNA libraries from persimmon fruit, and obtained information about genes related to the ascorbate biosynthesis pathway. DNA microarray analyses showed that L-galactono-1, 4-lactone dehydrogenase genes were expressed more strongly in "Endou" fruit than in fruit of "B wasei", a fast-softening cultivar. These results suggest that the ability to accumulate ascorbate is related to softening of persimmon fruit, and that ascorbate may function as a radical scavenger.

Keywords: /Persimmon/ /Ethylene/ /Shelf life/

Jeong, M., et al. 2013. Master packaging system for sweet persimmon applicable to produce supply chains. *Postharvest Biol. & Technol.* 86: 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 Chains/

Raimbault, A.K., et al. 2013. The expression patterns of bromelain and AcCYS1 correlate with blackheart resistance in pineapple fruits submitted to postharvest chilling stress. *J. Plant Physiol.* 170: 1442 -1446.

Abstract

Blackheart is a physiological disorder induced by postharvest chilling storage during pineapple fruit export shipping. The aim of this study was to check the involvement of bromelain, the cysteine protease protein family abundantly present in pineapple fruits, and AcCYS1, an endogenous inhibitor of bromelain, in the development of blackheart. For this we checked the response to postharvest chilling treatment of two pineapple varieties (MD2 and Smooth Cayenne) differing in their resistance to blackheart. Quantitative RT-PCR analyses showed that postharvest chilling treatment induced a down-regulation of bromelain transcript accumulation in both varieties with the most dramatic drop in the resistant variety. Regarding AcCYS1 transcript accumulation, the varieties showed opposite trends with an up-regulation in the case of the resistant variety and a down-regulation in the susceptible one. Taken together our results suggest that the control of bromelain and AcCYS1 expression levels directly correlates to the resistance to blackheart development in pineapple fruits.

Keywords: /Pineapple/ /Blackheart/ /Pineapple/ /Postharvest/ /Chilling Treatment/

Soler, A., et al. 2013. Differential response of two **pineapple** cultivars (*Ananas comosus* (L.) Merr.) to SAR and ISR inducers against the nematode *Rotylenchulus reniformis*. *Crop Protection*. 54: 48 - 54.

Abstract

We hypothesized that inducing systemic resistances can contribute to the control of the nematode *Rotylenchulus reniformis* in pineapple. In greenhouse experiments conducted in Martinique, the pineapple cultivars Smooth Cayenne and MD-2 were treated with methyljasmonate (JAME) and salicylic acid (SA), elicitors of induced systemic resistance (ISR) and systemic acquired resistance (SAR). The efficacy of the elicitors was tested by inoculating plantlets grown in individual pots with a monospecific population of *R. reniformis* reared on *Vigna unguiculata*. The final nematode populations, 45 days after inoculation on MD-2 treated with JAME were reduced by 67.0% ($p \leq 0.006$). Nematode populations on MD-2 plants treated with SA were reduced by 55.8% ($p \leq 0.016$). Nematode populations on SC were not reduced by the elicitors. In a second experiment, using split-root systems, JAME was applied to MD-2 plantlets and enzymatic activities involved in plant defense and stress responses were monitored for 14 h after treatment. Additional pots were inoculated with nematodes 24 h after JAME treatment and examined ten days later. Transient stress was observed along with an increase in enzymatic response after inoculation with nematodes. These results showed that the MD-2 was primed through an ISR by JAME. The question now arises whether ISR can be specifically induced only in certain pineapple cultivars. Results are discussed from the perspective of introducing new strategies to manage pineapple nematodes.

Keywords: /Pineapple/ /Salicylic acid/

Zhang, B.Y., et al. 2013. Effect of atmospheres combining high oxygen and carbon dioxide levels on microbial spoilage and sensory quality of fresh-cut **pineapple**. *Postharvest Biol. & Technol.* 86: 73 - 84.

Abstract

Fresh-cut fruit such as pineapple have a very limited shelf-life. The study aims at prolonging the shelf-life of fresh-cut pineapple by means of modified atmospheres (MAs). The effect of MAs combining high O₂ (21–70%) and CO₂(21–50%) levels on microbial spoilage and sensory quality of fresh-cut pineapple was therefore evaluated. In the first part of the study, the behaviour of two spoilage yeasts (*Candida sake* and *Candida argentea*) and one lactic acid bacterium (*Leuconostoc citreum*), which had previously been isolated from spoiled commercial fresh-cut pineapple cubes, were monitored on pineapple agar separately. In the second part of the study, the shelf-life of commercial fresh-cut pineapple cubes packaged in selected Mas was evaluated at 7°C. The results showed that MAs combining high O₂ and high CO₂ levels had a large inhibitory effect on the growth and volatile metabolite production of *C. sake* and *C. argentea* on pineapple agar. A MA with 50% O₂ and 50% CO₂ was in both cases the most inhibitive. Although MAs induced the production of ethyl acetate by the yeasts, the quantity of ethyl acetate was much lower in high O₂ and high CO₂ than that in air due to lower yeast population density in MAs. With regards to growth, *L. citreum* was not sensitive to high O₂ and CO₂ levels. The fresh-cut pineapple packaged in air had deteriorated and were not acceptable any more by day 7, while those packaged in 50% O₂ combined with 50% CO₂, which also retarded the growth of aerobes and yeasts on pineapple cubes during storage, were still acceptable. It can be concluded that a MA with 50% O₂ and 50% CO₂ shows the best potential for extension of the shelf-life of fresh-cut pineapple.

Keywords: /Pineapple/ /Fresh-cut/ /Modified Atmosphere Packaging/

POMEGRANATE

Castro-Giraldez, M., et al. 2013. Study of pomegranate ripening by dielectric spectroscopy. *Postharvest Biol. & Technol.* 86: 346 - 353.

Abstract

Pomegranate (*Punica granatum* L.) is one of the fruits most recently studied for its many health benefits and its high antioxidant capacity and total phenolic content. Currently, the industry uses destructive methods to ensure the quality standards demanded by consumers. In this context, dielectric spectroscopy is presented as an interesting technique to monitor, on-line, fruit quality standards and ripening changes. The aim of this study is to analyze the effect of the major components of pomegranate and its structure on the dielectric spectrum between 500 MHz and 20 GHz. Some physical, chemical and dielectric measurements were carried out in the arils, spongy white tissues and peel. A maturity index was defined based on dielectric properties of fruit at two different frequencies, 2.4 and 1.2 GHz. The results demonstrated the utility of this index for pomegranate.

Keywords: /Pomegranate/ /Polyphenols/ /Maturity Index/

Martinez-Romero, D., et al. 2013. *Aloe vera* gel coating maintains quality and safety of ready-to-eat pomegranate arils. *Postharvest Biol. & Technol.* 86: 107 - 112.

Abstract

Several postharvest treatments were performed on pomegranate arils prior to storage in rigid polypropylene boxes for 12 days at 3°C: water (control), ascorbic + citric acids (at 0.5 or 1%), Aloe vera gel (at 50 or 100%), 50% A. vera gel + 0.5% ascorbic and 0.5% citric acid, and 100% A. vera gel + 1% ascorbic and 1% citric acid. A. vera (alone or in combination with acids) led to lower CO₂ and higher O₂ concentrations inside the packages compared with arils treated with water (control). With respect to quality attributes, A. vera coatings led to firmness retention and increased levels of total anthocyanins and total phenolics. In addition, A. vera treatments led to significantly lower counts for both mesophilic aerobics and yeast and moulds. Sensory analysis scores for flavour, texture, aroma, colour and purchase decision were higher in arils treated with A. vera, especially in those arils treated with 100% A. vera + 1% ascorbic and citric acids. Finally, no off-flavours in pomegranate arils were perceived by judges as a consequence of A. vera gel treatment.

Keywords: /Pomegranate/ /Aloe Vera/ /Edible Coating/ /Microbial Spoilage/ /Firmness/ /Minimally Processed/

Pena, M.E., et al. 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/ /Physicochemical Properties/

Shahbaz, H.M., Ahn, J., et al. 2014. Chemical and sensory quality of fresh **pomegranate** fruits exposed to gamma radiation as quarantine treatment. *Food Chem.* 145: 312 – 318.

Abstract

The U.S. Department of Agriculture in February 2012 approved the import of fresh pomegranates subjected to irradiation as a quarantine procedure with a minimum absorbed dose of 0.4 kGy against different pests. This study evaluated the application of different gamma-irradiation doses (0.4, 1, and 2 kGy) in fresh pomegranate fruits and their effect on the chemical and sensory characteristics. The total soluble solids, titratable acidity, and pH values remained unaffected up to 1 kGy treatment. Irradiation caused a significant decrease in the total anthocyanins and phenolic content. A strong positive correlation was observed among the antioxidant activities, total phenolics and anthocyanin contents. In general, a stronger preference was shown by sensory panelists for the juice from irradiated fruits. This study provides research-based information about the application of irradiation as a quarantine disinfestation treatment to enhance the marketing and consumer acceptance of pomegranates.

Keywords: /Pomegranates/ /Gamma Irradiation/ /Quarantine treatment/

PONKAN

Peng, G., et al. 2013. Chlorophyll a/b binding protein plays a key role in natural and ethylene-induced degreening of **Ponkan** (*Citrus reticulata* Blanco). *Scientia Hort.* 160: 37 - 43.

Abstract

Chlorophyll content in peel gradually declines during citrus fruit development, and this can be accelerated by applying ethylene. In order to understand the molecular regulation of chlorophyll loss, the expression of several chlorophyll-related genes was determined in Ponkan (*Citrus reticulata* Blanco) peel during fruit maturation and ethylene-induced degreening. During fruit development, the transcript level of pheophorbide *a* oxygenase (*CitPaO*) and stay-green protein (*CitSGR*) was stable, and no obvious change of chlorophyll *b* reductase (*CitNYC*) mRNA was found. In addition, chlorophyllase (*CitChlase*) mRNA was decreased, indicating the decline of chlorophyll degradation capacity in this process. Only the reduced expression of Mg-chelatase (*CitCHLH*) and chlorophyll *a/b* binding protein (*CitCAB1, 2*) was

found to be correlated with the reduction in chlorophyll content. Chlorophyll loss was greatly accelerated by postharvest ethylene fumigation. In this process, the expression of *CitCHLH*, *CitPaO* and *CitSGR* was not affected. However, it greatly increased the expression of *CitNYC* and *CitChlase*, and accelerated the decline in *CitCAB* expression. Taken together, these results indicate that the decrease in expression of *CitCAB* was highly associated with chlorophyll loss, no matter whether during natural or ethylene-induced degreening. However, the increase in *CitChlase* and *CitNYC* transcript abundance was only related to accelerated chlorophyll degradation in ethylene-induced degreening. In conclusion, the higher availability of free chlorophylls for degradation, resulting from down regulated expression of *CitCABs*, is likely to be a main reason for chlorophyll reduction during natural and ethylene-induced degreening.

Keywords: /Ponkan/ /Citrus/ /Degreening/ /Ethylene/ /Fruit Maturation/

STONE FRUIT

Sisquella, M., et al. 2013. Continuous microwave treatment to control postharvest brown rot in stone fruit. *Postharvest Biol. & 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/ /Peaches/ /Nectarines/ /Heat treatment/ /Disease control/

STRAWBERRIES

Blanch, M., et al. 2013. NADP-malic enzyme and glutathione reductase contribute to glutathione regeneration in *Fragaria vesca* fruit treated with protective high CO₂ concentrations. *Postharvest Biol. & Technol.* 86: 431 - 436.

Abstract

Treatment of harvested strawberries (*Fragaria vesca* L. Mara des Bois) with high concentrations of CO₂ is an effective means of limiting fungal decay and avoiding disorders caused by low temperature storage. In the present study, we investigated the role of NADP-ME gene expression and activity in

lowering malic acid contents and in the provision of NADPH required for the regeneration of the reduced form of glutathione (GSH). We also measured glutathione reductase (GR: EC 1.6.4.2) activity in strawberries treated with different high CO₂ concentrations (0, 20 and 40% for 3 days) during storage at 0°C. A decrease in malic acid content in fruit exposed to 20% CO₂ was primarily mediated by the stimulation of NADP-ME activity, rather than associated with changes in the expression of cytosolic NADP-ME genes. Moreover, malic acid decarboxylation was associated with a marked increase in GR activity, which may account for the increased levels of glutathione in fruit following exposure to 20% CO₂. This chain of events was not observed in untreated fruit stored in air or in fruit treated with 40% CO₂, suggesting that the unique cellular redox status of 20% CO₂-treated fruit plays an important role in detoxification and protection from damage during storage. Based on these findings, we propose that NADP-ME activation in fruit exposed to 20% CO₂ provides NADPH for glutathione regeneration by GR, thereby conferring protection against the cellular damage caused by low temperatures or excessive high CO₂ levels.

Keywords: /Strawberries/ /Malic Enzyme/ /Malic Acid/

TABLE GRAPES

Liu, Yong-Biao. 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 mealybug 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 mealybug on harvested table grapes.

Keywords: /Table Grapes/ /Controlled atmosphere/ /Postharvest Pest Control/ /Mealybug/

Nally, M.C., et al. 2013. Biocontrol of fungi isolated from sour rot infected **table grapes** by *Saccharomyces* and other yeast species. *Postharvest Biol. & Technol.* 86: 456 - 462.

Abstract

Sour rot is an important disease of grapes caused by an etiologic complex of microorganisms in which filamentous fungi play a key role. Yeasts are used for biocontrol of pathogenic filamentous fungi on fruits. The major objective of this study was to assess in vivo on detached berries the effect of viticultural yeasts on phytopathogenic fungi involved in grape sour rot. Yeasts that were found to be effective in vivo against the fungi were assayed for their possible pathogenicity in humans: growth at 42°C, pseudo hyphal formation, adhesion, and phospholipase and protease activity. A total of 234 yeasts belonging to 14 genera were assayed against the following pathogens: *Aspergillus caelatus*, *Aspergillus carbonarius*, *Aspergillus terreus*, *Aspergillus versicolor*, *Fusarium oxysporum*, *Penicillium commune*, *Rhizopus stolonifer* and *Ulocladium sp.* Forty-three (16 *Saccharomyces* and 27 non-*Saccharomyces*) showed antagonistic properties against some of the fungi assayed in grapes at 25°C. Yeast isolates determined as biocontrol agents under in vivo conditions were isolated from fermenting musts (35), viticultural soils (6) and grape berries (2). Twenty biocontrol agents did not show phenotypical characteristics associated with pathogenicity in humans.

Keywords: /Table grape/ /Sour Rot/ /Biocontrol/

Ngcobo, M. E.K., et al. 2013. Investigating the potential of a humidification system to control moisture loss and quality of 'Crimson Seedless' table grapes during cold storage. *Postharvest Biol. & Technol.* 86: 201 - 211.

Abstract

The potential of humidifying cold storage rooms to control moisture loss and quality of table grapes in different package designs was studied. Fruit were stored in cold rooms ($-0.33 \pm 0.32^\circ\text{C}$ or $-0.12 \pm 0.32^\circ\text{C}$) with humidifier (95.0% RH) or no humidification (90.3% RH) respectively. Room humidification resulted in a 7.5% and 9.0% increase in RH inside the clamshell and open-top punnets multi-scale packages respectively in comparison to non-humidified storage, while there was no significant change in RH inside the 4.5 kg carry bag multi-packaging. The grapes were assessed for weight loss and SO₂ injury at intervals during a 35 d period. After 21 d of cold storage under humidification, weight loss of grapes was significantly higher ($P < 0.05$) in packages with open-top punnets than clamshell punnets and carry-bags. After 35 days in non-humidified cold storage, grape weight losses were $1.45 \pm 0.32\%$, $1.62 \pm 0.21\%$ and $2.01 \pm 0.57\%$ for the 4.5 kg carry-bag, 5 kg clamshell punnet and 5 kg open-top multi-packages, respectively. When fruit were stored inside the same types of multi-packages under humidification, the corresponding weight losses were $0.97 \pm 0.34\%$, $1.08 \pm 0.27\%$ and $2.00 \pm 0.57\%$. Cold storage humidification reduced the rate of stem dehydration and browning; however, it increased the incidence of SO₂ injury in table grape bunches and caused wetting of the packages.

Keywords: /Table grapes/ /Cold storage/ /Quality/ /Moisture Loss/

Youssef, K. & Roberto, S. R. 2014. Applications of salt solutions before and after harvest affect the quality and incidence of postharvest gray mold of 'Italia' table grapes. *Postharvest Biol. & Technol.* 87: 95 - 102.

Abstract

The efficacy of some potassium and calcium based salts, namely potassium sulphate (PS), potassium sorbate (PSo), potassium carbonate (PC), potassium bicarbonate (PB), calcium sulphate (CS), calcium chelate (CCh), calcium chloride (CC) and calcium silicate (CSi) against gray mold of 'Italia' table grapes, was evaluated. In in vitro experiments, PSo, PC, PB, and CCh completely inhibited mycelial growth of *Botrytis cinerea* at 0.25%. Under artificial inoculation, salts at 1% (immersed or sprayed) showed a variable effect against the pathogen. For natural infection, salt solutions (1%, w/v) were applied according to three strategies: (a) spray (one week) before harvest, (b) immersion after harvest, and (c) combined treatments spray and immersion. The decay incidence of gray mold was evaluated after 30 days at $2 \pm 1^\circ\text{C}$ and 90–95%RH, followed by 7 days of shelf-life at $22 \pm 2^\circ\text{C}$. All tested salts significantly reduced the decay incidence of gray mold as compared to a water control for the three strategies. The percentages of reduction ranged between 77–100, 91–98, and 61–100% for the preharvest treatment, in combined application, and in the postharvest treatment, respectively. PB and PSo were the most effective salts, completely inhibiting development of gray mold when applied before harvest and as a postharvest treatment. The influence of salts on physical and chemical properties of berry quality including total soluble solids, titratable acidity, pH, color index, weight losses and microbiological profiles was also investigated. New strategies are needed with the critical goal of controlling gray mold of grapes with no fungicide residues. Salts applied just before harvest may be an effective way to minimize gray mold during storage.

Keywords: /Grape/ /Table Grapes/ /Botrytis Cinerea/ /Gray Mold/

TANGERINE

Kumpoun, W., Chuttong, B. & Uthaibutra, J. 2013. Development of bee wax coating materials for 'Sai Nam Pueng' tangerine fruit. Acta Hort. 989: 117 – 120.

Abstract

The study was conducted to develop a suitable bee wax coating for 'Sai Nam Pueng' tangerine that can be kept for at least 1 year at ambient temperature ($25\text{-}30^\circ\text{C}$) and determine its suitability for application in a commercial coating machine without any effect on coating properties. The results revealed that optimum coating formula comprised of 15.0% (w/v) ethanol, 6.0% (w/v) oleic acid, 4.0% (w/v) bee wax and 0.4% (w/v) resin in water. This coating material was stored at ambient temperature ($25\text{-}30^\circ\text{C}$) for 1 year which showed similar characteristics as freshly prepared coating material. In addition, the bee wax material proved to be suitable for commercial coating machine for tangerine fruit. The quality of the coated 'Sai Nam Pueng' tangerine fruit had acceptable quality after 2 weeks storage at 25°C and up to 5 weeks at 15°C .

Keywords: /Tangerine/ /Wax Coating/

WATERMELON

Abbaszadeh, R., et al. 2013. Prediction of watermelon quality based on vibration spectrum. Postharvest Biol. & Technol. 86: 291 - 293.

Abstract

Judging watermelon quality based on its apparent properties such as size or skin color is difficult. A non-destructive method is employed here, based on vibrational response spectrum, to determine the quality indices of watermelon (Charleston gray). The responses of samples to vibration excitation were recorded by laser Doppler vibrometry (LDV). The phase shift between input and output signals were extracted over a wide frequency range. The total soluble solids (TSS), titratable acidity (TA) and TSS/TA ratio also measured as watermelon quality characters. Stepwise multiple linear regression (SMLR) as well as partial least square regression (PLS) was applied to extracted vibration spectrums to construct prediction models of watermelon quality. The results showed that performance of SMLR models were better than PLS. The determination coefficients (R^2) of SMLR validation models were 0.9976, 0.9985 and 0.9542 for TSS, TA and TSS/TA respectively. It is likely that reduction of cell wall materials to soluble solids during ripening process changes viscoelastic properties of watermelon reflected by vibrational response. This study demonstrated the feasibility of mentioned method for predicting the quality of watermelons in an industrial grading system.

Keywords: /Watermelon/ /Quality/

VEGETABLES

BABY SPINACH

Moosekian, S.R., Jeong,S. & Ryser, E.T. 2014. Inactivation of sanitizer-injured Escherichia coli O157:H7 on **baby spinach** using X-ray irradiation. Food Control. 36: 243 – 247.

Abstract

Chemical sanitizers are widely used to minimize cross-contamination during commercial flume washing of leafy greens. However, in addition to microbial inactivation, sanitizer exposure can also lead to sublethal injury. This study assessed the potential of sanitizer-induced cell injury to enhance resistance of Escherichia coli O157:H7 on baby spinach when X-ray irradiation was subsequently used as a microbial inactivation strategy. A 3-strain E. coli O157:H7 cocktail was exposed to a peroxyacetic acid-based sanitizer (PAS) at 5.2 ppm, a chlorine-based sanitizer (CS) at 5.2 ppm, both of which are commonly used in flume washing systems, or to a quaternary ammonium-based sanitizer (QAS) at 18 ppm to obtain 86 e99% injury. Pre-irradiated, round-cut (2.54 cm diameter) baby spinach leaves were dip-inoculated by immersion in the injured cocktail for 5 min and then irradiated in Whirl-pak bags at doses of up to 0.063 kGy using a low-energy X-ray irradiator (Rayfresh Foods, Ann Arbor, MI). Healthy and injured survivors were respectively quantified by plating appropriate dilutions on Sorbitol MacConkey Agar (SMAC) overlaid with trypticase soy agar containing 0.6% yeast extract and SMAC. On inoculated spinach, E. coli O157:H7 injury decreased from 86e99 to 66, 63, and 1% for PAS-, CS-, and QAS-treated cells, respectively. D10-values for PAS-, QAS-, and CS-injured E. coli O157:H7 on baby spinach were 0.014 ±0.000, 0.022 ± 0.001, and 0.024 ± 0.001 kGy, respectively. Prior exposure to PAS significantly ($P < 0.05$) enhanced E. coli O157:H7 susceptibility to X-ray irradiation, while exposure to CS significantly ($P < 0.05$) reduced susceptibility. These results suggest that PAS may be preferred for irradiated baby spinach.

Keywords: /Spinach/ /X-ray irradiation/ /Escherichia coli O157:H7/

BRASSICA CHINESIS

Wang, Y., Zhang, L. & Zhu, S. 2014. 1-Methylcyclopropene (1-MCP)-induced protein expression associated with changes in Tsai Tai (*Brassica chinensis*) leaves during low temperature storage. *Postharvest Biol. & Technol.* 87: 120 – 125.

Abstract

Leaf yellowing is an early symptom of senescence and greatly affects the commercial value of leafy vegetable products. The ethylene action inhibitor 1-methylcyclopropene (1-MCP) has been widely studied regarding its effects on senescence, but little is known on how it influences the protein expression profile of leafy vegetables in storage. In this study, by using a proteomic approach, changes in proteomic profile induced by 1-MCP in Tsai Tai (*Brassica chinensis*) leaves during storage under low but non-freezing temperature were investigated. Compared with the control, 1-MCP treatment inhibited leaf etiolation and reduced weight loss of Tsai Tai stored at 1°C, indicating that it delayed senescence. Two dimensional electrophoresis revealed 16 differentially accumulated protein spots, 12 of which were successfully identified by mass spectrometry. A comparison between the control and the 1-MCP-treated Tsai Tai showed that 1-MCP enhanced levels of four proteins involved in photosynthesis, i.e. photosystem II protein, oxygen-evolving enhancer protein 2, chloroplast ribulose 1,5-bisphosphate carboxylase/oxygenase activase and high molecular weight RuBisCO, inhibited malate dehydrogenase, a key enzyme involved in the tricarboxylic acid cycle, down regulated gibberellin 2-beta-dioxygenase expression, a key enzyme involved in biosynthesis of active gibberellins, and suppressed glutathione s-transferase, an important scavenger for reactive oxygen species. These results imply that 1-MCP could maintain leaf capacity for carbon assimilation, inhibit the tricarboxylic acid cycle, induce biosynthesis of GAs and reduce levels of reactive oxygen species, which together may have contributed to inhibition of leaf yellowing and delay of senescence.

Keywords: /*Brassica Chinensis*/ /Senescence/ /1-MCP/

BROCCOLI

Kou, L., et al. 2014. Pre-harvest calcium application increases biomass and delays senescence of broccoli microgreens. *Postharvest Biol. & Technol.* 87: 70 - 78.

Abstract

Microgreen consumption has been steadily increasing in recent years due to consumer awareness of their unique color, rich flavor, and concentrated bioactive compounds. However, industrial production and marketing is limited by their short shelf-life associated with rapid deterioration in product quality. This study investigated the effect of pre-harvest calcium application on the post-harvest quality and shelf-life of broccoli microgreens. Broccoli microgreen seedlings were sprayed daily with calcium chloride at concentrations of 1, 10 and 20 mM, or water (control) for 10 days. The fresh-cut microgreens were packaged in sealed polyethylene film bags. Package headspace atmospheric conditions, overall visual quality and tissue membrane integrity were evaluated on days 0, 7, 14, and 21, during 5°C storage. Results indicated that the 10 mM calcium chloride treatment increased the biomass by more than 50%, and tripled the calcium content as compared to the water-treated controls. Microgreens treated with 10 mM calcium chloride spray exhibited higher superoxide dismutase and peroxidase activities, lower tissue electrolyte leakage, improved overall visual quality, and reduced microbial growth during storage. Furthermore, calcium treatment significantly affected expression of the senescence-associated genes BoSAG12, BoGPX6, BoCAT3 and BoSAG12. These results provide

important information for commercial growers to enhance productivity and improve postharvest quality and shelf-life, potentially enabling broadening of the retail marketing of broccoli microgreens.

Keywords: /Broccoli/ /Fresh Cut/ /Modified Atmosphere Packaging/ /Postharvest Quality/ /Shelf Life/

CARROTS

Alves, J.A., et al. 2013. Identification of respiration rate and water activity change in fresh-cut carrots using bio speckle laser and frequency approach. *Postharvest Biol. & Technol.* 86: 381 - 386.

Abstract

For consumers, fresh-cut fruits and vegetables are a convenient product and a healthy source of fresh food that has nutritional and sensory characteristics similar to those of intact products. In this paper, a non-destructive method for analyzing fresh-cut fruit and vegetables is described. The bio speckle laser technique is based on the optical phenomenon of interference generated by a coherent light interacting with biological materials or dynamical systems. Although many publications on this technique's biological applications have reported that bio speckle activity corresponds to the activity of biological samples, there is some difficulty in determining the correlation between a particular phenomenon and the activity observed. In this study, we evaluated the use of bio speckle data for measuring the physiological properties of fresh-cut carrots stored at two temperatures (0 and 10°C). In conjunction with the bio speckle activity, the moisture content, respiration rate, water activity, and mass loss changes were monitored using traditional analytical methods to evaluate the possible correlation of the bio speckle data with any of these phenomena with or without the use of frequency signatures. The results showed that the manifestation of water in the monitored activity was isolated only by removing these high frequencies, thus allowing the activity manifested in the material to be linked to a specific phenomenon, such as respiration. Therefore, we were able to monitor the respiration process in fresh-cut carrots and assign a spectral signature to their water content and respiration.

Keywords: /Carrots/ /Fresh-Cut/ /Respiration Rate/

CUCUMBER

Rupasinghe, A.P.S., et al. 2013. Effect of 1-MCP, NAA and IBA on fruit retention of gherkin (*Cucumis sativus* 'Anguria') under greenhouse conditions. *Acta Hort.* 1004: 189 - 194.

Abstract

Gherkin (*Cucumis sativus* 'Anguria') experiences a heavy pre-mature fruit drop, resulting in low crop productivity under humid tropical greenhouse conditions. Therefore, the influence of exogenous auxines (NAA and IBA) and an ethylene inhibitor, 1-methylcyclopropane (1-MCP) on the fruit retention of gherkins was examined in a two-step glass house experiment. In the first step, foliar application of 1-MCP (50 mg L⁻¹ at three week intervals) and NAA (10 mg L⁻¹ at one, two and three week intervals) were carried out as separate treatments with a control (water spray), commencing at 50% flowering. In the second step, 1-MCP treatment was replaced with IBA (10 mg L⁻¹) while two concentrations of NAA (5 and 10 mg L⁻¹) were applied in two week intervals. Number of fruits dropped and harvested fruits per plant were monitored continuously. Results revealed that 1-MCP significantly reduced cumulative pre-mature fruit drop up to 27% (32 fruits/plant) compared to 43% in the control (50 fruits/plant).

Exogenous NAA did not show a significant treatment effect. However, hormonal regulation could not improve the overall fruit yield of gherkins. In the second step, foliar application of IBA resulted the highest fruit yield (652 g/plant) due to more fruit retention. The experiment revealed the positive impact of foliar application of 1-MCP as well as IBA for retaining more fruits in greenhouse grown gherkins.

Keywords: /Cucumber/ /1-MCP/

GREEN PEPPER

Ogai, R., et al. 2013. An attenuated isolate of pepper mild mottle virus for cross protection of cultivated **green pepper** (*Capsicum annuum* L.) carrying the L³ resistance gene. *Crop Protection*. 54: 29 - 34.

Abstract

Pepper mild mottle virus (PMMoV), which causes mosaic disease of green pepper (*Capsicum annuum* L.), is transmitted via the soil or sap during cultural practices such as pruning and harvesting. Here we examined the use of the attenuated PMMoV isolate L3-163, which can systemically infect pepper crops carrying the L3 resistance gene, for cross protection. During the greenhouse cultivation of green peppers in commercial production in plastic houses, the L3-163 isolate provided a high-level protection in previously inoculated pepper plants against the wild-type virus infection, resulting in acceptable economic fruit yields compared with non-inoculated control plants. Moreover, the L3-163 isolate was compatible to all of the main pepper cultivars grown in Japan. The level of cross protection (% infection with the attenuated isolate) needed to prevent or minimize economic loss from wild-type PMMoV was from 50% to 75%. These results indicate that the attenuated isolate effectively protected commercially cultivated pepper plants against PMMoV infection, thereby providing an alternative to methyl bromide soil fumigation in Japan.

Keywords: /Green Pepper/ /Methyl Bromide/

LEEK

Bernaert, N., et al. 2013. Antioxidant changes during postharvest processing and storage of **leek** (*Allium ampeloprasum* var. *porrum*). *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/package 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/ /*Allium ampeloprasum* var. *porrum*/ /Postharvest/ /Storage/

LETTUCE

Tudela, J.A., et al. 2013. Preharvest and postharvest factors related to off-odours of fresh-cut iceberg lettuce. *Postharvest Biol. & Technol.* 86: 463 - 471.

Abstract

The influence of different preharvest and postharvest factors affecting off-odour development of fresh-cut iceberg lettuce in low-O₂ modified atmospheres (MA) was investigated. Fresh-cut iceberg lettuce developed undesirable off-odours under low O₂ and elevated CO₂ atmospheres. A strong relationship between CO₂ concentration and off-odour development was observed. Significant differences in off-odour development existed among different cultivars in two harvests in consecutive years. The influence of maturity stage was evaluated, comparing fresh-cut product from immature and over-mature heads with commercial ones. Higher CO₂ concentrations and higher accumulation of ethanol and acetaldehyde were detected in the headspace of MA-packed lettuce from immature heads. Differences in respiration rate of the fresh-cut product from heads cultivated during the winter–spring seasons were around 30%. Respiration rate of fresh-cut iceberg lettuce increased when medium temperature during cultivation increased. Changes in the product weight generated different CO₂ levels which correlated with the production of ethanol and acetaldehyde and other off-odour metabolites related with the lipoxygenase (LOX) pathway such as hexanal, 1-hexanol, and cis-3-hexen-1-ol. Volatile compounds such as cis-3-hexen-1-ol, β-elemene, ethyl acetate and dimethyl sulphide increased their content more than 10 times compared with other volatiles. Moreover, differences in the initial flushed gas-mixture with or without CO₂ showed higher CO₂ concentrations and the development of stronger off-odours when samples were flushed with an enriched CO₂ gas-mixture. In summary, visual quality of fresh-cut iceberg lettuce is important but so are odour and flavour. MAP currently used for fresh-cut lettuce may need some modification to inhibit off-odours and achieve better aroma and flavour qualities for preserving “freshness” of the cut product. Screening for cultivars with low browning potential and fermentation, harvested at optimum maturity stage and with an adequate package design are recommended.

Keywords: /Lettuce/ /*Lactuca sativa* L./ /Minimally Processed/ /Quality/ /Respiration Rate/ /Modified Atmosphere Packaging/

ONION

Wang, W. & Li, C. 2013. Measurement of the light absorption and scattering properties of onion skin and flesh at 633 nm. *Postharvest Biol. & Technol.* 86: 494 - 501.

Abstract

Understanding the optical properties of onion tissues is essential to applying optical methods for onion quality inspection. This study estimated the optical properties of dry skin, wet skin, and flesh of

red, Vidalia sweet, white, and yellow onions at the wavelength of 633 nm. The total diffuse reflectance, total transmittance, and collimated transmittance of single-layer onion tissues were measured by spectroscopic systems. Based on the measured data, the absorption coefficient μ_a and the reduced scattering coefficient μ'_s of onion tissues were calculated using the inverse adding-doubling method. The results indicated that the dry and wet skins had significantly higher μ_a and μ'_s than the flesh at 633 nm. For both skins and flesh, the μ_a varied between cultivars, while the differences of the μ'_s between cultivars were less profound. All types of onion tissues were high-albedo materials at 633 nm. Using the calculated optical properties, Monte Carlo simulations were performed to model the light propagation in 25 different scenarios of multi-layer onion tissues for four cultivars, respectively. The results showed that the incident light at 633 nm would lose 99% of its energy within 6 layers in any of the simulated scenarios, and the light penetrated more layers in the sweet onions than in the other three cultivars. This work provided fundamental understanding of the optical properties of onion tissues and the light propagation in onion bulbs at 633 nm. The investigation of the onion optical properties will be extended to a broader spectrum in the future.

Keywords: /Onion/ /Absorption/

RADISH

Pushkala, R., et al. 2013. Chitosan based powder coating technique to enhance phytochemicals and shelf life quality of **radish** shreds. *Postharvest Biol. & Technol.* 86: 402-408.

Abstract

Minimally processed radish forms an important segment of the rapidly growing minimally processed industry worldwide. Radish shreds have a short shelf life thus necessitating the use of chemical additives. However, demand for natural preservatives in foods has increased. Chitosan is a natural antimicrobial biopolymer with a good film forming ability. Hence, it is used as an edible coating on whole and freshcut fruits and vegetables. The present investigation explored powder coating technique using purified chitosan and chitosan lactate for shelf life extension of shredded radish. Macro perforated LDPE resealable pouches were used to pack the samples. Samples were stored at 10°C for 10 d. Physico-chemical characteristics, phytochemicals, antioxidant activity, respiration rate and color were analyzed periodically. The study also determined microbial load and sensory acceptability in the stored samples. Chitosan treated samples exhibited a lower degree of weight loss, respiration rate, titrable acidity, % soluble solids and higher content of phytochemicals, moisture, and pH compared with control samples. The treated samples also exhibited better sensory acceptability, lower exudate volume, lesser browning and lower microbial load compared to control. This indicated better potential marketability of the coated radish shreds. Chitosan powder coating could be used as an efficient technique for quality maintenance and shelf life extension of radish shreds with feasibility for large scale application.

Keywords: /Radish/ /Fresh Cut/ /Chitosan/ /Shelf life/

TOMATO

Aguilo-Aguayo, I., 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 non-thermal 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, β-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/ /Physical Qualities/ /Decontamination/

Biswas, P., East, A.R., et al. 2014. Interpreting textual changes in low temperature stored tomatoes. *Postharvest Biol. & Technol.*, 87: 140 – 143.

Abstract

Low temperature storage alters tomato textural properties, resulting in unusual changes in firmness, while ripening during cool storage can confound these chilling-induced textural changes. Inconsistent results have been reported related to chilling-induced alteration in tomato texture. The effects of chilling on tomato texture were investigated using fruit stored at 2.5 or 6 °C (chilled) or 20 °C (non-chilled) for 27 d before transfer to 20 °C. Given that many factors influence the firmness of chilling-injured tomato and different measurement methods indicate different characteristics of tomato texture, the present study employed a range of textural measurement techniques in order to interpret chilling-induced textural changes in tomatoes during long term storage. Analysis of data from a range of textural methods indicated that storage at 6 °C mainly induced loss of turgor whereas 2.5 °C induced loss of tissue integrity along with turgor loss. Plotting textural changes against colour as an indicator of ripening allowed a clearer definition of chilling-induced textural change.

Keywords: /Tomato/ /*Solanum lycopersicum*/ /Colour/

Bu, J., et al. 2013. Postharvest UV-C irradiation inhibits the production of ethylene and the activity of cell wall-degrading enzymes during softening of tomato (*Lycopersicon esculentum* L.) fruit. *Postharvest Biol. & Technol.* 86: 337 - 345.

Abstract

Mature green cherry tomato fruit were harvested and treated with ultraviolet-C (UV-C) irradiation at a predetermined dose of 4.2 kJ m⁻² and stored at 18°C for 35 days. The effects of UV-C

treatment on firm-ness, cell wall compositions (pectin and cellulose), cell wall ultra-structure, levels of ethylene production, and activities of cell wall degrading enzymes in the fruit were investigated during storage. Major genes involved in cell wall degradation (PME 2.1, Cel 1, PG cat and Exp 1) were also checked. Fruit firmness was better maintained in UV-C treated fruit corresponding with higher contents of cellulose and acid-soluble pectin. Transmission electron microscopy indicated that UV-C irradiation retarded cell wall disassembly in the pericarp. Ethylene production was significantly inhibited by UV-C treatment. The UV-C treatment also suppressed the transcriptional expression of PME2.1, Cel1, PGcat and Exp1 genes, and inhibited pectin methylesterase (PME; EC 3.1.1.11), polygalacturonase (PG; EC3.2.1.15) and cellulase (EC3.2.1.4) activities during storage. These results suggested that the inhibition of ethylene production, which in turn down-regulated expression of genes encoding cell wall degrading enzymes, might be one of the possible mechanisms of UV-C delaying tomato fruit softening.

Keywords: /Tomato/ /Cherry Tomato/ /Fruit Softening/ /Ethylene/

El Airaj, H., et al. 2013. Decreased monodehydroascorbate reductase activity reduces tolerance to cold storage in **tomato** and affects fruit antioxidant levels. *Postharvest Biol. & Technol.* 86: 502 - 510.

Abstract

Fruit antioxidants are necessary for human health and also have physiological roles in protecting fruit against oxidative stress. Our previous work has shown that monodehydroascorbate reductase (MDHAR) activity was positively correlated with fruit resistance to cold storage in introgression lines of tomato, *Solanum lycopersicum*. We have produced transgenic lines with reduced MDHAR activity to directly study the impact of this gene on fruit resistance to chilling and the antioxidant pool in two different genetic backgrounds: M82, a processing tomato with low to medium ascorbate levels, and IL925, an introgression line of M82 containing a fragment of the wild tomato *Solanum pennellii* genome, including the *S. pennellii* MDHAR allele. Large decreases in fruit MDHAR activity were obtained and correlated with slight losses in fruit firmness and fruit ascorbate, an effect that was independent of the genetic background. Fruit colour after chilling was also positively correlated with the redox state of the ascorbate pool and fruit firmness, although at harvest these correlations were less significant. Furthermore, other modifications in fruit of transgenic lines were observed as red fruit showed increased glutathione levels. Therefore manipulation of MDHAR activity confirms the link between antioxidant protection, fruit tolerance to chilling and fruit ripening at low temperatures, although the strength of the phenotypes indicates that other factors are involved.

Keywords: /Tomato/ /*Solanum lycopersicum*/ /Postharvest/ /Chilling/

Fagundes, C., Perez-Gago, M.B., et al. 2013. Antifungal activity of food additives in vitro and as ingredients of hydroxypropyl methylcellulose-lipid edible coatings against *Botrytis cinerea* and *Alternaria alternata* on cherry **tomato** fruit. *Int'l. J. Food Microbiol.* 166: 391 – 398.

Abstract

The antifungal activity of food additives or 'generally recognized as safe' (GRAS) compounds was tested in vitro against *Botrytis cinerea* and *Alternaria alternata*. Radial mycelial growth of each pathogen was measured in PDA Petri dishes amended with food preservatives at 0.2, 1.0, or 2.0% (v/v) after 3, 5, and 7 days of incubation at 25 °C. Selected additives and concentrations were tested as antifungal ingredients

of hydroxypropyl methylcellulose (HPMC)-lipid edible coatings. The curative activity of stable coatings was tested in in vivo experiments. Cherry tomatoes were artificially inoculated with the pathogens, coated by immersion about 24 h later, and incubated at 20 °C and 90% RH. Disease incidence and severity (lesion diameter) were determined after 6, 10, and 15 days of incubation and the 'area under the disease progress stairs' (AUDPS) was calculated. In general, HPMC-lipid antifungal coatings controlled black spot caused by *A. alternata* more effectively than gray mold caused by *B. cinerea*. Overall, the best results for reduction of gray mold on cherry tomato fruit were obtained with coatings containing 2.0% of potassium carbonate, ammonium phosphate, potassium bicarbonate, or ammonium carbonate, while 2.0% sodium methylparaben, sodium ethylparaben, and sodium propylparaben were the best ingredients for coatings against black rot.

Keywords: /Tomato/ /Lycopersicon Esculentum/ /Postharvest Disease/ /Gray mold/ /Black rot/

Farneti, B., et al. 2013. Greenhouse climate control affects postharvest **tomato** quality Postharvest Biol. & Technol. 86: 354 - 361.

Abstract

In this study, important quality properties such as firmness, sugar and acid levels were measured and analysed in tomatoes harvested from three greenhouses during a five month period and stored at 16°C for over 20 days. Tomatoes were harvested from three identical, neighbouring, greenhouses which were either conventionally ventilated (open greenhouse) or mechanically cooled (semi-closed greenhouses). Sugar and acids levels were hardly affected by greenhouse type. Compared to the open greenhouse, semi-closed greenhouses produced heavier and less mature (firmer) fruit at the commercial harvesting stage based on colour. Fruit maturity differences could be linked to the vertical temperature gradient and to CO₂ levels in the different greenhouses. This indicates that CO₂ levels and temperature affect the synchronisation between colour and firmness maturity at harvest. The acceptance period, i.e., the time period both tomato colour and firmness are considered acceptable by consumers, will likely be positively affected when growers switch from conventionally ventilated to semi-closed production systems. Additional to greenhouse effects also effects of the harvest month were observed. The sugar to acid ratio was highest and glucose to fructose ratio was lowest in July, the month with the highest irradiance, irrespective of green-house type. The estimated value for the maximum firmness (F_{max}) varied from 17.9 N in August to 31.2 N in June. This monthly variation in F_{max} explains an important part of the variation found in the postharvest behaviour of tomatoes. Interestingly, the monthly variation in F_{max} showed the same trend as found for the monthly initial sugar levels. It might be hypothesised that the monthly variation in glucose and fructose levels causes variation in that part of firmness that is generated by cell turgor. The monthly variation in F_{max} , sugar and acid levels could not be linked to climate conditions and remains to be elucidated.

Keywords: /Tomato/ /Firmness/ /Temperature/ /Quality/

Hoang, N.H., et al. 2013. Identification and inheritance of a new source of resistance against **tomato** spotted wilt virus (TSWV) in *Capsicum*. Scientia Hort. 161: 8 - 14.

Abstract

Tomato spotted wilt virus (TSWV) is an important viral disease affecting pepper production worldwide. A single dominant resistance gene, *Tsw*, originating from *Capsicum chinense* has been

identified and utilized during the last several decades. However, there have been reports that Tsw resistance can be overcome by new field isolates of TSWV. This has necessitated the identification of a new source of resistance. Here, a set of pepper germplasm collections comprising 487 accessions from six *Capsicum* species and 30 commercial F1 hybrids was evaluated for resistance to TSWV. A new resistance source, *C. chinense* 'AC09-207', was identified and characterized. Genetic analysis showed that the resistance in *C. chinense* 'AC09-207' was conferred by a single dominant gene. The resistance responses of 'AC09-207' were compared with other known resistance sources. The timing and number of necrotic response were similar to *C. chinense* 'PI152225', whereas the premature abscission of inoculated cotyledons and leaves were significantly different from other resistance sources, 'PI152225' and 'PI159236'. To compare genome locations between the new resistance gene and Tsw, an allelism test was conducted. No recombinants were found in all F1, F2 and reciprocal backcross populations derived from the new resistance source and three known resistance sources ('PI152225', 'PI159236', and 'PI159234') demonstrating that the new resistance gene may be a unique allele at the Tsw locus or be controlled by a different gene tightly linked to Tsw.

Keywords: /Tomato/ /Disease resistance/ /*Capsicum*/

Li, Z., et al. 2013. Stability tests of two-finger **tomato** grasping for harvesting robots. *Biosystems Eng.* 116: 163 - 170.

Abstract

In this study, the theories of spatial and contact grasp stability were extended and integrated into a whole system, and then a vision processing approach that extracts the relevant information for synthesising plate and curved finger grasps for unknown tomato fruits from tomato images was presented. Finally, stability tests involving grasping tomatoes with two parallel fingers were performed using two types of fingers (plate and curved fingers). Existing theories of grasp stability related to rigid objects could be integrated and extended to analyse the grasping stability for half-ripe tomatoes. Curved fingers were more suitable for stably grasping tomatoes than were plate fingers. The prediction method of stable grasp regions can be regarded as a potential strategy (algorithm) for achieving a programmed control of two-fingered tomato grasp stability based on vision feedback. Visual perception is used to reduce the uncertainty and obtain relevant geometric information about the tomatoes during harvesting.

Keywords: /Tomato/ /Harvesting/

Liplap, P., 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/ /Shelf life/ /Short-term storage/ /Hyperbaric Pressure/ /Physiological Stress/

Yan, R., et al. 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 upregulated, 195 downregulated). Treatment with 1-methylcyclopropene (1-MCP) at the turning stage restored expression to levels of the mature green (MG) stage in 159 upregulated and 45 downregulated genes, suggesting a strong dependence on ethylene signaling during ripening. Among 194 ethylene-upregulated 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 downregulated 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/

ORNAMENTALS

DAHLIA

Shimizu-Yumoto, H & Ichimura, K. 2013. Postharvest characteristics of cut **dahlia** flowers with a focus on ethylene and effectiveness of 6-benzylaminopurine treatments in extending vase life. *Postharvest Biol. & Technol.* 86: 479 - 486.

Abstract

With the aim of extending vase life of cut dahlia flowers, we investigated the postharvest characteristics of the flowers. Our focus was on the role of ethylene on senescence and on treatments that have extended vase life of other flowers. Continuous exposure to ethylene at 2 or 10 $\mu\text{L L}^{-1}$ significantly accelerated petal abscission in cut flowers. Flowers continuously immersed in 1 or 10 $\mu\text{L L}^{-1}$ 2-chloroethylphosphonic acid (CEPA) solution wilted earlier than those treated with distilled water (DW) or 0.15 g L^{-1} citric acid. Ethylene production from the ovary and ray petal was relatively high (4.5 and 0.9 nL g^{-1} fresh weight h^{-1} , respectively) at harvest, but decreased gradually over 5 days. No remarkable increase in ethylene production was observed during senescence. Silver thiosulfate complex (STS), an inhibitor of ethylene action, did not extend the vase life of cut flowers, although a high silver concentration was detected in flower organs. In contrast, pulse treatment with 1-methylcyclopropene (1-MCP) and dip treatment with 6-benzylaminopurine (BA) extended the vase life of florets, and BA was more effective than 1-MCP when the flowers were held in both DW and CEPA. BA spray treatment extended vase life of cut 'Kokucho,' 'Kamakura' and 'Michan' flowers. These results suggest that dahlia flower senescence is partially regulated by ethylene, and BA is more effective in delaying the senescence of cut dahlia flowers than ethylene action inhibitors.

Keywords: /Dahlia/ /Ethylene/ /Vase Life/

PETUNIA

Colquhoun, T.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 wavelength scan 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: /Petunia/

HERBS AND SPICES

ARTICHOKES

Sennoi, R., et al. 2013. Biological control of southern stem rot caused by *Sclerotium rolfsii* using *Trichoderma harzianum* and arbuscular mycorrhizal fungi on Jerusalem artichoke (*Helianthus tuberosus* L.). *Crop Protection.* 54: 148 - 153.

Abstract

Efficacy of *Trichoderma harzianum* and the arbuscular mycorrhizal fungus (AMF) *Glomus clarum* for suppression of southern stem rot caused by *Sclerotium rolfsii* in Jerusalem artichoke was investigated in Thailand under greenhouse conditions. Experimental factors included two Jerusalem artichoke genotypes (HEL 246 and JA 37), two levels of *T. harzianum* and *G. clarum* (inoculated and blank). The biological control agents were added to the potting medium immediately before seedlings of Jerusalem artichoke were transplanted into it; 20 days later, seedlings were inoculated with *S. rolfsii* by placing infested sorghum seeds at the base of the stem. The combination of cv. HEL 246 with addition of both *G. clarum* and *T. harzianum* had the lowest disease incidence (30%) and required the longest time to permanent wilt (11 days after inoculation). Inoculation of cv. JA 37 and HEL 246 with *G. clarum* alone gave better control of the disease than did inoculation with *T. harzianum* alone. The results are the first published report of biological control of *S. rolfsii* on Jerusalem artichoke.

Keywords: /Artichoke/ /Biological Control/

BASIL

Costa, L., et al. 2013. Application of low intensity 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 $\mu\text{mol m}^{-2}\text{s}^{-1}$, 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/ /*Ocimum basilicum*/ /Postharvest/ /Senescence/

OLIVE

Jimenez-Jimenez, F., et al. 2013. Table olive cultivar susceptibility to impact bruising. Postharvest Biol. & Technol. 86: 100 - 106.

Abstract

Developing mechanical harvesting for table olives will require decreasing fruit damage during harvest and postharvest handling, transport and storage. The susceptibility to bruising and its development overtime were studied in three table olive varieties, cv. 'Manzanilla', 'Gordal Sevillana' and 'Hojiblanca'. Bruising was produced with controlled energy impacts of 56, 26, 13 mJ. A strong correlation ($r^2 = 0.77-0.90$) between bruise volume and impact energy was demonstrated. Bruise susceptibility was higher in the Manzanilla variety, followed by Hojiblanca and Gordal Sevillana cultivars. Bruise time evolution was evaluated using a spectrophotometer for visible and near infrared regions. A bruise index was developed using different wavelengths, 545, 670 and 800 nm. Most darkening due to the browning process happened within 1 h, was exponential and dependent on impact energy level. The discoloration was greatest in the Manzanilla, followed by Hojiblanca and Gordal Sevillana olives.

Keywords: /Olive/ /Mechanical Harvesting/ /Postharvest Handling/ /Fruit Quality/