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GENERAL

POSTHARVEST

B. Gollnow, B., J. Faragher and D. Joyce. 2014. **Postharvest** manual answers many questions. Acta Hort. 1031: 119 – 124.

Abstract

Many authors have noted that consumer confidence in buying fresh flowers is strongly related to their perceived value in that quality and vase life must be high and consistent over time for consumers to repeat buy. Growers, wholesalers, exporters and retailers seek practical information about recommended handling and treatments at the harvest and postharvest stages, including that relating to flowers native to Australia and South Africa ("wildflowers"). This information is essential for products to be of high quality with an acceptable vase life for the end consumer, especially if exported. Published postharvest manuals generally focus on traditional flower crops and so rarely include many, or any, wildflowers. A manual entitled *Postharvest Handling of Australian flowers from Native Plants and Related Species* was published in 2002 and addressed this gap, but required updating. This situation presented an opportunity to provide in-depth information to compliment the Australian wildflower quality specifications (see accompanying paper in the same volume), and to assemble the latest knowledge on wildflower quality and postharvest issues. The resultant manual contains extensive information about harvesting, quality issues and recommended postharvest care focussed on wildflowers. Much of the information is documented for the first time, being based on the most up to date research and development (R&D) as well as practical experience of the floral supply chain, researchers and other technical experts. The manual provides practical and detailed information on postharvest treatment of fresh wildflowers for growers, florists, wholesalers and exporters to use on a daily basis. It discusses the many unique features of wildflowers that must be understood and managed in order to maximise their quality and vase life after marketing and export. The manual also includes postharvest advice for 16 flower- and foliage lines for which quality specifications were not produced. This advice is presented according to the same template as the specifications.

Keywords: /Postharvest/ /Vase life/ /Quality/ /Supply Chain/

STORAGE

Dias, Graca, M., et.al. 2014. Carotenoid stability in fruits, vegetables and working standards – effect of **storage** temperature and time. Food Chem. 156: 37 – 41.

Abstract

The effects of freezing and storage temperature on the mass fraction of α - and β -carotene, β -cryptoxanthin, lutein, lycopene and zeaxanthin in minimally processed fresh food products, were evaluated after sample preparation, extraction and saponification (only when strictly necessary). Effects of freezing and long-term stability were studied at two temperatures, -20 and -70 °C, using high

performance liquid chromatography (reversed phase columns, UV–Vis diode array detector) at time points during storage; measurement uncertainty was included in the evaluation. Stability of working standard solutions was also examined. Freezing did not affect the carotenoid mass fraction under the conditions studied. Carotenoids in orange, cherry, peach, apple, and kale were stable (except α -carotene and zeaxanthin in peach) for 13, 9.7, 5.7, 2.5 and 7.5 months, respectively. For these food sample matrices, no significant difference between the freezing/storage at - 20 and -70 °C was observed. Standard solutions (0.05– 5 lg/mL) were stable for at least 6 months at - 70 °C, except lycopene which at 0.05 lg/mL was apparently stable only for six weeks.

Keywords: /Storage/ /Temperature/

FRUITS

APRICOT

Yan, Ruixiang, et.al. 2014. UV-C inactivation of Escherichia coli and dose uniformity on **apricot** fruit in a commercial setting. *Postharvest Biol. & Technol.* 95: 46 – 49.

Abstract

A UV-C treatment system (two treatment chambers connected by an inclined belt to rotate apricots between chambers) was tested in a commercial setting. Escherichia coli ATCC 25922, used as a surrogate for E. coli O157:H7 to determine the system's antimicrobial efficacy, was inoculated onto fruit surfaces at a population of 6.8 log CFU/fruit. UV-C dosage was evaluated by attaching film dosimeters to six fixed locations on each apricot. Results suggested that reduction of inoculated E. coli ATCC 25922 populations on the apricot fruit by UV-C treatment was small (only 0.5–0.7 logs). There were large variations in UV-C doses among varying apricot surface locations. Approximately 1/3 of apricots had individual surfaces receiving less than 0.2 kJ m⁻² UV-C exposure, even though fruit received, on average, more than 1 kJ m⁻². Low reductions of E. coli may be attributed, in part, to non-uniform UV-C exposure. This study demonstrates the need to use a fruit rotation device more capable of delivering uniform UV-C dosage to the surface of apricots for inactivating bacteria in a commercial setting.

Keywords: /Apricot/

AVOCADO

Manuela Donetti, Leon A. Terry. 2014. Biochemical markers defining growing area and ripening stage of imported **avocado** fruit cv. Hass. *J. Food Composition & Anal.* 34: 90 – 98.

Abstract

Intra-varietal differences in avocado fruit composition were investigated with regard to fruit growing area, maturity, ripening stage and storage conditioning. In particular, mesocarp nutrients such as fatty acids and C7 sugars were investigated as they relate to fruit origin and ripening stage, respectively. The effect of storage temperature on nutrient level was also assessed. Fruit from Chile, Peru and Spain and harvested in the respective early, middle and late season were ripened for seven days at 18 or 23 °C. At specific intervals, mesocarp fatty acids and sugar profiles were identified. The oil composition differed according to origin and harvest-time, suggesting oleic acid as a potential marker in

distinguishing fruit origin. Chilean fruit had higher oleic content (57–61%) follow by Spanish (54–60%) and Peruvian (40–47%) fruit. In early season fruit D-mannoheptulose content decreased during shelf life from 128 to 23.5 mg g⁻¹ (Chile), from 115 to 33.6 mg g⁻¹ (Peru), from 65.2 to 23.5 mg g⁻¹ (Spain). A similar trend was noted in middle and late season fruit and from the three origins. For the first time a relationship between C7 sugar content and mesocarp softening, fruit maturity and origin was identified.

Keywords: /Avocado/ /Ripening/

BANANA

Pongpraserta, Nutthachai, Varit Srilaonga. 2014. A novel technique using 1-MCP micro bubbles for delaying postharvest ripening of **banana** fruit. *Postharvest Biol. & Technol.* 95: 42 – 45.

This study aimed to investigate the application of micro bubble technology for delaying banana ripening. A preparation of 1-MCP designed for use as a form of aqueous micro bubble (MBs) solutions was formulated. Banana fruit were immersed in 500 nL L⁻¹ of aqueous 1-MCP micro bubbles (1-MCP-MBs) or fumigated with 500 nL L⁻¹ 1-MCP, then stored at 25 °C for 8 days. 1-MCP-MBs were more effective in delaying postharvest ripening than conventional 1-MCP fumigation. 1-MCP-MBs reduced the respiration rate and ethylene production compared to the control and 1-MCP fumigated fruit. Moreover, 1-MCP-MBs delayed yellowing and maintained firmness of banana fruit during storage. These results indicate that 1-MCP-MBs can be used as an alternative method for delaying the postharvest ripening of banana fruit, and its application for other commodities needs to be further elucidated.

Keywords: /Banana/ /Delayed Ripening/ /1-MCP/

Wang, Juan, et.al. 2014. Changes in resistant starch from two **banana** cultivars during postharvest storage. *Food Chem.* 156: 319 – 325.

Abstract

Banana resistant starch samples were extracted and isolated from two banana cultivars (Musa AAA group, Cavendish subgroup and Musa ABB group, Pisang Awak subgroup) at seven ripening stages during postharvest storage. The structures of the resistant starch samples were analysed by light microscopy, polarising microscopy, scanning electron microscopy, X-ray diffraction, and infrared spectroscopy. Physicochemical properties (e.g., water-holding capacity, solubility, swelling power, transparency, starch–iodine absorption spectrum, and Brabender microviscoamylograph profile) were determined. The results revealed significant differences in microstructure and physicochemical characteristics among the banana resistant starch samples during different ripening stages. The results of this study provide valuable information for the potential applications of banana resistant starches.

Keywords: /Banana/ /Postharvest/ /Storage/

BLUEBERRY

Kong, Qiulian, et.al. 2014. Effects of electron-beam irradiation on **blueberries** inoculated with *Escherichia coli* and their nutritional quality and shelf life. *Postharvest Biol. & Technol.* 95: 28 – 35.

Abstract

Fresh blueberries have become a popular new functional food because of their remarkably high levels of antioxidant phytonutrients and health benefits. However, the potential prevalence of human pathogens on blueberries has become an increased concern because they are consumed fresh. Procedures effective in decontamination and extending shelf life without affecting fruit quality are needed. Electron-beam irradiation was applied to fresh blueberries at the doses ranging from 0.5 to 3.0 kGy and its effectiveness for inactivating *Escherichia coli* (E. coli) K-12 and extending shelf life were investigated. The decimal reduction dose, D10 values, of E. coli in cultural medium and blueberries were 0.43 ± 0.01 kGy and 0.37 ± 0.015 kGy, respectively. Irradiation reduced bacteria inoculated on blueberries from 7.7×10^8 CFU/g to 6 CFU/g at 3.13 kGy and decreased the decaying of blueberries stored at 4°C up to 72% and at room temperature up to 70% at this dose. No significant effect on the total monomeric anthocyanins, antioxidant activity, and l-ascorbic acid content of blueberries was observed from irradiation at doses ≤ 3 kGy. However, significant decreases in the antioxidant activity and l-ascorbic acid content were found in both control and irradiated blueberries after storage at 4°C for 7 and 15 d. Information obtained in this study indicates that low dose electron-beam irradiation is effective in reducing E. coli and extending shelf life while maintaining the antioxidant properties of blueberries.

Keywords: /Blueberries/ /Antioxidant/ /Shelf Life/

Paniagua, C. A.R. East, J.A. Heyes. 2014. Interaction of temperature control deficiencies and atmosphere conditions during **blueberry** storage on quality outcomes. *Postharvest Biol. & Technol.* 95: 50 – 59.

Abstract

Southern hemisphere blueberry producers often export their products through extended supply chains to Northern hemisphere consumers. During extended storage, small variations in temperature or atmosphere concentrations may generate significant differences in final product quality. In addition, relatively short delays in establishing cool storage temperatures may contribute to quality loss. In these experiments a full factorial analysis was done of the effects of three cooling delays (0, 12 or 24 h at 10°C), three atmosphere concentrations (air, 10% CO₂+ 2.5% O₂ and 10% CO₂+ 20% O₂) and two storage temperatures (0°C and 4°C) which were assessed for their impact on final quality, measured as weight loss, firmness and rot incidence. Two blueberry cultivars were studied: 'Brigitta', a high bush cultivar, and 'Maru', a rabbit eye. Delays in cooling had a small effect on final product weight, whereas variation in storage temperature and atmosphere during simulated transport influenced both firmness and rot incidence. Atmospheres with 10% CO₂ reduced decay incidence, particularly at low oxygen concentration (2.5% O₂), although the latter conditions tended to soften fruit. In order to achieve optimal postharvest storage for blueberries, minimising temperature variability in the supply chain is important, as is finding the potentially cultivar-specific optimal combination of high CO₂ and low O₂ concentration that results in simultaneously minimising rot incidence and induced softening.

Keywords: /Blueberry/ /Storage/ /Quality/

CACTUS PEAR

Vergara, Cristina, et al. 2014. Microencapsulation of pulp and ultrafiltered cactus pear (*Opuntia ficus-indica*) extracts and betanin stability during storage. *Food Chem.* 157: 246 – 251.

Abstract

Pulp (CP) and ultrafiltered (UF) cactus pear extracts were encapsulated with Capsul (C) by applying a central composite design (CP-C and UF-C systems) by spray-drying. To evaluate the effect of the extract, microparticles obtained under optimal conditions were characterised and stored at 60 °C. Betacyanin and betaxanthin encapsulation efficiency reached values above 98% for both systems studied. This efficiency was attributed to strong interactions between betalains and the polymer. Betalain degradation in CP-C and UF-C microparticles followed pseudo-first order kinetics. The betacyanin degradation rate constant was significantly higher for CP-C than for UF-C. These results suggested that the mucilage or higher sugar content of CP increased the hygroscopicity of the CP-C microparticles, leading to the degradation of betalain. The hydrolysis pathway was the main mechanism of betanin degradation during microparticle storage. These results demonstrate the potential utility of both CP-C and UF-C microparticles as natural colourants for healthy foods.

Keywords: /Cactus Pear/ /Storage/

CARAMBOLA

Zainudin, Mohd Asraf Mohd, et.al. 2014. Variation of bioactive compounds and antioxidant activity of carambola (*Averrhoa carambola* L.) fruit at different ripening stages. *Scientia Hort.* 172: 325 – 331.

Abstract

The variations in bioactive compounds and antioxidant activity of carambola (cv. B17) fruit at different ripening stages were investigated. The carambola fruit was harvested from week 9 until week 13. Ascorbic acid (AA), total phenolic content (TPC), total flavonoids content (TFC), total carotenoids content (TCC), β -carotene, tocopherol homologues (α , β , γ and δ) and sugar composition (sucrose, glucose and fructose) were analyzed for each sampling week. Antioxidant activity was measured with 2,2-diphenyl-1-picrylhydrazil (DPPH) and β -carotene/linoleic acid model (BCLAM) assays. The results showed that AA, TCC and sugar composition were significantly ($P < 0.05$) increased while TPC, TFC and β -carotene showed reversed trends as ripening process was in progressed. Interestingly, the tocopherol compounds varied differently with contribution of α and β -tocopherols highest on week 12 and then decreased on week 13 but γ - and δ -tocopherols were constantly decreased during ripening. Meanwhile, antioxidant activities for both assays were significantly ($P < 0.05$) decreased. Multivariate analysis revealed a notable variation of tested attributes among the ripening stages. Bioactive compounds such as TPC, TFC, β -carotene, γ - and δ -tocopherol were found to be dominant in unripe fruit while those of sugar (sucrose, glucose and fructose), TCC, α - and β -tocopherol were prominent in the ripe fruit. The findings of this study advocate harvesting of carambola fruit at an appropriate stage to get maximum nutritional benefits.

Keywords: /Carambola/ /Antioxidant/ /Ripening/

CITRUS

Parra, Javier, Gabriela Ripoll, Benito Orihuel-Iranzo. 2014. Potassium sorbate effects on citrus weight loss and decay control. *Postharvest Biol. & Technol.* 96: 7 – 13.

Abstract

Potassium sorbate (PS) is a well-known and widely used food preservative. Among other applications, it is used as a GRAS fungi static postharvest treatment for citrus, although its use is not free of significant adverse effects. In this paper, we study in detail the efficacy of wax containing increasing concentrations of PS to control *Penicillium digitatum* decay in citrus fruit, and its effect on fruit weight loss. Decay control and weight loss increased with the concentration of PS in the wax. Wax with typical amounts of 2–5% PSs showed poor decay reduction indices (DRI), between 26% and 32%, whereas fruit weight loss increased compared with non-waxed controls. Waxing of fruit reduced weight loss by up to 40%, depending on wax formulation, but the addition of just 2% PS to the wax caused an increase in fruit weight loss of up to 65% compared with the waxed fruit. Similar results were observed for all the types of wax formulations tested. The hygroscopic effects of PS are even more damaging for citrus fruit with leaves. The leaves lose weight very rapidly when PS is added to the wax and they become desiccated in 24 h. We also present the results of a similar study where PS was applied to citrus as an aqueous treatment. When applied in water, PS was far more effective for decay control than when applied in wax, but there was also a considerable increase in fruit weight loss. A treatment combining aqueous PS with Fortisol®Ca Plus biostimulant completely solved the problem of weight loss, these mixtures being commercially feasible treatments.

Keywords: /Citrus/ /Decay Control/ /Weight Loss/

Yamauchi, Naoki, et al. 2013. Control of degreening in postharvest green sour **citrus** fruit by electrostatic atomized water particles. *Food Chem.* 156: 160 – 164.

Abstract

The effect of electrostatic atomized water particles (EAWP) on degreening of green sour citrus fruit during storage was determined. Superoxide anion and hydroxyl radicals included in EAWP were present on the surface of the fruit peel after the treatment. Hydrogen peroxide was formed from EAWP in an aqueous solution, which could indicate that a hydroxyl radical of EAWP turns to hydrogen peroxide in the fruit flavedo as well as in the aqueous solution. EAWP treatment effectively suppressed the degreening of green yuzu and Nagato-yuzukichi fruits during storage at 20 °C. The enhancement in K⁺ ion leakage of both EAWP-treated fruits reduced in comparison with the control. In spite of EAWP treatment, total peroxide level in both fruits showed almost no changes during storage, suggesting that hydrogen peroxide formed by EAWP treatment could stimulate the activation of hydrogen peroxide scavenging system and control degreening of these fruits during storage.

Keywords: /Citrus/ /Degreening/ /Storage/ / Green Sour/

GUAVA

Lien, Cheng-Chang. 2014. Assessing **guava** maturity by statistical analyses of dropped fruit impact responses. *Postharvest Biol. & Technol.* 95: 20 – 27.

Abstract

A non-destructive method for assessing the maturity of guava fruit was developed based on the mechanical properties obtained from dropped fruit impact responses. The levels of maturity were

classified with cluster and discriminant analyses on the raw impact measurements and their derived indices. The number of indices being processed was reduced with stepwise regression analysis. The accuracy of classification was improved using linear discriminant analysis to 76.3% with the penetrometer stiffness as a calibrator and to 84.2% with postharvest days as a calibrator. The performance shows that falling impact together with adequate statistical analyses provides a promising non-destructive approach in assessing the maturity of guava. The non-destructive nature was validated by repeating the test on the same specimen. The test mechanism is mechanical and can therefore be integrated as the maturity inference engine on an automated guava sorter.

Keywords: /Guava/ /Maturity/

KIWIFRUIT

Hu, Huali, et.al. 2014. Hydrogen-rich water delays postharvest ripening and senescence of **kiwifruit**. Food Chem. 156: 100 – 109.

The effect of hydrogen-rich water (HRW) on prolonging the shelf life of kiwifruit and possible underlying mechanisms were assessed. Our results revealed that HRW (30%, 80%, and 100%) displayed different effects in inhibiting the rot of kiwifruit. Among these treatments, 80% HRW had the most significant effect by decreasing the rot incidence and preserving the firmness of kiwifruit. This conclusion was supported by the fact that 80% HRW treatment could effectively alleviate pectin solubilization and reduce the activities of cell wall-degrading enzymes. On the other hand, HRW treatment was able to reduce the respiration intensity, increase the activity of superoxide dismutase, decrease lipid peroxidation level, and maintain the radical (DPPH[•], O₂^{•-}, and [•]OH) -scavenging activity of kiwifruit. Moreover, the inner membrane of mitochondria exhibited higher integrity. Thus, our results demonstrate that HRW treatment could delay fruit ripening and senescence during storage by regulating the antioxidant defence.

Keywords: /Kiwifruit/ /Ripening/ /Senescence/ /Postharvest/

LITCHI

Kumar, V.et.al. 201. New threats of insect pests and disease in **litchi** (*Litchi chinensis* Sonn.) in India. Acta Hort. 1029: 417 – 424.

In India, litchi is grown mainly in the eastern part of the country and Bihar Province contributes nearly 74% of the total production. Between July 2011 to June 2012, some new threats of pests and diseases were observed during scouting and fixed plot surveys of litchi orchards in Bihar that were hitherto either unnoticed or of minor importance. Studies were conducted to assess the occurrence and level of damage by these pests and diseases. Ten trees in an orchard were randomly selected and observations recorded in three branches having approximately 200 leaflets. Pests were reared in the laboratory for identification and study of their biology. The symptoms of damage were described. Three insect pests viz., red weevil (*Apoderus blandus*), semilooper (*Anisodes illepidaria*) and bagworm (*Eumeta cramerii*) and one disease viz., leaf and twig blight (*Colletotrichum gloeosporioides* and *Gloeosporium* sp.) were identified. While red weevil and semilooper damaged young leaves, bagworm preferred older leaves. Temperature fluctuations, particularly during peak summer and winter, negatively affected the activity of red weevil and semilooper while bagworm was affected by high temperature during summer. The results indicated that trees having highly damaged canopies (>50% foliage) by these pests

represented as much as 40.0% while partially damaged (10-30% foliage) plants represented were up to 20.8%. The incidence of leaf and twig blight disease was from 28.1 to 66.3%. The percentage infected leaflets in a tree varied from 21.0 to 37.0, whereas disease severity index was 3.7 to 47.8%. The disease manifested itself from the beginning of August to the end of February. The occurrence of *A. illepidaria* and *E. crameri* is being reported on litchi for the first time from India. The emerging insect pests and diseases may become a limiting factor to litchi cultivation and will have a socio-economic impact for litchi growing areas.

Keywords: /Litchi/

Mhlope, S.D. and F. J. Kruger. 2014. Evaluation of hydro-cooling as a postharvest treatment for sulphur dioxide fumigated 'Mauritius' **litchi** fruit. Acta Hort. 1029 : 331 - 336.

Abstract

A study was performed to establish what effect hydro-cooling has on the quality of 'Mauritius' litchi fruit when applied before and/or after sulphur fumigation. Two trials were carried out with the Mauritius' cultivar at the beginning and towards the end of the harvest window. During the trials, the temperature of the fruit was effectively reduced by hydro-cooling from around 20°C to between 5 and 6°C within 15 min. After cooling, the fruit were stored for 30 days at 1°C followed by another 6 days on the shelf at ambient temperatures. No statistically significant differences in total soluble solid content, pericarp browning or firmness were noticed after storage. However, during both the early and late season the hydro-cooled fruit were found to lose more mass than the control fruit. Another negative observation made was that the titratable acid content of the hydrocooled fruit was significantly lower than that of the non-hydro-cooled fruit after storage. During both the early and late season, the fruit that received a hydrocooling treatment after sulphur fumigation had higher incidences of fungal infections than the control. During the early season, the litchis that received hydrocooling treatment before sulphur fumigation had slightly higher levels of spoilage while they had slightly lower levels during the late season. Based on the current results it would appear that hydro-cooling will not improve the quality of sulphur fumigated 'Mauritius' litchi fruit and the technique is therefore not recommended at this stage.

Keywords: /Litchi/ /Postharvest/

Mitra, S.K., T.K.S. Irenaeus and S.K. Dutta Ray. 2014. Overview of postharvest management of **litchi**. Acta Hort. 1029: 319 – 324.

Abstract

The perishability of the litchi fruit limits marketing, especially of exports to countries some distance from the main area of production. The skin of litchi turns brown soon after harvest or rots after a few days if the fruit are not handled correctly. The loss of attractive red colour reduces its market appeal. Although the initial pericarp browning is primarily a cosmetic problem, it reduces the commercial value of the fruit. Further browning is generally associated with the loss of eating quality. Postharvest research on litchi has been on-going since the 1940s, and there has been a significant escalation of research in the last 20 years. Much of the current international research has focused on aspects of SO₂-low-pH technology or pericarp physiology. Research is now being redirected from chemical based treatments, especially SO₂-related technologies, to more environmentally sustainable strategies. While it is difficult

to overlook the possibility of future genetic manipulation of litchi postharvest characteristics, we believe that the short term currently anticipated successes from conventional strategies may be more significant. Research progress in postharvest physiology and the technology of storage of litchi fruit are briefly reviewed in this paper.

Keywords: /Litchi/ /Browning/ /Postharvest Management/

Oosthuysen, S. A. 2014. Effect of coating sulphured 'Madras' **litchi** fruits with polymerCoat directly after harvest on the incidence of *Penicillium* colonization after cold storage. Acta Hort. 1029: 353 – 358.

Abstract

The effect of coating sulphured 'Madras' litchis with a polymer formulation was assessed as a measure to prevent or limit moisture loss and *Penicillium* colonization during and after cold storage. The fruits were stored at 1°C for 28 days, and subsequently evaluated after 8 and 10 days at 20°C. Export cartons of 'Madras' litchi fruits were coated with PolymerCoat directly after sulphuring and packing. The fruits were harvested and sulphured the day before treatment. PolymerCoat was applied at 25, 50, 75 and 100% concentrations. Uncoated fruits served as controls. PolymerCoat was effective in reducing moisture loss during cold storage and was highly effective in preventing *Penicillium* fruit colonization, particularly when applied at full strength. 95% of the fruits treated at full strength were devoid of *Penicillium* 10 days after cold-storage, 39 days after harvesting. Weight loss during cold storage was reduced by 5%. Taste appeal and juice total soluble solids content were reduced by coating, but not to levels of the fruits being unappealing. Coating appears to hold a great benefit regarding export of 'Madras' fruits to the EU. Coating at full strength might be recommended.

Keywords: /Litchi/ /Shelf Life/ /Cold Storage/ /Postharvest/ /Coating/

Pan, J.C., et.al. 2014. Effects of quality of postharvest shoots on flowering and fruiting of **Litchi chinensis** 'Shuidongheiyue'. Acta Hort. 2029: 259 – 264.

Abstract

Six-year-old trees of *Litchi chinensis* Sonn. 'Shuidongheiyue', were used to study the effects of flushing time of terminal shoots and the number of shoots remaining on a postharvest pruning cut on flowering and fruiting of the cultivar. The results of the study showed that the flowering rate of postharvest shoots, which terminally flushed between 25 August and 10 September, 11 September and 25 September, 26 September and 11 October 2008 and thereafter, was 93.33, 85.92, 45.44 and 0%, respectively. All the trees in treatment 1 (one shoot left/pruning cut), treatment 2 (two shoots left/pruning cut) and the control (CK; no shoot-thinning after pruning; 3.55 shoots/pruning cut) produced flowers. The yield of the trees in treatments 1, 2 and the CK was 7.66, 20.85 and 23.76 kg, respectively; the flowering rate of postharvest shoots was 95.46, 89.77 and 78.07%, respectively; the length of postharvest shoots was 57.99, 42.07 and 31.37 cm, respectively; the diameter of postharvest shoots was 0.92, 0.73 and 0.58 cm, respectively; the number of compound leaves of postharvest shoots was 25.6, 16.7 and 12.7, respectively; fruit number/postharvest shoot was 4.09, 5.59 and 3.55, respectively; and fruit number/pruning cut was 4.09, 11.19 and 12.61, respectively. It can be concluded that the best time for the last postharvest flush to grow out is between the end of August and mid-September in Nanning, Guangxi, China.

Keywords: /Litchi/ /Quality/ /Postharvest/

Schoemana, M.H. ,F.A. Botha and F.J.Kruger. 2014. Evaluation of a universal slow release sulphur dioxide sheet for the South African **litchi** export industry. Acta Hort. 1029: 359 – 364.

Abstract

Studies on the efficacy of slow release sulphur dioxide (SO₂) sheets commenced during the early 2000s in South Africa. The results showed that the sheets significantly reduce the risk of fungal infections when placed in the bottom of litchi cartons containing commercially fumigated 'Mauritius' litchi fruit. The trials further revealed that the maximum SO₂ residue limits as specified by the European Union (10 ppm in aril) was not exceeded when using the sheets. In subsequent trials, the fumigation dosage and number of sheets to be used with both 'Mauritius' and 'McLean's Red' litchi fruit were refined and appropriate recommendations were formulated. In order to standardize the sheet for usage with all South African litchi carton types, a 'one sheet fits all carton types' sheet (Grapetek™) was evaluated. To do this, the sheet was tested in combination with export and local market cartons from three manufactures. The trial was again performed with both the 'Mauritius' and 'McLean's Red' cultivars and the fruit were stored under export simulation conditions (30 days at 1°C) followed by a shelf life phase of 12 days at 13°C. This standardized slow release sulfur dioxide sheet was found to significantly reduce fungal infections during the mid to late stages of the shelf life period. An interaction between the sheet and carton type was also recorded. Generally, well ventilated export cartons gave better results than poorly ventilated local market cartons.

Keywords: /Litchi/ /Storage/ /Shelf Life/ /Export/

Singh, Sukhvinder Pal., et. al. 2014. Preharvest application of abscisic acid promotes anthocyanins accumulation in pericarp of **litchi** without adversely affecting postharvest quality. Postharvest Biol. & Technol. 96: 14 – 22.

Pericarp colour of litchi fruit is an important quality attribute that determines its market value and consumer acceptance. Plant growth regulators (PGR) such as abscisic acid (ABA) and ethephon are known to play important roles in peel colour development during maturation and ripening of non-climacteric fruits (e.g. grape and litchi). Our aim was to investigate the effects of preharvest application of ABA, ethephon and their combination on pericarp colour and fruit quality of litchi (cv. Calcuttia) and also to assess the potential effects on postharvest performance of fruit. Exogenous application of ABA (150 or 300 mg L⁻¹) at the colour-break stage significantly increased the concentration of total anthocyanins and cyanidin-3-O-rutinoside, the major anthocyanin contributing 71–96% of the total anthocyanins, in litchi pericarp compared to ethephon (500 μL L⁻¹). Among different anthocyanins quantified, the relative contribution of cyanidin-3,5-diglucoside to the total anthocyanins was significantly higher in all PGR-treated fruit compared to the control, but the concentration of cyanidin-3-O-glucoside was specifically enhanced by ABA. No significant effect on the concentrations of epicatechin, and quercetin-3-O-rutinoside was observed in response to PGR treatments. Ethephon (500 μL L⁻¹) treatment did not significantly increase the anthocyanin levels in pericarp, but it caused more degradation of chlorophyll pigments than control. Aril quality with regard to firmness, soluble solids and acidity was not significantly affected by PGR treatments, except that ethephon treated fruit showed significant softening and lower acidity. Postharvest changes in fruit quality attributes including pericarp browning during cold storage at 5°C for 14 d were mainly related to the storage duration effect, rather than PGR treatment. In conclusion, ABA treatment (150 or 300 mg L⁻¹) at the colour-break stage

enhanced anthocyanins accumulation in litchi pericarp without adversely affecting postharvest quality and storage stability for 14 d.

Keywords: /Litchi/ /Anthocyanins/ /Ethephon/

Sultan, M.Z. 214. Effect of postharvest coating with gum arabic on pericarp browning and desiccation of **litchi** fruit (*Litchi chinensis* Sonn.) during storage. Acta Hort. 1029: 345 – 352.

Abstract

Litchi fruit (*Litchi chinensis* Sonn.) is a popular export commodity due to its attractive skin color and exotic flavor. Pericarp browning, postharvest decay and desiccation are identified as major constraints affecting the commercial quality of litchi fruits during storage, transportation or at the consumer shelf. This present study was carried out during the two successive seasons 2011 and 2012 to investigate the effects of postharvest coating with gum arabic (GA) on pericarp browning and aril decay of litchi during storage. Litchi fruits, 'Mauritius', were harvested (at the commercially mature stage with 90-95% of the peel exhibiting red color) from an orchard located in the North West Egyptian Delta. The fruits were rapidly cooled with crushed ice in water (0°C) for 10 min and then transferred to the postharvest laboratory within 4 h of harvest and dipped in commercial GA solutions at: 0 (water as control), 5, 10, 15 and 20% (w/v). The coated fruits were air dried, packed in commercial perforated polyethylene boxes each containing 20 fruits (approximately 450 g), and then the boxes were divided into 2 groups: the first was stored at 5°C and 95% relative humidity (RH) and the second was stored at room temperature (28°C and 55% RH). The results showed that browning index (BI), weight loss, decay and respiration rate were significantly lowered in coated fruits with 10% GA either at 5°C or at room temperature. The results suggested that GA plays an active role in reducing pericarp browning, desiccation and decay, thus improving litchi fruit quality and storability. The role of GA in delaying pericarp browning and desiccation of litchi fruits is discussed.

Keywords: /Litchi/ Browning/ /Postharvest/ /Coating/

LONGAN

Han, D.M., et.al. 2014. Recent advances in postharvest research on **longan** fruit. Acta Hort. 2019: 325 – 330.

Abstract

This paper reviews recent advances in research on the storage characteristics of longan fruit after harvest from the viewpoints of storability, harvest maturity, postharvest disease, aril breakdown and especially pericarp structure. Types of postharvest biological changes in longan fruit are also summarized including respiration, ethylene release, cell membrane permeability, aril quality, senescence physiology related to free radicals, aril breakdown, chilling injury physiology, roles of polyamine and postharvest molecular biology.

Keywords: /Longan/ /Storage/ /Browning/

You, C.H., et. at. 2014. Effects of precooling on storage and ROS metabolism of **longan** fruit. Acta Hort. 1029: 337 – 344.

Abstract

Effects of cold room precooling and ice water precooling on storage and reactive oxygen species (ROS) metabolism of longan (*Dimocarpus longan* Lour.) fruit were studied. Changes of pericarp browning index, pericarp moisture content, activities of relative enzymes of ROS metabolism and contents of pulp total soluble solids (TSS), titratable acid (TA) and vitamin C (Vc) during storage were measured. The results indicated that cold room precooling and ice water precooling can maintain pericarp moisture content and decrease pericarp browning index, but have little effect on contents of TSS, TA and Vc. After cold room precooling and ice water precooling, activities of peroxidase (POD) in the pericarp and pulp of longan were inhibited. Activities of superoxide dismutase (SOD) increased in the pericarp but were inhibited in the pulp of precooled fruit. Precooling treatments also inhibited the content of hydrogen peroxide (H₂O₂) in longan pulp. Anti-superoxide anion activities in longan pulp were increased in cold room precooling but decreased in ice water precooling. Postharvest ice water precooling of longan fruit can maintain high scavenging activities of the superoxide anion and less ROS content, delay fruit aging, maintain quality and improve storage life.

Keywords: /Longan/ /Precooling/

ORANGE

Lafuente, Maria T. Fernando Alferes, Paco Romero. 2014. Postharvest ethylene conditioning as a tool to reduce quality loss of stored mature sweet oranges. *Postharvest Biol. & Technol.* 94: 104 – 111.

Abstract

Ethylene is related to senescence but also induces protective mechanisms against stress in plants. The citrus industry only applies the hormone to induce fruit degreening. The aim of this work was to determine the effect of ethylene on the quality of colored citrus fruit stored under commercial conditions to extend postharvest life, since it protects them from stress causing postharvest disorders such as chilling injury (CI) and non-chilling peel pitting (NCPP). The effect of conditioning mature Navelate and Lane Late sweet oranges (*Citrus sinensis* L. Osbeck) for 4 days with 2 μL L⁻¹ ethylene at 12°C, rather than a higher temperature used for degreening, on the quality of fruit stored at 2 or 12°C, was examined. The ethylene conditioning (EC) treatment did not increase color but reduced calyx abscission and NCPP in fruit of both cultivars stored at 12°C, and also CI in Navelate fruit at 2°C. Lane Late fruit did not develop CI but showed a new disorder in EC fruit held at 2°C. This disorder began as scalded areas around the fruit stem end and extended over the fruit surface during storage. EC had no deleterious effect on the quality of Navelate oranges stored at either 2 or 12°C. Similar results were found in Lane Late fruit although EC slightly increased off-flavor perception at 2°C and the maturity index at 2 and 12°C. Moreover, EC slightly increased the content of bioactive flavonoids in the pulp of Navelate fruit but significant differences between control and EC fruit were only found after prolonged storage at 2°C. In Lane Late fruit, EC avoided the initial decrease in flavonoid content found in control samples. Results show, therefore, that EC at 12°C may be a tool to extend postharvest life of NCPP and CI-sensitive oranges, and that the tolerance of citrus cultivars to the combined effect of EC and non-freezing low temperature (2°C) should be tested to select the proper storage temperature.

Keywords: /Oranges/ /Ethylene/ /Postharvest/ /Quality/ /Storage/

PEACH

Shinya, P., et.al. 2014. Effect of prolonged cold storage on the sensory quality of peach and nectarine. *Postharvest Biol & Technol.* 95: 7 – 12.

Abstract

To maintain peach and nectarine quality after harvest, low temperature storage is used. Low temperatures induce physiological disorders in peach, but the effect of cold storage on the sensory quality of the fruit before it is damaged by chilling injury syndrome remains unclear. To evaluate the cold storage effect on the sensory quality two peach cultivars ('Royal Glory' and 'Elegant Lady') and two nectarines ('Ruby Diamond' and 'Venus') were harvested at a standardized firmness level and subjected to quality evaluations and sensory analysis at harvest and after storage at 0°C for 35 d. For both time points, a supplementary ripening followed such that homogeneous flesh firmness and suitability for consumption was achieved. The fruit segregation through the Durofel firmness (DF), evaluated using a non-destructively method(Durofel device), allowed the formation of a uniform group of fruit in terms of Abstract flesh firmness (FF), showing scores between 45.1 and 55.9 N. The average FF in fruit ripened immediately after harvest was 22.9 N and 25.6 N in fruit ripened after cold storage for 35 d. The "acceptability" of fruit is highly correlated with "aroma", "sweetness", "juiciness", "texture" and "flavor". Only the "acid taste" parameter had no significant correlation with "acceptability" or with the other parameters evaluated. It is possible to conclude that the sensory quality and acceptability of peach and nectarine are characteristic of each cultivar and change, depending on the time elapsed after harvest. In general, it was confirmed that nectarine cultivars have a more consistent quality than peach cultivars.

Keywords: /Peach/ /Nectarine/ /Cold Storage/

POMEGRANATE

Magwaza, Lembe Samukelo, Umezuruike Linus Opara. 2014. Investigating non-destructive quantification and characterization of pomegranate fruit internal structure using X-ray computed tomography. *Postharvest Biol. & Technol.* 95: 1 – 6.

Abstract

In this study, X-ray computed tomography (CT) coupled with image analysis techniques was investigated for non-destructive characterization and quantification of internal structure of intact pomegranate fruit (cv. Shani-Yonay). X-ray tomograms of intact fruit were acquired using a V|Tome|X L240 commercial X-ray CT system based on X-ray radiation generated from a source voltage of 200 kV with the electron current set at 100 μ A. Two-dimensional (2D) radioscopic images were acquired with a micro focus direct X-ray tube and used to reconstruct three-dimensional (3D) images to quantify volumes occupied by airspace, albedo, and arils, using image processing software. The calculated volumes for these fruit fractions were 7.82 ± 1.09 , 167.29 ± 16.54 , and 182.11 ± 17.04 mL, estimated to contribute 2.22, 46.86 and 50.92% of total fruit volume, respectively. Destructive validation data were similar to non-destructive data, with volumes for albedo and arils of 166.08 ± 14.69 and 170.58 ± 14.25 mL, respectively, contributing 46.07 and 47.32% of total fruit volume. The remaining 6.61% of total fruit volume tested destructively could be due to the presence of air space and calyx. This work has

demonstrated the capability of X-ray CT with image analysis as a useful non-destructive technique to study the quantity and distribution of edible and non-edible portions of pomegranate fruit.

Keywords: /Pomegranate/ /Non-destructive/ /Fruit Quality/

STRAWBERRY

Van de Poel, Bram, et.al. 2014. Detached ripening of non-climacteric **strawberry** impairs aroma profile and fruit quality. *Postharvest Biol. & Technol.* 95: 70 – 80.

Abstract

Climacteric fruit show an autocatalytic burst in ethylene production during ripening and are therefore able to ripen detached from the plant. This detached ripening of climacteric fruit is a unique feature that is widely exploited by the postharvest industry. Non-climacteric strawberry on the other hand, ripens without the autocatalytic ethylene response. Surprisingly, we found that strawberry was capable of ripening after detachment at the green stage. This apparent ripening process was studied by comparing ethylene production and multiple fruit quality traits between strawberries that ripened on the vine versus detached. Our findings show that ethylene production is hardly influenced by the dissimilar ripening conditions, yet fruit quality is heavily affected. Importantly, detached strawberries did not reach the same fruit mass, lowering the market value of the detached ripened fruit. Furthermore, sugar and acid analysis showed that detached strawberries have a low malic acid, glucose, fructose and sucrose content compared to fruit ripened on the vine, indicating that a continuous supply of photosynthesis assimilates, water and nutrients by the plant is essential for normal fruit ripening. The unique aroma of strawberries was also heavily altered in detached ripened fruit. Detached strawberries had a lower abundance of most volatile compounds, except for alcohols, resulting in less intense aroma and unwanted off-flavors. It can be concluded that detached ripened strawberries are of inferior quality compared to normal vine-ripened strawberries and are unsuitable for marketing.

Keywords: /Strawberry/ /Detached Ripening/ /Ethylene/ /Fruit Quality/

TABLE GRAPES

Youssef, Khamis, Sergio Ruffo Roberto. 2014. Salt strategies to control *Botrytis* mold of 'Benitaka' **table grapes** and to maintain fruit quality during storage. *Postharvest Biol. & Technol.* 95: 95 – 102.

Abstract

Gray mold is the most common postharvest disease of table grapes in most regions of the world. The effect of eight salts, namely sodium silicate (SSi), sodium sulphate (SS), sodium carbonate (SC), sodium bicarbonate (SB), iron chelate (Fech), iron sulphate (FeS), ammonium bicarbonate (AB), and ammonium oxalate (AO) was determined in vitro on mycelial growth and spore suspension of *Botrytis cinerea*. In particular, SSi, SC, SB, FeS, and AB completely inhibited pathogen growth at 0.25% concentration. Six salt solutions at 1%, immersion or spray, were tested to verify their effect on grapes artificially inoculated with *B. cinerea*. All salts significantly reduced the percentage of gray mold as compared to control except for Fech after one week at $22 \pm 1^\circ\text{C}$. Three salt solutions were applied, in vivo, according to different strategies: (i) spraying before harvest, (ii) immersion after harvest, and (iii)

the combination of pre- and postharvest treatments. Water was involved as a negative control while Rovral (a.i. iprodione) and SO₂ served for comparisons. After one month of cold storage at 2 ± 1°C followed by one week of shelf-life at 22 ± 2°C, the natural incidence of postharvest mold was mostly caused by *B. cinerea*. The efficacy of preharvest applications was noticeably high and statistically was not enhanced by further treatments after harvest. Salts applied only after harvest was not effective in suppressing Botrytis mold, with the exception of FeS. The influence of salts on physicochemical properties for berry quality was also monitored. The field application of salts can be considered as an appropriate regime to enhance their activity since no negative impact of their application on quality profile was observed. The incidence of gray mold can be significantly reduced using some salts which are safe for consumers and the environment.

Keywords: /Table Grapes/ /Storage/ /Quality/ /Botrytis Mold/

VEGETABLES

BROCCOLI

Gang, Ma., et.al. 2014. Effect of red and blue LED light irradiation on ascorbate content and expression of genes related to ascorbate metabolism in postharvest **broccoli**. *Postharvest Biol. & Technol.* 94: 97 – 103.

Abstract

The effects of red and blue light-emitting diode (LED) lights on the senescence of broccoli (*Brassica oleracea* L. var. *italica*) after harvest were investigated. The results showed that irradiation with red LED light was effective in delaying senescence in broccoli after harvest. Under red LED light, the yellowing process was delayed, and ethylene production and reduction of ascorbate (AsA) were suppressed in broccoli after harvest. In contrast, the blue LED light treatment did not significantly affect the senescence process of broccoli after harvest. As the red light is inconvenient for customers in selecting broccoli in the supermarket, we designed a type of modified white LED light. In this modified white LED light, the ratio of blue light was decreased, while the ratio of red light was increased. Under the modified white LED light, AsA reduction in broccoli was slightly delayed on the first and second days after harvest. Moreover, the modulation of AsA reduction by the modified white LED light treatment was highly regulated at the transcriptional level. The up-regulation of the AsA biosynthetic genes (BO-VTC2 and BO-GLDH) and AsA regeneration genes (BO-MDAR1 and BO-MDAR2) contributed to the higher AsA content in the modified white LED light treatment on the first and second days after harvest. The results presented might provide new strategies to improve the nutritional quality of broccoli after harvest.

Keywords: /Broccoli/ /Irradiation/

Gomez-Lobato, Maria E., Sofia A.Mansilla. 2014. Expression of stay-green encoding gene (BoSGR) during postharvest senescence of **broccoli**. *Postharvest Biol. & Technol.* 95: 88 – 94.

Abstract

Degreening caused by chlorophyll degradation is the most important feature that determines postharvest loss of quality in broccoli. Chlorophyll molecules are assembled to several thylakoid

proteins, from which chlorophylls must be released in order to be catabolized. Stay-Green (SGR), a chloroplast-located protein, specifically interacts with light harvesting complex subunits helping toward their destabilization and to the release of chlorophylls. In this work, a fragment of a gene encoding a SGR from broccoli (BoSGR) was cloned. The expression of BoSGR was analyzed and detected an important increment during postharvest senescence, simultaneously with chlorophyll degradation. In order to analyze the effect of different growth regulators, different groups of broccoli heads were treated with cytokinins, ethylene and 1-MCP. Cytokinins and 1-MCP delayed the increment of BoSGR expression whereas ethylene accelerated the process. In addition, several postharvest treatments that delay degreening in broccoli florets were applied to evaluate their effects on BoSGR expression. Samples treated with modified atmosphere, hot air, UV-C or white lights showed a delay in chlorophyll degradation and degreening. In most cases, the treatments also delayed the increment of BoSGR expression during senescence, reaffirming the relationship between the expression of this gene and chlorophyll degradation.

Keywords: /Broccoli/ /Postharvest/ /Senescence/

CARROT

Lepse, L., et al. 2014. Influence of controlled atmosphere on the carrot storage quality. Acta Hort. 59 – 64.

Abstract

During the last decade the vegetable production in Latvia and in Lithuania had a tendency to grow. Therefore qualitative long term storage facilities become a topical problem for vegetable growers in Latvia. Till now the storage has been performed in storage rooms with controlled temperature and relative humidity, but not gas composition. Therefore the marketing period is often relatively short and at the end of the winter and spring mostly imported vegetables are offered for customers. The solution is vegetable storage in CA. Carrot was stored in CA atmosphere during the storage periods of 2010/2011 and 2011/2012 in the storage house of Pūre Horticultural Research Centre, Latvia. The storage room was equipped with ULO pallet system "Besseling" 20 channels atmosphere control station. The best results in the investigation were obtained by carrot storing in the O₂ level between 7 and 13% and CO₂ between 3 and 5%.

Keywords: /Carrot/ /Postharvest/ /Quality/

EGGPLANT

Ghidellia, Christian, et. al. 2014. Extending the shelf life of fresh-cut eggplant with a soy protein–cysteine based edible coating and modified atmosphere packaging. Postharvest Biol. & Technol. 95: 81 – 87.

Abstract

The effect of a soy protein-based edible coating with antioxidant activity, and conventional and super-atmospheric modified atmosphere (MA) packaging, on the quality of fresh-cut 'Telma' eggplants, was evaluated during storage. In a first experiment, eggplant pieces were dipped in either a coating composed of soy protein isolate (SPI) and 0.5% cysteine (Cys), or water as an uncoated control. Samples

were packed in trays under atmospheric conditions to reach a passive MA (MA-P) or two gas mixtures (MA-A: 15 kPa CO₂ + 5 kPa O₂; MA-B: 80 kPa O₂) and were stored at 5°C. Atmospheric conditions were used as the control conditions (Control). The coated samples packed under MA-B and Control conditions resulted in the highest whiteness index (WI) values during storage, whereas MA-A did not improve the shelf-life of minimally processed eggplants and had the lowest WI values. The MA-B and atmospheric control conditions helped to maintain firmness, whereas the coating helped to maintain the weight loss under MA-A and MA-B. The maximum commercial shelf-life was reached on day 6 for the coated samples packed under atmospheric conditions. In a second experiment, the commercial shelf-life of fresh-cut eggplants was extended to 8 and 9 storage days by increasing the Cys content in the edible coating from 0.5 to 1% under MA-B and Control storage conditions, respectively.

Keywords: /Eggplant/ /Fresh Cut/ /Modified Atmosphere Packaging/ /Enzymatic Browning/

MUSHROOM

Khan, Zia Ullah, et al. 2014. Effects of composite chemical pre treatment on maintaining quality in button **mushrooms** (*Agaricus bisporus*) during postharvest storage. *Postharvest Biol. & Technol.* 95: 6 – 41.

Abstract

This study evaluated the effects of composite chemical pre treatment on the quality of postharvest button mushrooms. Three different treatments, including (T1) control (water), (T2) 1 mmol L⁻¹ Na₂EDTA + 10 mmol L⁻¹ CaCl₂ and (T3) 1 mmol L⁻¹ Na₂EDTA + 2.5% CaCl₂ + 0.5% citric acid + 2.5% sorbitol were used for pretreatments. The results showed that T3-treated samples maintained good firmness and color and had less weight loss during the postharvest storage. Lower levels of H₂O₂, -OH and low malondialdehyde content (MDA) were observed in T3 compared with T1 and T2 samples. Significantly higher soluble protein contents and higher activities in the antioxidant enzymes, i.e., superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APX), peroxidase (POD) were observed in T3 compared with T1 and T2 at the end of the storage period (P < 0.05). These results suggest that the T3 treatment could be useful in preserving button mushrooms.

Keywords: /Mushroom/ /Storage/ /Quality/

TOMATO

Cheema, Amer, et al. 2014. Improving quality of greenhouse **tomato** (*Solanum lycopersicum* L.) by pre- and postharvest applications of hexanal-containing formulations. *Postharvest Biol. & Technol.* 95: 13 – 19.

Abstract

From harvest to consumption, tomato (*Solanum lycopersicum* L.) fruit are exposed to several exogenous factors that enhance product deterioration. Phospholipase D is a key enzyme involved in membrane deterioration that occurs during fruit ripening and senescence. Hexanal, an inhibitor of phospholipase D has been successfully used for pre- and postharvest treatment of fruit, vegetables and flowers. In this study, effectiveness of pre- and postharvest application of an aqueous hexanal formulation and an enhanced freshness formulation (EFF) containing hexanal and other ingredients were evaluated by monitoring changes in quality parameters during postharvest storage of greenhouse

tomatoes. Tomatoes subjected to preharvest spray with EFF containing 1 mM hexanal twice a week had better colour, and firmness than untreated fruit and hexanal formulation treated fruit. EFF treated tomatoes also showed low hue angle values indicative of enhanced red colour. Preharvest spray with 1 mM hexanal twice a week resulted in higher levels of ascorbic acid and soluble solids in fruit than those subjected to EFF treatment, and the control. Postharvest dip application of harvested tomatoes in 2 mM hexanal as EFF resulted in enhanced brightness and hue angle values, reduced red colour, increased fruit firmness and ascorbic acid content after 21 days of storage, indicative of better quality. The results suggest that hexanal has the potential to enhance shelf-life and quality of greenhouse tomatoes.

Keywords: /Tomato/ /Postharvest/ /Storage / /Shelf life/ /Quality/

Kalidas, K. and K. Akila. 2014. Micro level investigation of marketing and post harvest losses of **tomato**. J. Stored Products and Postharvest. 5 (1): 1 – 7.

Most vegetables are perishable in nature, and in that post harvest losses and distribution channel plays a vital role in price fixation of vegetables, especially in tomato which is sensitive to much environment-genetic interaction disorders which may be manifested during post harvest losses at various stages of its marketing. A substantial quantity of production is subjected to post-harvest losses at various stages of its marketing. The quantum of loss is governed by factors like perishable nature, method of harvesting and packaging, transportation, etc. Tomato being a third most cultivated crop, the postharvest loss is significant in terms of quantity and economic value. This study undertaken in Coimbatore on tomato has suggested marketing loss in the estimation of marketing margins, price spread and efficiency and has used a modified formula for it. It has been observed that a majority of tomato producers sell their produce to the wholesalers facilitated by commission agents at different stages. The aggregate postharvest losses from farm gate to consumers in tomato ranges from 13 to 26%. It has indicated the necessity of reducing the market to intermediaries, for minimizing postharvest losses and providing remunerative price to the producers. The results have emphasized that efforts should be made to adopt improved packaging techniques, cushioning material at the farm level. The producer's share in consumer's price as estimated by old method has been found higher and the inclusion of marketing loss in the estimation of marketing margins, price spread and efficiency has indicated that the old estimation method unduly over-states the farmers' net price and profit margins to the market middlemen. It is appropriate to use modified method for the estimation of marketing margins and price spread.

Keywords: /Tomato/ /Postharvest Losses/ /Marketing

HERBS AND SPICES

ARTICHOKE

Ruiz-Jiménez, Jose M., et.al. 2014. Effect of oxalic acid on quality attributes of **artichokes** stored at ambient temperature. Postharvest Biol. & Technol. 95: 60 – 63.

Abstract

The effect of oxalic acid (OA) on the overall quality of artichokes (*Cynara cardunculus* L. subsp. *scolymus* (L.) Hayek, formerly *Cynara scolymus* L. cv. Blanca de Tudela) was investigated for the first time in this vegetable. Artichokes were dipped in OA solution at 1 mM for 10 min and then stored at 20

°C. OA application delayed the deterioration process in artichokes during storage by retarding weight loss, softening, colour changes and chlorophyll degradation. In addition OA significantly reduced mesophilic aerobics and yeast and moulds counts with respect to controls. Finally, the content of total phenolics and antioxidant activity were not affected negatively by OA treatment. Thus, OA treatment might be a promising method for delaying postharvest deterioration and maintaining the overall quality of artichokes.

Keywords: /Artichokes/ /Quality/ /Temperature/

ROSEMARY

Vallverdu-Queralt , Anna, et.al. 2014. A comprehensive study on the phenolic profile of widely used culinary herbs and spices: rosemary, thyme, oregano, cinnamon, cumin and bay. Food Chem. 154: 299 – 307.

Abstract

Herbs and spices have long been used to improve the flavour of food without being considered as nutritionally significant ingredients. However, the bioactive phenolic content of these plant-based products is currently attracting interest. In the present work, liquid chromatography coupled to high-resolution/accurate mass measurement LTQ-Orbitrap mass spectrometry was applied for the comprehensive identification of phenolic constituents of six of the most widely used culinary herbs (rosemary, thyme, oregano and bay) and spices (cinnamon and cumin). In this way, up to 52 compounds were identified in these culinary ingredients, some of them, as far as we know, for the first time. In order to establish the phenolic profiles of the different herbs and spices, accurate quantification of the major phenolics was performed by multiple reaction monitoring in a triple quadrupole mass spectrometer. Multivariate statistical treatment of the results allowed the assessment of distinctive features among the studied herbs and spices.

Keywords: /Rosemary/ /Culinary herbs/ /Spices/ /Polyphenols/ /Rosemary/ /Thyme/ /Oregano/

SPICES

Kirkin, Celale, et. al. 2014. Combined effects of gamma-irradiation and modified atmosphere packaging on quality of some spices. Food Chem. 154: 255 – 261.

Abstract

Thyme (*Thymus vidgaris* L.), rosemary (*Rosmarinus officinalis* L.), black pepper (*Piper nigrum* L.) and cumin (*Cuminum cyminum* L.) in ground form were packaged in either air or 100% N₂ and c-irradiated at 3 different irradiation levels (7 kGy, 12 kGy, 17 kGy). Total viable bacterial count, yeast and mould count, colour, essential oil yield and essential oil composition were determined. Microbial load was not detectable after 12 kGy irradiation of all samples. Irradiation resulted in significant changes in colour values of rosemary and black pepper. The discolouration of the irradiated black pepper was lower in modified atmosphere packaging (MAP) compared to air packaging. Essential oil yield of irradiated black pepper and cumin was lower in air packaging compared to MAP. Gamma-irradiation generally decreased monoterpenes and increased oxygenated compounds, but the effect was lower in MAP. Overall, spices should be irradiated under an O₂-free atmosphere to minimise quality deterioration.

Keywords: /Spices/ /Gamma Irradiation/ /Modified Atmosphere Packaging/

CUTFLOWERS

Ahmad, Iftikhar, John M. Dole. 2014. Optimal postharvest handling protocols for Celosia argentea var. cristata L. 'Fire Chief' and Antirrhinum majus L. 'Chantilly Yellow'. *Scientia Hort.* 172: 308 – 316.

Abstract

Celosia (*Celosia argentea* var. *cristata* L.) and snapdragon (*Antirrhinum majus* L.) are commercially important specialty cut flowers, but postharvest handling protocols for extending vase life need to be optimized. Stems of 'Fire Chief' celosia harvested when the flower heads were <2 cm in diameter had 14.0 days longer vase life than stems harvested with flower heads >5 cm at harvest, while 'Chantilly Yellow' snapdragon stems harvested when the lowermost florets started expanding had 3.4 days more vase life than stems harvested with three to five florets opened at harvest. However, visual quality of later-harvested stems of both species was higher than early harvested stems due to showier, larger flower celosia heads and a greater number of total florets of snapdragon spikes opened during the vase period. Harvest procedures, exogenous ethylene, anti-ethylene agents, and commercial hydrators had no effect on longevity of both species except silver thiosulfate, an anti-ethylene agent, increased vase life of snapdragon 3.2 or 3.7 days more than deionized (DI) water or 1-methylcyclopropene, respectively. Stems of celosia did not tolerate storage at $3 \pm 1^\circ\text{C}$, irrespective of the storage method, and if necessary, should only be stored for ≤ 1 week in water. On the other hand, snapdragon stems could be dry-stored for 2 weeks with no decrease in vase life and had a longer vase life than stems stored in water. Pulsing with 5 or 10% sucrose supplemented with the antimicrobial agent, isothiazolinone at 0.007 mL L⁻¹, for 24 h, and use of hydrator for 4 hours and/or holding preservatives for 44 h reduced vase life of celosia stems compared to DI water. Whereas, use of both hydrator for 4 h and holding preservatives for 44 h did not result in significant differences in vase life, but pulsing with 5 or 10% sucrose supplemented with the antimicrobial agent, isothiazolinone at 0.007 mL L⁻¹, for 24 h doubled vase life of snapdragon stems and increased flower bud opening and fresh weight of stems during the vase period. Celosia stems kept continuously in Flora life Clear Professional Flower Food with or without floral foam had longer vase life compared with Chrysal Clear Universal Flower Food or foam saturated with DI water, while snapdragon stems kept continuously in commercial preservatives had 2-fold longer vase life compared with DI water. Floral foam reduced vase life of snapdragon when saturated with preservatives, or had no effect when saturated with DI water. Vase life and quality of both 'Fire Chief' celosia and 'Chantilly Yellow' snapdragon stems can be extended by following appropriate postharvest handling procedures.

Keywords: /Celosia/ /Snapdragon/ /Vase life/ /Harvesting/