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GENERAL

CHILLING INJURY

Aghdam, Mortez Soelimani, et.al. 2013. Heat shock proteins as biochemical markers for postharvest **chilling** stress in fruits and vegetables. Scientia Hort. 160: 54 – 64.

Abstract

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

1-MCP

Ambawa, Alemayehu, et.a l. 2013.Effect of box materials on the distribution of **1-MCP** gas during cold storage: A CFD study. J. Food Eng. 119: 150 – 158.

Abstract

1-Methylcyclopropene (1-MCP) is a synthetic plant growth regulator used commercially to delay ripening of fruits. The substance is applied in gas form (as a fumigant) in the storage room. In long term postharvest cold storage, fruit are placed in boxes (usually plastic or wooden bins) and stacked in a

specific pattern. The top of the boxes are frequently covered with a thin plastic sheet for the purpose of reducing fruit moisture loss. Wooden boxes, card linings and other plant based porous materials used in bins have 1-MCP adsorption capacity. Plastic covers affect the airflow and with that the 1-MCP transport. In this paper, the influence of box materials and plastic cover on the distribution of 1-MCP in cold storage was studied using validated CFD models. Reynolds Average Navier–Stokes equations with the SST k–x turbulence model were used to calculate the airflow. Diffusion, convection and adsorption of 1MCP were modeled to obtain 3D spatial and temporal distributions of 1-MCP inside a storage container, boxes and fruit. Time dependent profiles of calculated 1-MCP concentrations in the air in the container agreed well with measurement data. The plastic cover imposed no effect on the adsorption of 1-MCP. Wooden boxes notably adsorbed 1-MCP from the treatment atmosphere and may reduce the efficacy and uniformity of the treatment.

Keywords: /1-MCP/ /Cold Storage/

Ambawa, Alemayehu, et.a l. 2013. Porous medium modelling and parameter sensitivity analysis of **1-MCP** distribution in boxes with apple fruit. J. Food Eng. 119: 13 – 21.

Abstract

1-methylcyclopropene (1-MCP) is a gas used commercially in cold storage rooms to delay ripening of fruit. It is currently not known how the gas distributes in the bins and is taken up by the fruit. Here a porous-medium model is developed based on volume averaging of the transport equations of momentum and 1-MCP in the air and product. The proposed model was compared with experimental data and validated direct-CFD model. The velocity field in and around the stack were well reproduced by the porous medium model. Concentration predictions were in average 4% and maximally 7% over the average measured values. The porous medium model also agrees well with the direct-CFD model. Influential model parameters were identified through parameter sensitivity study. Porosity, skin mass transfer coefficient and specific surface area strongly affect the simulation. Accordingly model simplifications were suggested and recommended for commercial cold storage rooms.

Keywords: /1-MCP/ /Apple/

FRUITS

BANANA

Kuang, Jian-fei, et. al. 2013. Molecular characterization of two **banana** ethylene signaling component MaEBFs during fruit ripening. Postharvest Biol. & Technol. 85: 94 – 101.

Abstract

EIN3 Binding F-box protein (EBF) is an essential signaling component necessary for ethylene response. However, little information is available on EBF genes during banana fruit ripening. Two EBF genes designated MaEBF1 and MaEBF2 were isolated and characterized from banana fruit. Subcellular localization analysis showed that MaEBF1 and MaEBF2 were both nuclear proteins. Expression of MaEBF1 and MaEBF2in fruit with four ripening characteristics revealed that MaEBF2 was enhanced by ethylene during fruit ripening, while MaEBF1 changed only slightly. Moreover, the MaEBF2 promoter

was activated after ethylene treatment, further supporting its involvement in fruit ripening. More importantly, MaEBF2 was shown to physically interact with MaEIL5, using yeast two-hybrid (Y2H) and bimolecular fluorescence complementation (BiFC) assays. Together, these results suggest that MaEBF may be involved in banana fruit ripening, at least partly via interaction with MaEIL5. Our findings expand our understanding of the regulatory network of ethylene signaling cascade in banana fruit ripening.

Keywords: /Banana/ /Fruit Ripening/

BLUEBERRY

Mehra, L.K. et.al. 2013. Effect of postharvest biofumigation on fungal decay, sensory quality, and antioxidant levels of **blueberry fruit**. Postharvest Biol. & Technol. 85: 109 – 115.

Abstract

Postharvest decay, caused by various fungal pathogens, is an important concern in commercial blueberry production, but current options for managing postharvest diseases are limited for this crop. Four plant essential oils (cinnamon oil, linalool, p-cymene, and peppermint leaf oil) and the plant oil-derived bio-fungicides Sporan (rosemary and wintergreen oils) and Sporatec (rosemary, clove, and thyme oils) were evaluated as postharvest bio fumigants to manage fungal decay under refrigerated holding conditions.Hand-harvested Tifblue rabbiteye blueberry fruit were inoculated at the stem end with conidial suspensions of Alternaria alternata, Botrytis cinerea, Colletotrichum acutatum, or sterile deionized water (checkinoculation) and subjected to biofumigation treatments under refrigeration (7.C) for 1 wk. Sporatec volatiles reduced disease incidence significantly ($P < 0.05$) in most cases, whereas other treatments had no consistent effect on postharvest decay. Sensory analysis of uninoculated, biofumigated berries was performed utilizing a trained sensory panel, and biofumigation was found to have significant negative impacts on several sensory attributes such as sourness, astringency, juiciness, bitterness, and blueberry-like flavor. Biofumigated fruit were also analyzed for antioxidant capacity and individual anthocyanins,and no consistent effects on these antioxidant-related variables were found in treated berries. Because of limited efficacy in reducing postharvest decay, negative impacts on sensory qualities, and failure to increase antioxidant levels, the potential for postharvest biofumigation of blueberries under refrigerated holding conditions appears limited.

Keywords: /Blueberry/ /Sensory/ /Quality

CITRUS

D'Aquino, Salvatore, et.al. 2013. Combined effects of potassium sorbate, hot water and thiabendazole against green mould of **citrus** fruit and residue levels. Food Chem. 141: 858 – 864.

Abstract

Postharvest treatments of potassium sorbate only controlled recently established infections of Penicillium digitatum on Femminello siracusano lemons but did not confer any persistent protection. The loss of efficacy of potassium sorbate to control green mould decay was related to its irregular deposition on the fruit surface, as revealed by environmental scanning electron microscopy of oranges, and to the brief persistence of potassium sorbate residues. When treatment was done at 53 C, the co-

application of potassium sorbate with thiabendazole reduced thiabendazole residues in Moro and Sanguinello oranges, compared to thiabendazole treatment alone. However, treatment efficacy against two isolates of P. digitatum (thiabendazole- sensitive and thiabendazole-resistant) notably improved, indicating that potassium sorbate and hot water potentiated thiabendazole activity. Potassium sorbate residues remarkably decreased during fruit storage and were not affected by the co-application of thiabendazole.

Keywords: /Citrus/ /Green Mould/ /Heat Treatment/

Peng, Gang. 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 Cit-CAB 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: /Citrus/ /Ponkan/ /Ethylene/

MANGO

Yilma Dessalegna, Amare Ayalew, Kebede Woldetsadik. 2013. Integrating plant defense inducing chemical, inorganic salt and hot water treatments for the management of postharvest **mango** anthracnose. Postharvest Biol. & Technol. 85 : 83 – 88.

Abstract

Preharvest dips of mango fruit in plant defense inducing chemicals (PDIC) integrated with postharvest treatments with inorganic salts and hot water were evaluated for the management of anthracnose on artificially inoculated mango fruit. Either of the PDICs salicylic acid or potassium phosphonate at 1000 mg L−1combined with a fruit dip for 3 min in 3% aqueous sodium bicarbonate at 51.5◦C significantly reduced disease development as compared to other treatments and the control. This

combination kept anthracnose severity (lesion development) below 5% during much of the 12 days experimental period and had the maximum proportion of marketable fruit (93.3%). The mean disease severity on untreated control fruit exceeded 30%, disease incidence reached 100% and marketability dropped to 0%. The treatments also maintained quality of mango; pH, TSS, TA, firmness and color of treated mango fruit significantly ($P < 0.001$) differed from those of the control. Heating calcium chloride (3%) to 51.5◦C did not significantly improve its effect on severity of mango anthracnose even when combined with preharvest PDICs. The integrated measures involving sodium bicarbonate offer effective options for the management of mango fruit rot due to anthracnose.

Keywords: /Mango/ /Preharvest/ /Hot Water Treatment/

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

Abstract

The effect of -aminobutyric acid (BABA) on control of anthracnose caused by Colletotrichum gloeosporioides in mango fruit and its possible mechanisms were investigated. The results show that BABA treatments effectively suppressed the expansion of lesion in mango fruit inoculated with C. gloeosporioides during storage at 25.C, with the greatest efficacy being obtained using 100 mM BABA. However, BABA at 25.400 mM did not exhibit direct antifungal activity against C. gloeosporioides in vitro. Further-more, BABA treatment at 100 mM enhanced the activities of -1,3-glucanase (GLU), chitinase (CHT) andphenylalanine ammonia lyase (PAL). BABA treatment also contributed to the accumulation of hydro-gen peroxide (H2O2), while decreasing the rate of superoxide radical (O2..) production. Concurrently, BABA increased the activity of superoxide dismutase (SOD), while inhibiting catalase (CAT) and ascorbate peroxidase (APX) activities. These results indicate that increased disease resistance of mango fruit after BABA treatment during storage might be attributed to an elicitation of defense response involving in the enhancement of defense related enzyme activities and modulation of antioxidant system activities.

Keywords: /Mango/ /Postharvest/ /Anthranose/

PAPAYA

Li, Xueping, et.al. 2013. Isolation and characterization of ethylene response factor family genes during development, ethylene regulation and stress treatments in **papaya** fruit. Plant Physiol. & Biochem. 70: 81 – 92.

Abstract

Ethylene response factors (ERFs) play important roles in fruit development, ripening, defense responses and stress signaling pathways. After harvest, climacteric fruit such as papaya are subject to a range of problems associated with postharvest handling and storage treatments. There have been few attempts to evaluate the role of ERFs in fruit's responses to environmental stimuli. To investigate the transcriptional mechanisms underlying fruit developmental, ripening and stresses, we cloned four ERFs from papaya. The deduced amino acid sequence of CpERFs contained the conserved apetalous (AP2)/ERF domain, which shared high similarity with other reported AP2/ERF domains. The phylogeny,

gene structures, and putatively conserved motifs in papaya ERF proteins were analyzed, and compared with those of Arabidopsis. Expression patterns of CpERFs were examined during fruit development, under 1-MCP treatment, ethephon treatment, biotic stress (temperature stress) and pathogen stress. CpERFs displayed differential expression patterns and expression levels under different experimental conditions. CpERF2 and CpERF3 showed a close association with fruit ripening and CpERFs had a high expression level in the earlier stages during the fruit development period. The expression of CpERFs strongly associated with stress response. These results support the role for papaya ERFs in transcriptional regulation of ripening-related or stress respond genes and thus, in the regulation of papaya fruit-ripening processes and stress responses.

Keywords: /Papaya/ /Stress Treatment/

Ong, Mei Kying. 2013. Postharvest profile of a Solo variety 'Frangi' during ripening at ambient temperature. Scientia Hort. 160: 12 – 9.

Abstract

Changes in physical, chemical properties and antioxidant levels during postharvest ripening of Frangi • f 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 concen-tration (7.9.17.6%), ascorbic acid content (169.322 mg 100 g.1fresh weight (FW)), total phenolic content(0.515.0.686 mg GAE (gallic acid equivalents) g.1FW), ethylene production (5.83.81.3 l kg.1h.1), respiration rate (24.5.59.0 ml CO2kg.1h.1), carotene (0.045.0.201 mg 100 g.1FW) and lycopene content(0.08.0.244 mg 100 g.1FW) was observed during storage, whereas there were a reduction in titratable acidity (0.162.0.075%), firmness (108.7.7 N) and hue angle (157.96.8.). Frangi • papaya particularly after4 days of ambient storage showed improved antioxidant activity (0.32.1.55 mM Fe(II) g.1FW).c 2013 Elsevier B.V. All rights reserved

Keywords: /Papaya/ / Postharvest/ /Solo Papaya/

PEAR

Yan, Shijie, et.al. 2013. Maturity and cooling rate affects browning, polyphenol oxidase activity and gene expression of 'Yali' **pears** during storage. Postharvest Biol. & Technol. 85 : 39 – 44.

Abstract

Browning is the main physiological disorder of 'Yali' pear (Pyrus bretschneideri Rehd) during storage. In this study, the relationships between browning development in fruit from different harvest dates, and cooled either rapidly or slowly, with polyphenol oxidase (PPO) activity and isozymes, and PPO gene expression has been investigated. Development of browning was highest in late-harvest fruit in both core and flesh tissues and was higher in rapidly cooled than slowly cooled fruit. Mid-harvest fruit had the lowest browning incidence and PPO activity of core tissue was higher than in flesh and seeds, while the peak of PPO activity in mid-harvest fruit was the lowest. Six PPO isoenzymes were detected in fruit, three bands A, B and E in flesh and core tissues, three bands C, D and F in the seeds. The intensity of PPO isoenzyme staining of bands A and B in pulp and core was similar to that of PPO activity and browning incidence. PPO gene expression increased and then decreased in core tissues. Trends of

expression were similar to those of PPO activity. Rapid cooling promoted the expression PPO. The results suggest PPOplays an important role in 'Yali' pear browning during storage.

Keywords: /Pear/ /Storage/ /Browning/ /Maturity/

PINEAPPLE

Ko, Lien, et.al.2013. Field evaluation of transgenic **pineapple** (Ananas comosus (L.) Merr.)cv. 'Smooth Cayenne' for resistance to blackheart under subtropical conditions. Scientia Hort. 159: 103 – 108.

Abstract

A comparative analysis of transgenic pineapple lines transformed with a polyphenol oxidase (PPO) gene(ppo) and the untransformed cultivar 'Smooth Cayenne' was made from plants grown in a series of field trials under cool subtropical conditions in southeast Queensland. In the four field trials where black heart was recorded, all of the control lines expressed blackheart on each occasion and exhibited the greatest incidence (50%) and severity (34%) of symptoms. Irrespective of the gene transfer method or the gene construct used, 38% of the lines produced were regarded as blackheart resistant, having no blackheart symptoms in two or more trials. Five blackheart resistant transgenic lines consistently performed as well as or better than control plants in terms of fruit characteristics and quality.

Keywords: /Pineapple/ /Ananas comosus L. Merr./

POMOGRANATE

Fawole, Lolanivi Amos, Umezuruike Linus Opara. 2013. Developmental changes in maturity indices of **pomegranate** fruit: a descriptive review. Scientia Hort. 159: 152 – 161.

Abstract

During pomegranate fruit development, advancing maturity stages correspond to a number of coordinatedphysiological, biochemical, and structural processes that result in changes in size, colour and flavour, ultimately making the fruit desirable for consumption. Optimum fruit maturity is crucial formaintaining high total soluble sugar (TSS) content, good colour and overall fruit quality. Literature on quality indices of pomegranate fruit at commercial harvest is voluminous, but research on changes that occur during fruit developmental processes in terms of physico-chemical, physiological and sensory aspects also needs to be taken into consideration for the development of optimum maturity index for pomegranate cultivars. A few studies have reported on the effects of cultivar difference, growing region and maturity status on fruit harvest maturity and eating quality. This review attempts to discuss current knowledge on the changes which occur in fruit maturity indices during development of pomegranate cultivars.

Keywords: /Pomegranate/ /Maturity Indices/

STRAWBERRY

Hashmi, Majid S. et.al. 2013. Hypobaric treatment stimulates defence-related enzymes in **strawberry** Postharvest Biol. & Technol. 85: 77 – 82.

Abstract

Strawberry fruit are very prone to fungal decay. Postharvest hypobaric treatment is a potential new tech-nique to delay fungal decay in strawberries. Hypobaric treated (50 kPa, 4 h) strawberries had reduced rot incidence from natural infection during subsequent storage for 4 days at 20◦C and after subsequent inoculation with Botrytis cinerea or Rhizopus stolonifer spores. Biochemical analysis of strawberries suggested that activities of defence-related enzymes were increased with the hypobaric treatment; phenylalanineammonialyase (PAL, EC: 4.3.1.24) and chitinase (EC: 3.2.1.14) peaked 12 h after treatment, while peroxidase (POD, EC: 1.11.1.7) increased immediately. Polyphenol oxidase (PPO, EC: 1.10.3.1) activity remained unaffected during subsequent storage for 48 h at 20◦C. In addition, the effect of low oxygen treatment (10% at 101 kPa, 4 h) was investigated to determine if the lower partial pressure of oxygen generated during hypobaric treatment contributed to the observed effect. However the low oxygen treatment did not influence rot development, suggesting that the treatment effects were pressure rather than oxygen related. The results suggest that hypobaric treatment causes reduced decay incidence due to stimulation of defence-related enzymes. Studies of defence-related genes are required to further explore the induced resistance mechanisms of hypobaric treatments.

Keywords: /Strawberry/ /Hypobaric Treatment/

TABLE GRAPES

Crupi, Pasquale, et. al. 2013. Postharvest stilbenes and flavonoids enrichment of **table grape** cv red globe (Vitis vinifera L.) as affected by interactive UV-C exposure and storage conditions. Food Chem. 141: 802 – 808.

Abstract

Flavonoids and stilbenes are secondary metabolites produced in plants that can play an important health promoting role. The biosynthesis of these compounds generally increases as a response to biotic or abiotic stress; therefore, in order to achieve as high phenolic accumulation as possible, the interactive effects of storage conditions (temperature and time) and UV-C radiation on polyphenols content in postharvest Redglobe table grape variety were investigated. During a storage time longer than 48 h, both cold storage (4 C) and UV-C exposure of almost 3 min (2.4 kJ m2) positively enhanced the content of cis- and transpiceid (34 and 90 lg g1 of skin, respectively) together with quercetin-3-O-galactoside and quercetin-3- O-glucoside (15 and 140 lg g1 of skin, respectively) up to three fold respect to control grape samples. Conversely, catechin was not significantly affected by irradiation and storage treatments. With regard anthocyanins, the highest concentrations of cyanidin-3-O-glucoside and peonidin-3-Oglucoside were observed in Redglobe, stored at both room temperature and 4 C, after 5 min (4.1 kJ m2) of UV-C treatment and 24 h of storage. Gathered findings showed that combined postharvest treatments can lead to possible ‘‘functional’’ grapes, within normal conditions of market commercialization, responding to the rising consumers demand to have foods that support and promote health.

Keywords: /Table Grapes/ /Anthocyanins/ /Storage/

Ngcobo, Mduduzi, E.K. et.al. 2013. Moisture diffusivity of **table grape** stems during low temperature storage conditions. Biosystem Eng. 115: 346 – 353.

Abstract

Moisture diffusivity of grape stems was studied under cold airflow storage conditions (1.21 ± 0.25 °C and 1.18 ± 0.23 $ms^{-1)}$ during postharvest storage. The stems were stored without packaging liner films or with packaging liners (packed in non-perforated liner films) under low temperature conditions inside cold room. Effective moisture diffusivity values for stem parts packed in non-perforated liner films were lower than the values obtained for stem parts stored without packaging liners, and varied from from 5.06×10^{-14} -1.05×10^{-13} m^2 s^{-1} . Dehydration rate of stem parts directly exposed (without liners) to circulating cold air was significantly ($P < 0.05$) higher than the dehydration rates of stem parts packed in non-perforated liner film. Empirical models were applied to describe the dehydration kinetics of the different parts of stem.

Keywords: /Table Grape/ /Storage/

Peng, Gang, et.al. 2013. Chlorophyll a/b binding protein plays a key role in natural and ethylene-induced degreening of Ponkan (**Citrus** reticulata Blanco). Scientia Hortic. 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 levelof pheophorbide a oxygenase (CitPaO) and stay-green protein (CitSGR) was stable, and no obvious changeof 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 Cit-CAB 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: /Citrus/ /Ponkan/ /Ethylene/

VEGETABLES

LETTUCE

Bonaisa, Anna, et.al. 2013. Pre-harvest nitrogen and Azoxystrobin application enhances postharvest shelf-life in Butterhead **lettuce**. Postharvest Biol. & Technol. 85: 67 – 76.

Abstract

Two trials were carried out on Butterhead lettuce (March–May 2008 and April–June 2009) to investigatethe effect of the application of nitrogen fertilizer (0, 50 and 100 kg ha−1of N) and of strobilurin (Azoxys-trobin, methyl (E)-2-{2-[6-(2-cyanophenoxy)pyrimidin-4-yloxy]phenyl}-3-methoxyacrylate) on (i) yield and morphological traits at harvest, (ii) physical (weight loss and dry matter), visual (chlorophyll con-tent and main colour indices), physiological (relative water content, osmotic potential, and electrolytic leakage), and nutritional (ascorbic acid, nitrate, and polyphenol content) quality of raw material and their changes after storage of fresh-cut leaves. Cool storage lasted 7 and 12 days in the first and second experiment, respectively. In the first cycle, under early-spring conditions, lettuce yield was lower by 38% and, even if the product was lighter coloured [higher L* (+6%) and lower CHL (−21%)], it had lower dry matter content (−32%), higher electrolyte leakage (EL) (+14%) and WL Trans(+8%) compared with the raw product from the second cycle. In both years, the increase of N supply and the application of Azoxystrobin improved yield (by 8.5% and 10%, respectively). The response in N fertilization was more evident under early-spring (2008) compared to late-spring (2009) conditions (12.3% vs. 4.8%), and when(2008) the highest N rate interacted with the application of Azoxystrobin (+12.9% compared with the other treatments). The nitrate content in leaves was always reduced by Azoxystrobin application (−43%) and increased with the N supply (+53%). In the second experiment, when storage was prolonged for 12days, strobilurin improved postharvest shelf-life by reducing chlorophyll degradation (−27%), senescence (−19%, measured as EL), and browning (−53%, measured as h◦ index decrease). Azoxystrobin lowered also the total polyphenol content of raw material (−12.5%), which can be linked to less browning during storage. During postharvest storage, irrespective to the preharvest dose, N supply kept the visual quality and physiological senescence indices constant (L*, h◦and EL). The suitability of the Butter head lettuce to fresh-cut processing depends on climatic growing conditions. Preharvest Azoxystrobin supply improves the nutritional quality of the raw material, reducing leaf nitrate content, and the shelf-life in prolonged storage. The N rate of 100 kg ha−1of N is suitable under less favourable growing conditions, while the rate of 50 kg ha−1is better for more favourable climatic conditions, especially if a moderate contribution in available N from soil organic matter mineralization and no leaching from heavy rains is expected.

Keywords: /Lettuce/ /Shelf-Life/ /Postharvest Life/

López-Fernández, O., R. Rial-Otero, J. Simal-Gándara. 2013. Factors governing the removal of mancozeb residues from **lettuces**. Food Control. 24: 530 – 538.

Abstract

Mancozeb was spiked in smooth and curly lettuces at two different concentrations (low and high), andlettuces were subjected to different washing treatments (with tap water, Amukine, hydrogen peroxide,
acetic acid, and ammonium hydroxide) at varying time and temperature. The determination of residuallevels was then carried out by using acetonitrile extraction and high performance liquid chromatography with diode array detection (HPLC-DAD). The study of analysis of variance among these experiments allowed identifying the main factors governing the removal of mancozeb residues from lettuces. In general, the oxidant character of the washing agent is the most important condition that affects removal of mancozeb from lettuces, being hydrogen peroxide more efficient than sodium hypochlorite. Moreover, other factors controlling mancozeb removal from lettuces are surface wax, concentration gradient, and also washing pH. The washing processing factor resulted to be a rest of 4% under the optima conditions (either Amukine solution for 10 min at 25 °C, or hydrogen peroxide solution for 5 min at water temperature of 15 Mancozeb was spiked in smooth and curly lettuces at two different concentrations (low and high), and lettuces were subjected to different washing treatments (with tap water, Amukine, hydrogen peroxide, acetic acid, and ammonium hydroxide) at varying time and temperature. The determination of residual levels was then carried out by using acetonitrile extraction and high performance liquid chromatography with diode array detection (HPLC-DAD). The study of analysis of variance among these experiments allowed identifying the main factors governing the removal of mancozeb residues from lettuces. In general, the oxidant character of the washing agent is the most important condition that affects removal of mancozeb from lettuces, being hydrogen peroxide more efficient than sodium hypochlorite. Moreover, other factors controlling mancozeb removal from lettuces are surface wax, concentration gradient, and also washing pH. The washing processing factor resulted to be a rest of 4% under the optima conditions (either Amukine solution for 10 min at 25 C, or hydrogen peroxide solution for 5 min at water temperature of 15 °C).

Keywords: /Lettuce/

Lopez-Galvez, Francisco, et.al. 2013. Effect of new sanitizing formulations on quality of fresh-cut iceberg **lettuce**. Postharvest Biol. & Technol. 85: 102 – 108.

Abstract

In the present study, three recently patented decontamination agents: peroxyacetic acid combined withlactic acid, and two different combinations of hydrogen peroxide with citric acid (with and without pro-pylene glycol), were compared with sodium hypochlorite and tap water washing regarding their effecton equilibrium modified atmosphere packaged (EMAP) fresh-cut iceberg lettuce. Effects of these sani-tizers on respiration rate, electrolyte leakage, microbial levels, and sensory quality of the product afterdecontamination and during storage (3 d at 4◦C followed by 4 d at 7◦C) were elucidated. Hydrogen per-oxide based sanitizers provoked a significant increase in the respiration rate and the electrolyte leakage of fresh-cut iceberg lettuce compared with tap water washing. Peroxyacetic acid combined with lactic acid resulted in similar results to those of tap water washing for all the parameters analyzed. However ,other aspects of the combination of peroxyacetic and lactic acids (e.g. efficacy for cross-contamination avoidance) should be assessed in the future in order to determine its suitability for fresh-cut iceberg lettuce processing.

Keywords: /Lettuce/ /Fresh Cut/ / Fresh Produce/ /Quality/ /Modified Atmosphere Packaging/ /Storage/ /Postharvest/

MUSHROOM

Jiang, Tianjia, et.al. 2013. Effect of alginate/nano-Ag coating on microbial and physicochemical characteristics of shiitake **mushroom** (Lentinus edodes) during cold storage. Food Chem. 141: 954 – 960.

Abstract

The effect of a novel alginate/nano-Ag coating material on the preservation quality of shiitake mushroom (Lentinus edodes) during 4 ± 1 C storage was investigated. The results showed that the alginate/nano-Ag coating had quite a beneficial effect on the physicochemical and sensory quality, compared to the control treatment. After a 16-day storage, mushroom weight loss, softening, and browning of the alginate/nano- Ag coating were significantly inhibited. The lower microbial counts, including mesophilic, psychrophilic, pseudomonad, and yeasts and moulds, in treated mushrooms during storage should be attributed to the alginate/nano-Ag coating. Meanwhile, the contents of the reducing sugar, total sugar, total soluble solids and electrolyte leakage rate were increased to 3.9 mg/g, 11.2 mg/g, 5.1% and 16.5% for the alginate/nano- Ag coating and 3.7 mg/g, 8.3 mg/g, 6.3% and 31.7% for the control treatment. Therefore, the alginate/nano- Ag coating could be applied for preservation of the shiitake mushroom to expand its shelf life and improve its preservation quality.

Keywords: /Mushroom/ /Cold Storage/

SPINACH

Diezma, Belen, et.al. 2013. Examination of the quality of **spinach** leaves using hyperspectral imaging Postharvest Biol.. & Technol. 85: 8 – 17.

Abstract

The present research is focused on the application of hyperspectral images for the supervision of quality deterioration in ready to use leafy spinach during storage (Spinacia oleracea). Two sets of samples of packed leafy spinach were considered: (a) a first set of samples was stored at 20.C (E-20) in order to accelerate the degradation process, and these samples were measured the day of reception in the laboratory and after 2 days of storage; (b) a second set of samples was kept at 10.C (E-10), and the measurements were taken throughout storage, beginning the day of reception and repeating the acquisition of Images 3, 6 and 9 days later. Twenty leaves per test were analyzed. Hyperspectral images were acquired with a push-broom CCD camera equipped with a spectrograph VNIR (400.1000 nm). Calibration set of spectra was extracted from E-20 samples, containing three classes of degradation: class A (optimal quality), class B and class C (maximum deterioration). Reference average spectra were defined for each class. Three models, computed on the calibration set, with a decreasing degree of complexity were compared, according to their ability for segregating leaves at different quality stages (fresh, with incipient and non-visible symptoms of degradation, and degraded): spectral angle mapper distance (SAM), partial least squares discriminant analysis models (PLS-DA), and a non linear index (Leafy Vegetable Evolution, LEVE) combining five wavelengths were included among the previously selected by CovSel procedure. In sets E-10 and E-20, artificial images of the membership degree according to the distance of each pixel to

the reference classes, were computed assigning each pixel to the closest reference class. The three methods were able to show the degradation of the leaves with storage time.

Keywords: /Spinach/ /Quality/

TUBERS AND ROOTCROPS

SUGARBEETS

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

Abstract

Exogenous application of salicylic acid (SA) reduces storage rots in a number of postharvest crops. SA's ability to protect sugarbeet (Beta vulgaris L.) taproots from common storage rot pathogens, however, is unknown. To determine the potential of SA to reduce storage losses caused by three common causal organisms of sugarbeet storage rot, freshly harvested roots were treated with 0.01, 0.1, 1.0 or 10 mM SA, inoculated with Botrytis cinerea, Penicillium claviforme, or Phoma betae, and evaluated for the severity of rot symptoms after incubation at 20 .C and 90% relative humidity. Roots were obtained from plants that received sufficient water or were water-stressed prior to harvest. Roots from water-stressed plants were included since water-stress increases sugarbeet root susceptibility to storage rot and SA mitigates drought effects in other plant species. SA at concentrations of 0.01.10 mM had no effect on the severity of storage rot caused by B. cinerea, P. claviforme, or P. betae in roots from plants that received sufficient water prior to harvest. However, SA at these same concentrations reduced the severity of rot symptoms for all three pathogens in roots from plants that were water stressed before harvest. For water-stressed roots, all concentrations of SA produced statistically equivalent reductions in the weight of rotted tissue for each pathogen, and on average, SA reduced rot severity due to B. cinerea, P. claviforme, and P. betae by 54, 45, and 58%, respectively. SA reduced rot from all three pathogens by reducing lesion size, but did not affect the incidence of infection. The ability of SA to reduce rot severity in water-stressed roots, but not in roots that received sufficient water before harvest suggests that SA alleviated the negative impact of water stress but did not directly protect sugarbeet roots against storage rots.

Keywords: /Storage / /Postharvest/ /Salicylic Acid Treatment/ /Storage/

SWEET POTATO

Cheem, M.U.A. et.al. 2013. The effects of ethylene, 1-MCP and AVG on sprouting in **sweet potato** roots Postharvest Biol. & Technol. 85: 89 – 93.

Abstract

Exogenous ethylene is commonly used as a commercial sprouting inhibitor of potato tubers. The role of ethylene in the control of sprouting of sweet potato roots, however, is not known. The aim of this study was to investigate the role of ethylene in control of sprouting in sweet potato roots by observing the effect of an ethylene synthesis inhibitor, aminoethoxyvinylglycine (AVG), and the ethylene antagonist,1-methylcyclopropene (1-MCP), in the presence and absence of exogenous ethylene on root

sprouting and associated sugar accumulation. Continuous exposure to 10 l L.1ethylene, 24 h exposure to 625 nl L.11-MCP or dipping in 100 l L.1AVG all inhibited sprout growth in sweet potato roots of two varieties over4 weeks of storage at 25.C. The observations that both ethylene on its own and 1-MCP, which inhibits ethylene action, inhibit sprout growth indicate that while continuous exposure to exogenous ethylene leads to sprout growth inhibition, ethylene is also required for sprouting. In potato tubers ethylene is required to break dormancy, while continuous exposure inhibits sprout growth. Monosaccharide concentrations in ethylene, 1-MCP or AVG treated roots were lower than in untreated roots, and for ethylene treated roots this was associated with higher respiration rates. This is consistent with the activation of some additional process by ethylene which uses energy through sugar metabolism.1-MCP and AVG both inhibited this increase in respiration rate and counteracted the decrease in monosaccharide concentrations. 1-MCP presumably counteracts the ethylene stimulation of this process, while the effect of AVG is attributed to its possible inhibitory effects on protein synthesis

Keywords: /Sweet potato/ /1-Methylcyclopropene/ /Sprouting/

HERBS & SPICES

ARTICHOKE

Ricci, Ide, et.al. 2013. Influence of pre-cutting operations on quality of f resh-cut **artichokes** (Cynara scolymus L.): effect of storage time and temperature before cutting. Postharvest Biol. & Technol. 85: 124 – 131.

Abstract

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

Keywords: /Artichoke/ /Storage/ /Fresh Cut/

ORNAMENTALS

CHRYSANTHEMUM

Liu, Feng, et. al. 2013. A green and effective approach for characterisation and quality control of **chrysanthemum** by pressurized hot water extraction in combination with HPLC with UV absorbance detection. Food Chem. Food Chem. 141: 1807 – 1813.

Abstract

Chrysanthemum is a ubiquitous plant with many species and wide uses, and it is usually consumed as functional food. The main aim of this paper is to demonstrate that chromatographic fingerprints obtained from the HPLC/UV analysis of the pressurized hot water extraction (PHWE) extracts together with the aid of principal component analysis (PCA), allowed for the clustering of various chrysanthemums of different species and provenance. In addition, a parallel study of pressurized fluid extraction (PFE) with methanol was carried out for comparison. From the results, a clearer separation and clustering was obtained with the environmentally-benign water extracts compared with methanol extracts. This study shows that PHWE in combination with HPLC/UV and PCA can be used successfully as a green and effective approach for characterisation and quality control of ubiquitous functional food such as chrysanthemum.

Keywords: /Chrysanthemum/ /Quality/ /Hot Water/