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GENERAL

CHITOSAN

Pal Singh, Tarun, Manish Kumar Chatli & Jhari Sahoo . 2015. Development of chitosan based edible films: process optimization using response surface methodology. J . Food Sci. Technol. 52(5): 2530 - 2543.

Abstract

Three-factors Box-Behnken design of response surface methodology (RSM) was used to optimize chitosan level (1.5, 2.0, 2.5 %w/v), glycerol level (0.5, 0.75, 1.0 %w/v) and drying temperature (35, 40, 45 °C) for the development of chitosan based edible films. The optimization was done on the basis of different responses viz. thickness, moisture, solubility, colour profile (L*, a*, b* value), penetrability, density, transmittance and water vapour transmission rate (WVTR). The linear effect of chitosan was significant ($p < 0.05$) on all the responses. However, density was only significantly ($p < 0.05$) affected by glycerol in a negative linear fashion. Drying temperature also significantly ($p < 0.05$) affected thickness, penetrability, transmittance and WVTR in linear terms. The quadratic regression coefficient of chitosan showed a significant effect ($p < 0.05$) on moisture, solubility and WVTR; glycerol level on moisture, L* value and transmittance; and drying temperature on a* value, penetrability, transmittance and WVTR. The effect of interaction of glycerol x temperature as well as chitosan x temperature was also significant ($p < 0.05$) on a* value and WVTR of edible films. The optimized conditions were: 2.0 % w/v chitosan level, 0.75 % w/v glycerol level and drying temperature 40 °C at a constant time of 48 h. All the response variables were in favourable range including thickness; 108.59 μm , penetrability; 16.41 N, transmittance; 75.60 %, WVTR; 0.00174 $\text{g}/\text{m}^2\text{-t}$ for the optimized edible film. Results concluded that edible films with desirable bio-mechanical properties can be successfully developed and effectively utilized in the food packaging industry.

Keywords: /Chitosan/ /Edible Films/

CONTROLLED ATMOSPHERE STORAGE

Tonutti, P. 2015. The technical evolution of controlled atmosphere storage protocols and the advancements in elucidating the fruit responses to low oxygen stress. Acta Hort. 1079: 53 - 60.

Abstract

Innovations in postharvest technology also deal with the modulation of gas composition in storage rooms and/or packaging, in particular concerning oxygen levels, which, for some storage protocols and fruit crops, is set at extremely low concentrations (1 kPa). Since the establishment of the first commercial CA rooms, the oxygen concentration showed a constant decrease throughout decades, reaching the lowest levels used in ULO (Ultra Low Oxygen), ILOS (Initial Low Oxygen Stress), and DCA (Dynamic Controlled Atmosphere) applications. This decreasing trend in oxygen concentrations used in storage rooms resulted in a general improvement of the quality parameters and the marketable life of the commodities (apples, in particular). The optimization of these techniques and the reduction of the risks (development of physiological disorders, off-odors, off-flavors) associated with keeping the fruit at such extreme conditions need to be based on a better knowledge of the metabolic responses to hypoxia. The metabolic responses of fruit tissues to low-oxygen stress are, as observed in model plants, mainly related to dramatic changes in mitochondrial respiration and the activation of the fermentative metabolism that appear to be differently affected (resulting in different levels of ethanol accumulation) by different low oxygen levels and in relation to the genetic background. Among others, ethanol, alanine, asparagine and aspartate concentrations in cortex tissue markedly change in relation to hypoxic conditions, thus representing possible metabolic markers of this kind of stress. Specific volatile compounds of apples are also differentially affected, whereas other volatile classes appear more stable. Using large-scale transcriptomic approaches coupled with metabolic profiling analyses it is now possible to better describe the global fruit responses to low oxygen conditions. In apples, in addition to the expression of genes involved in primary metabolism (major CHO, fermentation), hypoxia also affects specific secondary metabolic pathways that appear to be selectively modulated by different low oxygen treatments. Members of the ERF-VII transcription factors (TFs) gene family displayed differential expression suggesting their involvement in the modulation or controlling mechanisms of hypoxic responses, as observed in model species.

Keywords: /Controlled Atmosphere Storage/

FRESH PRODUCE

Tzortzakis, N. 2015. Gaseous ozone-enrichment for the preservation of **fresh produce**. Acta Hort. 1079: 273-278.

Abstract

Ozone is considered the most economically important air pollutant worldwide. Experimental studies reveal contrasting effects of ozone on foliar pathogens with several successful applications in postharvest level. Oranges, grapes and tomatoes were infected with green mould (*Penicillium digitatum*) and grey mould (*Botrytis cinerea*), then fruit incubated in 'clean air' or an ozone-enriched atmosphere

(concentrations ranging from 0.05 to 1.0 ppm). In vivo and in vitro experimentation revealed lesion development and spore production to be markedly reduced in fruit maintained in an ozone-enriched atmosphere. Higher concentrations/duration of exposure resulted in greater impacts on lesion development/spore production, with considerable benefits resulting from exposure to low levels of ozone (i.e., below the 0.2 ppm threshold set for the protection of human health). In vitro studies performed on fungi raised on potato dextrose agar (PDA) for 6-8 days at 13°C and 95% relative humidity (RH) revealed no direct effects of ozone on fungal development, implying that suppression of pathogen development was due in a large part to the impacts of ozone on fruit-pathogen interactions.

Keywords: /Fresh Produce/ /Modified Atmosphere Storage/ /Postharvest/

MODIFIED ATMOSPHERE STORAGE

Winotapun, C., N. et. al. 2015. Microperforation of three common plastic film by laser and their enhanced oxygen transmission for fresh produce **packaging**. Packaging Technol Sci. 28: 367-383.

Abstract

Three different plastic films of biaxially oriented polypropylene (BOPP), biaxially oriented polyethylene terephthalate (BOPET) and low-density polyethylene (LDPE) were perforated using Nd-YAG laser. Effects of laser pulse energy were examined by varying energies from 50 to 250 mJ where the pulse duration and pulse repetition were kept constant at 10 ns and 1 Hz, respectively. It was found that perforation diameters of all films increased with increasing pulse energies. Observed perforations were different among the three film types. Explanation was contributed to material inherent property and its interaction with laser. Incorporation of an inorganic filler (i.e. silica based anti-blocking agent used in packaging film) of 0.5 wt% into the LDPE films (0.5Si-LDPE) could improve perforation performance for LDPE. This was attributed to an increased thermal diffusivity of the 0.5Si-LDPE film. Commercial BOPET and BOPP films containing 97 microholes/m² (hole diameter of ~100 μm) showed an improvement in oxygen transmission rates (OTR) of 18 and 5 times that of the neat films without perforation. In the case of perforated 0.5Si-LDPE films having similar perforations of 97 microholes/m² and perforation diameter of 100 μm, a two-fold increase of OTR was obtained. Gas transmission rates of the microperforated films were measured based on the static method. Measured OTR and CO₂TR values of the three films with varying perforation diameters in a range of ~40–300 μm were compared and discussed. Overall results clearly indicate that perforation by laser is an effective process in developing breathable films with tailored oxygen transmission property for fresh produce packaging.

Keywords: /Modified Atmosphere Packaging/ /Fresh Produce/

PENICILLIUM EXPASUM

Lai, Tongfei, et. al. 2015. Inhibitory effect of exogenous sodium bicarbonate on development and pathogenicity of postharvest disease penicillium expansum. Scientia Hortic. 187: 108 - 114.

Abstract

Penicillium expansum, a widespread filamentous fungus, is a major causative agent of fruit decay and may lead to the production of patulin which causes harmful effects on human health. In this study, P. expansum isolated from naturally infected pears (*Pyrus bretschneideri* Rehd.) was identified by morphological observation and rDNA-internal transcribed spacer analysis. Then, the effects of exogenous sodium bicarbonate (NaHCO₃) on development and pathogenicity of P. expansum were evaluated in vitro and in vivo. Results indicated that NaHCO₃ at 0.6% (w/v) significantly ($P < 0.05$) reduced the germination of P. expansum conidia by up to 80% compared to the control after 10 h incubation. NaHCO₃ also showed good ability to inhibit germ tube elongation, mycelia expansion and hypha production of P. expansum. The lesion diameter and disease incidence of blue molds were markedly reduced by 0.6% NaHCO₃ treatment. Loss of membrane integrity was examined and quantified under 0.6% NaHCO₃ condition by the method of propidium iodide fluorescent staining. Furthermore, we found that NaHCO₃ obviously affected the relative expressions of four genes involved in patulin biosynthesis and effectively prevented patulin accumulation. These data will provide theoretical foundations for improving the application potential of NaHCO₃ on postharvest horticulture pathogens control.

Keywords: /Penicillium Expansum/ /Pathogenicity/Patulin/ Antifungal activity

PHYTOCHEMICALS

Gil, M.I. 2015. Pre- and postharvest strategies to enhance bioactive constituents of fruits and vegetables. Acta Hort. 1079: 95 - 106.

Abstract

In addition to vitamins, minerals, and dietary fibre, fruits and vegetables provide a whole range of non-nutrient constituents that have been suggested to be responsible for the health benefits associated with their consumption. Different strategies for increasing the health-promoting properties of fruits and vegetables have been explored. Successful examples of breeding and selection challenge for new cultivars have been described. An important strategy for growers to maximize specific phytochemicals is that the plants should be grown in open environments rather than in greenhouses. Solar radiation affects the production of phytochemicals involved in plant defence responses. Greenhouse grown plants have lower levels of phytonutrients due to the combined effects of higher temperatures and lower light

intensities. To date, agricultural practice recommendations have been established primarily for productivity goals, but not as a way to increase the phytonutrients. However, agricultural practices including type and rate of fertilization, irrigation and time of harvest can also be managed to enhance the content of bioactive compounds. It is difficult to draw definitive conclusions from data that prove more benefits to the organic vs. conventional agricultural practices. High doses of organic fertilizers can promote plant growth and decrease the content of bioactive compounds. Management of water frequency is critical for the yield and postharvest quality. Different beneficial phytochemicals tend to reach optimal levels around harvest maturity stage. Some flexibility exists for growers to harvest within a window of opportunity, but it seems evident that immature and over mature vegetables will contain lower concentrations of some important phytochemicals. Baby and multi leaves are excellent raw materials with high content of bioactive compounds. The effect of fresh-cut processing can increase the content of bioactive compounds which can be preserved under optimum storage conditions.

Keywords: /Phytochemicals/ /Anthocyanins/

POSTHARVEST

Ferguson, I.B. 2015. Minor crops – major problems and how they inform postharvest understanding. Acta Hort. 1079: 41-46.

Abstract

Much of our current knowledge on fundamental postharvest responses of fruit and vegetables has come from model crops such as tomato, and from major temperate crops such as apple and stonefruit. However, subtropical and tropical fruit crops are a large component of global fruit consumption, are economically and nutritionally important in many developing countries, and have some of the most intractable postharvest problems. We can learn much from studying the postharvest physiology and biochemistry of such crops. Recent work on loquat, mangosteen, and Chinese bayberry fruit highlights novel and fundamental issues concerning fruit ripening, low temperature responses and traits such as colour and texture.

Keywords: /Postharvest/ /Mangosteen/ /Loquat/ /Fruit Quality/ /Storage/

POSTHARVEST BIOLOGY

Labavitch, J.M., et. al. 2015. Cell wall metabolism: the yin and yang of fruit **postharvest biology**. Acta Hort. 1079: 27 - 40.

Abstract

For the fruit postharvest physiologist, discussions of cell wall metabolism initially bring to mind the processes associated with the fruit softening that occurs during ripening. Fruit softening traditionally has been equated to the series of apoplast-localized events that lead to textural changes, which are desired by most consumers. Among these events, the enzyme-catalyzed breakdown and solubilisation of cell wall polysaccharides are considered to be crucial in most fruit. The goal of this paper is to help us to see fruit softening in terms of a series of mechanistically connected wall metabolism processes that ends with the familiar texture changes, but which may influence a good deal more of the developmental and metabolism transitions that occur as a fruit ripens. Yin and Yang are terms that describe the apparently opposing, but occasionally complementary, sides of the same entity. The postharvest biologist certainly must apply this perspective to his/her view of the ripening fruit's cell wall metabolism. In general, the most costly fruit postharvest management problems are associated with poorly controlled ripening (the softening aspects, in particular) and losses to pathogens. Our work with tomato fruit demonstrates a Yin/Yang-like connection between (1) the wall metabolism events that control ripening and (2) the processes that convert an unripe, pathogen-resistant tomato to a fully ripe, pathogen-susceptible fruit. A biologist who studies the evolution of angiosperms would most likely see the ripening fruit's softening and increasing pathogen susceptibility as behaviors that contribute to seed dispersal and the eventual success of well-adapted species. A longer-term goal of this research is to understand the genetic basis of this linkage and then sever it, thus enabling the delivery of ripe and pathogen-free fruit to consumers.

Keywords: /Postharvest Biology/ /*Botrytis cinerea*/

POSTHARVEST TECHNOLOGIES

Crisosto, C.H., L. Ferguson and J. Rodriguez-Bermejo. 2015. Emerging **postharvest technologies**. Acta Hort. 1079: 47 - 52.

Abstract

Over the last decade, the fruit quality concept has evolved from a large bright red color to a flavorful, healthy, 'ready-to-eat', 'easy-to-eat', and safe fruit with high consumer acceptance. Current consumer preferences, hand labor costs, fruit prices, human safety concerns, and global markets have been forcing changes in the production and delivery of fresh fruit. Immediately after harvest, fruits begin to senesce, deteriorate and postharvest losses occur. As part of the fruit senescence process, commodities start to lose weight, firmness, flavor, and become more susceptible to cold storage stresses. Temperature and other environmental factors surrounding commodities control the biological processes associated with fruit senescence and deterioration. Breeding efforts using new genetic tools are now

used to develop fruit that ripen uniformly in the canopy with diverse predominant visual, shape, flavor, and texture attributes; and physiological traits at ripening adapted to minimally processed fruit. Because of recent advances in new nondestructive sensor technology and the long-term lack of flavor in the market, there is high interest in using non-destructive sensors to segregate fruit in the packing line according to their postharvest/ shelf life potential and consumer acceptance. However, consumers should be willing to pay a premium to justify the extra cost of using any new non-destructive sensor technology.

Keywords: /Postharvest Technologies/ /Nondestructive/

SHELF LIFE

Castellanos, D.A. and O.H. Anibal. 2015. Mathematical models for the representation of some physiological and quality changes during fruit storage. J. Postharvest Technol. 03 (01): 018 - 035.

Abstract

In fruits and vegetables, certain physiological processes, such as respiration and transpiration, and quality properties, such as color, firmness or weight, are used as consumer-based criteria of acceptability and shelf-life indicators. Changes in the rates of oxygen consumption, carbon dioxide and water vapor generation and product quality properties result from a series of biochemical processes. These processes are affected by internal conditions such as the ripening state and by external conditions such as temperature or environmental gas concentration. Understanding the time-progress of these processes and properties, according to variables that affect the product, and the mathematical models that regulate them, would be beneficial in selecting the most appropriate storage and preservation conditions to meet determined quality and shelf-life requirements. This manuscript describes the effect of postharvest storage conditions on biochemical and physiological processes related to respiration and transpiration and on quality property changes. Moreover, equations developed by many authors that describe the changes in these processes and properties according to storage conditions are reported.

Keywords: /Shelf-life/ / Postharvest storage/ /Respiration/ / Transpiration/

SOFTENING

Vicente, A.R., et. al. 2015. Role of “well known” proteins on cell wall degradation and **softening**. Acta Hort. 1079: 61 -70.

Abstract

Fruit softening has been largely associated with cell wall degradation by a number of loosening proteins. Firmness is a major quality attribute of fresh cherries and also an important factor affecting the susceptibility to postharvest rots. By analyzing the solubilization, depolymerization and composition of pectins and hemicelluloses in cultivars with contrasting firmness we found that the pattern and extent of their wall disassembly was quite similar. No marked pectin or hemicellulose depolymerization was observed and a similar reduction in tightly bound pectins and hemicellulose was detected in both cultivars during ripening. However, firm cherries presented pectic polymers with lower proportion of neutral sugars compared to uronic acids, suggesting that the variation in total wall polysaccharide and the branching of pectins assembled early in development or the proportion of homogalacturonan (HG) to type rhamnogalacturonan-I (RG-I) may contribute to the differences in firmness between cultivars. Dismantling of the cell wall by the action of relatively “well known” loosening agents is involved in the progressive softening occurring during ripening. Two of these proteins include polygalacturonases (*PG*) which are known to hydrolyze homogalacturonans and expansins (*Exp*) believed to participate in the relaxation of the cell wall by reducing hydrogen bonding between cellulose microfibrils and xyloglucan. We investigated the *in vivo* roles of these wall-disassembling proteins, by over expressing *PG* and *Exp1* both alone and in combination in a non-ripening *rin* tomato background. The simultaneous over expression of *PG* and *Exp1* in *rin* fruit restored softening in these non-ripening fruit. Unexpectedly, *PG* over expression resulted in higher hemicellulose depolymerization while increased levels of *Exp1* accelerated pectin turnover. This shows that besides their “well known” *in vitro* functions these proteins act *in muro* by facilitating the degradation of non-directly targeted wall components, likely by increasing the accessibility of pre-existing wall-degrading proteins to their polysaccharide substrates.

Keywords: /Softening/ /Cherry Tomato/

STORAGE

Joas, J., et. al. 2015. Exploiting the responses to abiotic constraints towards a better understanding of fruit physiology, ripening and quality. *Acta Hort.* 1079: 137-144.

Abstract

Environmental constraints are known to have some incidence on nutritional quality and physical characteristics of fruits. Responses of the plant to abiotic stresses are often characterized by changes in its oxidative status. For example, water stress applied on tomato plants enhanced the synthesis of reactive oxygen species (ROS), accompanied by an increase in ascorbate (AsA) content in the fruits. In the same way, an oxidative burst brought about shading leaves of citrus led to an increase in AsA and carotenoid contents in the fruit. These responses observed at the fruit level in planta can also be induced after harvest. So, after harvest and ripening, the activities of catalase and peroxidase were higher in the peel of mango fruit well-exposed to light, compared to fruit inside the canopy. In addition, AsA and carotenoid contents were higher in well-exposed fruits, while sugar content and titratable acidity (TA) remaining similar. Analogous changes were observed for mango fruits stored at different temperatures before ripening, with a graduated ROS response in ripe fruits. Sugar content and TA were similar in all fruits, but the final content of AsA and carotenoids were respectively negatively or positively correlated to storage temperature. These results confirm the role of the oxidative stress in the build-up of some quality criteria, for moderate stress. In addition to the environmental conditions, the maturity stage at harvest affects the postharvest ripening of climacteric fruit. Maturity stage at harvest of mangoes had an incidence in some hormonal balance such abscissic acid and ethylene. So, in addition to their impact on fruit physiology through the oxidative stress, it could be suggested that abiotic constraints could impair ripening metabolism. Therefore, investigations are required for a better understanding in the relationship between hormonal balance and the role of signaling pathways by oxidative stress in ripening metabolism.

Keywords: /Storage/ /Temperature/ /Tomato/ /Mango/

SUPPLY CHAIN

Hou, Mohamed Ait, Cristina Grazia, and Giulio Malorgio. 2015. Food safety standards and international **supply chain** organization. a case study of the Moroccan fruit and vegetable exports. *J. Food Control* 55: 190 - 199.

Abstract

This paper addresses the issue of international food supply chain organization faced to food safety standards. The case of Moroccan fruit and vegetable supply chain is taken as an example. The dynamics of Moroccan food safety legislation and regulatory systems and the measures taken to facilitate export ex-ante compliance capacity with target market requirements are analysed. The results of a direct survey on producers/exporters in the Souss Massa Region are presented. Operators are classified according to the typology of vertical linkages in producers/exporters, pure exporters, and cooperatives. The relations among the typology of operators,

targets markets, prevailing modes for food safety governance, and compliance costs and benefits with food safety standards are discussed.

Keywords: /Supply Chain/ /Fruits/ /Vegetables/ Food Safety/

FRUITS

APRICOT

Wu, B., et. al. 2015. Effects of different postharvest treatments on the physiology and quality of Xiaobai **apricots** at room temperature. J. Food Sci. Technol. 52 (4). 2247 - 2255.

Abstract

The effect of postharvest treatments on storage characteristics of harvested apricots in relation to fruit quality was investigated. 'Xiaobai' apricots treated with 1-methylcyclopropene (1-MCP), chlorine dioxide (ClO₂), calcium, and heat in sealed container and then stored at 20 °C with 90 % relative humidity (RH) for 10 days. Results showed that the treatments could reduce respiration production and MDA content, delay softening, postharvest decay, the decrease of soluble solids (SSC), and visual changes. Furthermore, the polyphenol oxidase (PPO), polygalacturonase (PG), and pectin methylesterase (PME), superoxide dismutase (SOD), catalase (CAT), peroxidase (POD) activities were reduced by treatments. Taken together, it is suggested that ClO₂ treatment might be an effective way to maintain the quality of apricot fruit except 1-MCP treatment.

Keywords: /Apricots / Quality / 1-MCP / /Calcium Treatment / /Heat Treatment/

BLUEBERRY

Hu, M.H., et. al. 2015. Estimating **blueberry** mechanical properties based on random frog selected hyperspectral data. Postharvest Biol. & Technol. 106: 1 - 10.

Abstract

A hyperspectral reflectance and transmittance imaging system was developed to non-destructively evaluate the comprehensive mechanical properties of blueberry. Reflectance and transmittance spectra were extracted from segmented hyperspectral images of whole fruit and correlated with fruit mechanical properties obtained from texture profile analysis and puncture analysis using least squares-support vector machine. A random frog spectral selection approach was applied to collect informative wavelengths. Prediction models based on random frog selected reflectance and transmittance spectra gave similar results to those based on respective full spectra. Combined spectra with single random frog, which were obtained by combining random frog selected reflectance and transmittance into one

spectral vector, were feasible for predicting hardness, springiness, resilience, force max and final force, with Rp (RPD) values of 0.86 (1.78), 0.72 (1.73), 0.79 (1.78), 0.77 (1.51) and 0.84 (1.72), respectively. When applying random frog again for combined spectra with single random frog, the obtained models were also satisfactory with fewer wavelengths. In conclusion, the use of hyperspectral reflectance and transmittance as well as their combined spectra, coupled with random frog approach, showed a considerable potential for predicting blueberry mechanical properties.

Keywords: /Blueberry/ /Mechanical Properties/ /Hyperspectral Imaging/

CANTALOUPE

Forney, C.F., et. al. 2015. Impact of heat sanitation of fresh whole **cantaloupe** on fruit quality and volatile metabolism. Acta Hort. 1079: 145 - 152.

Abstract

Harmful microorganisms can contaminate fresh fruits and vegetables and with this cause outbreaks of foodborne illness. Therefore, mitigation strategies are needed to eliminate or restrict the multiplication of potential pathogens while maintaining fresh produce quality. This study assessed a vapour heat treatment on the control of *Listeria* on whole fresh cantaloupes (*Cucumis melo*) and its impact on quality, composition and fruit physiology. Fruit inoculated with *Listeria innocua*, a non-pathogenic surrogate of *Listeria monocytogenes*, were treated with 84°C vapour heat for 240 s, followed by storage at 4, 7 or 10°C for 0, 7, 10 or 14 days. At these times, fruit were analyzed for visual appearance, firmness, soluble solids, titratable acidity, flesh colour, respiration rate, and volatile production. On average, the heat treatment achieved 4-log reductions in surrogate pathogen densities. However, the heat treatment caused discoloration of the rind affecting the visual quality of whole fruit. No discoloration or deterioration of flesh tissue, change in flesh firmness, soluble solids or titratable acids was associated with the heat treatment. Fruit respiration measured after warming fruit to 20°C was reduced in heat-treated fruit throughout storage, averaging a CO₂ production rate of 16.2 compared to 38.2 mg/kg h for non-heated fruit. This suggested permanent physiological damage occurred to the rind tissue. Heat treatments reduced acetaldehyde, had no effect on ethanol and increased ethyl acetate emissions. Storage at 10°C stimulated the emission of all three volatiles. The heat treatment stimulated the production of methyl, ethyl and acetate esters, but inhibited ester production during storage at temperatures that induced ripening. The vapour heat treatment was an effective sanitation treatment, but caused injury to the melon rind. Therefore, this treatment has potential to ensure safety of fresh-cut melon products.

Keywords: /Cantaloupe/ /Vapour Heat Treatment/

CARAMBOLA

Mustafa, M.A., et. al. 2015. The role of the ubiquitous phenolic compound salicylic acid in chilling tolerance of **carambola**. Acta Hort. 1079: 679 – 684.

Abstract

Carambola is a tropical fruit containing an abundance of phenolic acids and flavonoids. Low temperature storage is an effective tool for extending its shelf life, however, the fruit is particularly prone to chilling injury. Salicylic acid, as a stress hormone, plays a role in the induction of resistance related enzymes and has been shown to increase chilling tolerance. In this study, freshly harvested carambola were treated with 0.1 and 1 mM of salicylic acid and subjected to cold storage at 6°C for two weeks. Phenolic content, ascorbic acid content and the enzyme activity of peroxidase (POD) and polyphenol oxidase (PPO) were monitored during the storage period. The salicylic acid treatments resulted in increased ascorbic acid levels as well as POD and PPO enzyme activities, although these increases were brief and were not observed at the same time points during the storage period for the three parameters. Meanwhile, total phenolic content peaked for the fruits at the same time point as ascorbic acid, but the highest peak was observed for the untreated control. In spite of the results observed for total phenolic content, salicylic acid does appear to play a protective role in the fruits and has a potential to be exploited for maintaining the quality of these perishable commodities during cold storage.

Keywords: /Carambola/ /Abiotic Stress/

CITRUS

Defraeye, Thijs, et. al. 2015. Feasibility of ambient loading of **citrus** fruit into refrigerated containers for cooling during marine transport. Biosystem Eng. 134: 20 - 30.

Abstract

As an alternative to forced-air precooling, warm loading of citrus fruit into refrigerated containers for cooling during marine transport was explored. This practice could provide several logistic and economic savings. Although successful for resilient citrus fruits, the cooling process and performance of ambient loading have not been explored in a systematic manner. There is still a considerable potential to optimise the implementation of the technique and to apply it to more sensitive citrus or other fruits. Calculations identified the required cooling capacity of a refrigerated container as a function of the envisaged fruit cooling time, and these were complemented by a full-scale experiment. Although a refrigerated container was theoretically able to cool the produce in less than 5 days, the experiment showed that these cooling rates are not currently achieved in practice, bearing in mind that step-down cooling was applied. Future improvements in the

technique point towards an improved box design and better stacking on the pallet, and to reducing airflow short-circuits between pallets.

Keywords: /Citrus/ /Cold Chain/ /Precooling/ /Export/ /Refrigerated Container/

Ma, Qiaoli, et. al. 2015. Fluroxypyr—a potential surrogate of 2,4-dichlorophenoxyacetic acid for retarding calyx senescence in postharvest **citrus** fruit. *Postharvest Biol. & Technol.* 105: 17 - 25.

Abstract

Searching for an effective and safer alternative to the citrus fruit preservative 2,4-dichlorophenoxyacetic acid (2,4-d) is an issue of common concern in citrus-producing countries. In this study, 27 structural and functional analogues of 2,4-d were preliminarily selected from ZINC database by computer virtual screening. Four varieties of fresh citrus fruits harvested from three consecutive mature seasons were applied in experimental tests, aiming to precisely evaluate the preservation effects of the selected analogues by a comprehensive comparison with the corresponding indices of 2,4-d. The results indicated that fluroxypyr, which has lower toxicity than 2,4-d, significantly reduced calyx senescence and fruit decay without affecting the internal quality of the fruit. Therefore, it can be speculated that fluroxypyr can be an effective and safer alternative to 2,4-d for the preservation of citrus fruits in storage.

Keywords: /Citrus/Fruit Quality/

Custard Apple

Vyas, P.B., T.V.R. Rao, and V.R. Thakkar. 2015. Combined effects of chemical and physical elicitors on postharvest quality of **custard apple** *Annona squamosa* L., cv. Balanagar. *Scientia Hort.* 187: 50 - 57.

Abstract

The effect of the hot water (i.e. 45 ° C and 50 ° C) with six different combination treatments of 2 mM salicylic acid and 1% calcium chloride on the qualitative properties of custard apples stored at 25-27 ° C (60-70% R.H.) were investigated at a regular interval of 2 days under the present conditions. The biochemical analyses of the custard apples of the experimental set revealed that they retained the higher amount of ascorbic acid and showed delay in their ripening as compared to that of the fruits of the control set. The fruits treated by the hot water treatment (45 ° C) were effective in the maintenance of the lower activity of some of the enzymes responsible for the cell wall degradation and softening. Among all of the treatments tested under the current study, the treatment of 50 ° C

+ 2 mM salicylic acid and 1% calcium chloride could preserve the custard apples for up to 8 days as compared to only 4 days of the untreated custard apples.

Keywords: /Custard Apple/ / Calcium Chloride/ Fruit/ Hot Water Treatment/ Salicylic Acid/

FIG

Villalobos, M.C., et. al. 2015. Effect of modified atmosphere packaging on the antioxidant activity and total phenolic content in Albacor **figs**. Acta Hort. 1079: 573 - 580.

Abstract

Fig (*Ficus carica* L.) is an excellent source of nutrients and bioactive compounds that contribute to a healthy diet. However, they are highly perishable after harvest with limited shelf life period. The aim of the present study was to evaluate the effects of different equilibrium modified atmospheres (EMAP) generated through different microperforated biaxially oriented polypropylene (BOPP) films with different gas permeation on functional properties. Figs from the cultivar 'Albacor' were packaged using different films: macro-perforated film (control: C), microperforated film with 16 holes (M10), microperforated film with 5 holes (M30) and microperforated film with 3 holes (M50). Figs were then stored at 0°C and 90-95% relative humidity in darkness for 21 days. Gas composition, molds and yeast counts and functional properties such as total phenolic content (TP) and total antioxidant activity (TAA) of skin and flesh were analyzed at day 0 and after 7, 14, 17 and 21 days of cold storage. M50 film reached the highest CO₂ and lowest O₂ levels (10 and 11.95 kPa, respectively) within packages and showed an inhibitory effect on mold and yeast growth. TP and TAA levels were shown to be higher in skin compared to flesh. Conversely, in the control treatment the TAA level in skin decreased after 21 days of storage, whereas figs packaged in microperforated films maintained or increased their TAA levels. Additionally, figs stored under microperforated films presented higher TP and TAA levels in flesh than control fruit during cold storage. Therefore, figs packaged under modified atmospheres with microperforated films, especially M50 film, showed a positive effect for the maintenance of phytochemical content and delayed the incidence of postharvest disorders.

Keywords: /Fig/ /Modified Atmosphere Packaging/ / Total Phenolics/ /Antioxidant/

GOLDENBERRY FRUIT

Yıldız, G., et. al. 2015. Physical and chemical characteristics of **goldenberry fruit** *Physalis peruviana* L. J. Food Sci. Technol. 52(4). 2320 - 2327.

Abstract

Some physical and chemical characteristics of goldenberry fruit (*Physalis peruviana* L.) were investigated. These characteristics are necessary for the design of equipments for harvesting, processing, transportation, sorting, separating and packing. The fruit length, diameter, geometric and arithmetic mean diameters, sphericity, surface area, projected areas (vertical-horizontal) and aspect ratio of goldenberries were determined as 17.52 mm, 17.31 mm, 17.33 mm, 17.38 mm, 98.9 %, 0.949 cm², 388.67–387.85 mm² and 0.988, respectively. The mass of fruit, bulk density, fruit density, porosity and fruit hardness were 3.091 g, 997.3 kg/ m³, 462.3 kg/m³, 53.61 % and 8.01 N, respectively. The highest static coefficient of friction was observed on rubber surface, followed by stainless steel sheet, aluminum sheet, and plywood materials. The dry matter, water soluble dry matter, ash, protein, oil, carbohydrate, titratable acidity, pH, total sugar, reducing sugar, antioxidant capacity were 18.67 %, 14.17 %, 2.98 %, 1.66 %, 0.18 %, 13.86 %, 1.26 %, 6.07, 63.90 g/kg, 31.99 g/kg and 57.67 %, respectively. The fresh fruits have 145.22 mg gallic acid equivalent (GAE)/100 g total phenol content and skin colour data represented as L*, a*, b*, Chroma (C) and Hue angle (α) were 49.92, 25.11, 50.23, 56.12 and 63.48, respectively.

Keywords: /Goldenberry/ /Fruit Hardness/ /Colour/

GRAPEFRUIT

Lado, J., et. al. 2015. Resistance to chilling injury in red, lycopene-accumulating tissue of cold-stored **grapefruits**. *Acta Hort.* 1079: 249 - 256.

Abstract

Grapefruits are widely recognized by their extreme sensitivity to develop chilling injury (CI) during postharvest storage at low temperature. Moreover, many cultivars and mutants of grapefruits exhibit important differences in both external and internal coloration, from yellow to deep red, due to a distinctive accumulation of the red carotene lycopene. Thus, in this study the genetic variability in external peel coloration of grapefruits has been used to examine the potential relationship between carotenoid content and composition, and susceptibility to CI. CI increased progressively after 2 weeks storage at 2°C in fruit of the yellow grapefruit 'Marsh' (M) but in the fruits of red cultivar 'Star Ruby' (SR) CI symptoms were exclusively restricted to the yellow areas of the peel. Thus, CI was absent in red peel tissue, even after prolonged cold storage, in which lycopene content was about 14-times higher than in yellow tissue. In addition, SR grapefruits growing under shaded conditions developed an intense external red coloration and accumulated large amount of lycopene, and were also highly resistant to CI upon subsequent postharvest cold storage. To further explore the mechanisms involved in the resistance to CI induced by lycopene, total antioxidant activity was determined in

yellow and red peel tissue of grapefruit, and the potential relationship between carotenoids and the development of CI is discussed.

Keywords: /Grapefruit/ /Chilling Injury/

GRAPES

Flores, Gema, G.P. Blanch, and M.L.R. del Castillo. Postharvest treatment with - and + methyl jasmonate stimulates anthocyanin accumulation in **grapes**. LWT - Food Sci. & Technol. 62: 807 - 812.

Abstract

The effect of the postharvest application of (À) and (b)-methyl jasmonate (MJ) enantiomers on grapes antioxidant capacity, total phenolic compounds and anthocyanin concentration was examined on days 5 and 7 after treatment. The study also includes grapes treated with MJ racemic mixture and grapes without treatment (control) for comparison. Exogenous application of MJ induced an enhancement in the antioxidant activity and total phenolic compounds when compared to control grapes; this increase was higher when the enantiomers, rather than the mixture, were used (up to 42% for the antioxidant activity and for total phenolic compounds). Similarly, a significant increase was also registered in the total anthocyanin concentration when the enantiomers were applied. This increase ranged from 14 % to 42 % after 5 days of storage and from 22 % to 64 % when grapes were stored for 7 days. It was also observed an enhancement on individual anthocyanin concentration when the enantiomers were used. Nevertheless, no effects were observed on the anthocyanin relative distribution as a consequence of (À/b)-MJ, (À)-MJ and (b)-MJ treatment. Postharvest treatment of grapes with MJ enantiomers is proposed as means to increase antioxidant activity and anthocyanin concentration in grapes.

Keywords: /Grapes/ /Antioxidant/Functional Foods/

Wu, Ziming, et. al. 2015. Heat acclimation reduces postharvest loss of **table grapes** during cold storage - analysis of possible mechanisms involved through a proteomic approach. Postharvest Biol. & Technol. 105: 26 - 33.

Abstract

In this study, a combined biochemical and proteomic approach was used to investigate changes of fruit quality and protein expression profiles of grape berries upon hot water treatment (HWT) during the subsequent 45 days of cold storage. HWT obviously inhibited postharvest loss and chilling damage by reducing weight loss and membrane damage and slowing fruit softening. Proteomic analysis allowed the identification of 64 proteins regulated by heat treatment. Most of the up-regulated proteins in heat-treated grape berries were related to defense response

and redox metabolism, suggesting a physiological adaptation to environmental stress. In addition, the increased expression of proteins associated with carbohydrate and energy metabolism immediately after HWT provided a molecular explanation for the rapid decline of soluble sugar content observed in heat-treated grape berries, which might be necessary for activation of the energy-demanding defense response to storage environmental stress, thereby reduced postharvest loss during storage at low temperature.

Keywords: /Table Grapes/ /Cold Storage/ /Fruit Quality/ /Heat Treatment/

GUAVA

Bishnoi, Chetak, R.K. Sharma and S. Siddiqui. 2015. Effect of modified atmosphere on biochemical parameters and shelf life of **guava** *Psidium guajava* L. cv. Hisar Safeda and L49. *J. Postharvest Technol.* 03 (01): 014 - 017.

Abstract

An experiment was conducted to study the effect of different durations of modified atmosphere on bio-chemical parameters and shelf life of guava under ambient conditions. Fruits were packed in perforated polyethylene bags (LDPE) of thickness 300 gauge and then stored at 8°C in BOD incubator for the periods 1, 2, 3 and 4 days. After respective durations of storage under MA at 8°C, fruits were removed from MA and packed in CFB and stored at ambient temperature. Fruits were sampled at every day for various bio-chemical pigments of guava. Among different durations of MA storage, the maximum total sugars and reducing sugars was recorded in the fruits stored for 0, 1 and 2 days and minimum in the fruits stored in MA for 4 days. The fruits stored in MA for different durations maintained high phenol contents and recorded maximum phenol in the fruit stored in MA for 4 days and minimum in control fruits. Higher retention of chlorophyll was recorded in the fruits stored in MA for 4 days while lesser carotenoids were recorded in fruit stored in MA for 4 days. Carotenoids content increased and chlorophyll content decreased with the increase in storage period in both the cvs Hisar Safeda and L-49 (Sardar).

Keywords: /Guava/ Modified Atmosphere/ Shelf life/

JUJUBE

Yan, Jiaqi, et. al. 2015. Enhanced resistance of **jujube** *Zizyphus jujuba* Mill. cv. Dongzao fruit against postharvest *Alternaria* rot by aminobutyric acid dipping. *Scientia Hort.* 186. 108 - 114.

Abstract

Considerable losses of jujube (*Zizyphus jujuba* Mill. cv. Dongzao) fruit caused by *Alternaria* rot often occurred during storage. In order to evaluate effects of ^N_L-

aminobutyric acid (BABA) on the infection on jujubes by *Alternaria alternata*, the fruit were dipped in BABA solutions and then inoculated with the pathogen. Results showed that BABA dipping at concentrations of 0.5, 1.0 and 2.0 g L⁻¹ significantly ($P < 0.05$) reduced disease incidence and lesion area on the fruit inoculated with *A. alternata*, whereas BABA did not affect conidial germination and mycelial growth of the pathogen in vitro. In addition, BABA reduced natural infection and postharvest softening of jujubes during the storage at 0 °C and 85–95% relative humidity. Biochemical evaluations revealed that BABA enhanced activities of defence-related enzymes including peroxidase, phenylalanine ammonia-lyase and chitinase of the fruit. BABA altered antioxidant metabolism to trigger disease resistance by significantly ($P < 0.05$) decreasing catalase activity but increasing superoxide dismutase activity and ascorbic acid content in jujubes. These results suggested that the protective effects of BABA dipping on jujubes might be due to its ability on activating several highly coordinated defence-related responses of the fruit against infection, instead of its direct antifungal activity on the pathogen. These findings suggested that application of BABA would offer a promising approach for controlling postharvest disease and improving storage quality of horticultural products.

Keywords: /Jujube/ /*Alternaria Rot*/

KIWIFRUIT

Park, Yong Seo, Myeng He Im and Shela Gorinstein. 2015. Shelf life extension and antioxidant activity of Hayward **kiwi fruit** as a result of prestorage conditioning and 1-methylcyclopropene treatment. *J. Food Sci. Technol.* 52(5):2711 - 2720.

Abstract

Kiwi fruits (*Actinidia deliciosa* C.F. Liang et A.R. Ferguson) were treated by prestorage conditioning (20 °C for 2 days), 1-methylcyclopropene (1-MCP, 1 ppm for 16 h) and conditioning plus 1-MCP. After the treatment the fruits were immediately stored at 0 °C during 24 weeks. Flesh firmness gradually decreased with storage time and the rate of its loss was lower in 1-MCP and conditioning plus 1-MCP treatments than those of control or conditioning. However, SSC, acidity and pH did not change among treatments. Starch content decreased during the storage time regardless of treatments. Oppositely the amount of reducing sugars increased at the same duration of the treatments. Rate and incidence of fruit decay was the lowest in fruit treated with conditioning plus 1-MCP treatment. Fruit decay mainly caused pathogen *Botrytis cinerea* and its rate significantly decreased with conditioning plus 1-MCP treatment. Ethylene and respiration abruptly increased after 8 weeks of storage, but their contents were lower in 1-MCP and conditioning plus 1-MCP. Total soluble phenolics, flavonoids, and total antioxidant capacities were much higher than in other treatments. Kiwi fruits treated with conditioning plus 1-MCP extended the shelf life by reducing the rate of fruit decay and softening during

the storage. The bioactive compounds and total antioxidant status of fruits increased during the treatment.

Keywords: /Kiwifruit/ /Firmness/ / Fruit Decay/ / Ethylene/ Antioxidants/

Zhao, J.M., J.E. Bronlund and A.R. East. 2015. Effect of cooling rate on **kiwifruit** firmness and rot incidence in subsequent storage. Acta Hort. 1079:313 - 318.

Abstract

Temperature management is critical in maintaining quality and extending market life of 'Hayward' kiwifruit in the supply chain. In industry, harvested kiwifruit are pre-cooled using the forced draft cooling method to remove field heat. Removal of field heat reduces the rate of deterioration as fruit metabolism and growth of spoilage microorganisms are both lowered. Usually, rapid cooling is recommended to extend fruit storability and quality. This study investigates the change in kiwifruit firmness during storage as influenced by cooling profile to the storage temperature. Commercially produced 'Hayward' kiwifruit (*Actinidia deliciosa*) were either directly cooled (3 d) or gradually cooled (2 weeks) to storage temperature of 0°C and subsequently stored for up to 25 weeks. Fruit firmness and respiration rate measurements were conducted every 2 to 3 weeks across the storage period. Fruit that were cooled in 3 d had higher proportion of unmarketable fruit after 120 d of storage in comparison to fruit that were cooled in 2 weeks. After 40 d of storage, fruit cooled in 3 d displayed a more rapid average softening rate. An increase in respiration rate was observed in rapidly cooled fruit after 120 d, possibly due to the stress caused by chilling injury. Higher incidence of rotten fruit was found in fruit that were cooled in 2 weeks. This study suggests that gradual cooling allows kiwifruit to acclimatise to future low temperature storage conditions, implying that rapid cooling to storage temperature may not essentially improve the marketable life. On the other hand, gradual cooling increases the risk of rot development, possibly enabling the spoilage microorganism to advanced development initially. Controlled gradual cooling of fruit is impractical with the large harvest volumes of industry. Hence, there is a need to find an optimal cooling rate which removes field heat as applicable to industry.

Keywords: /Kiwifruit/ /Softening/ /Cooling/

LONGAN

Chen, Mengyin, et. al. 2015. Effects of adenosine triphosphate ATP treatment of postharvest physiology, quality and storage behavior of **longan** fruit. Food Bioprocess Technol. 8: 971 - 982.

Abstract

The effects of adenosine triphosphate (ATP) on postharvest physiology, quality, and storage behavior of harvested longan fruit were investigated. Fruit of "Fuyan" longan were dipped in 0.8 mM ATP solution or distilled water (control) for 20 min. The fruit were dried prior to packaging and then stored at 28 °C and 90 % relative humidity. The results showed that as compared with control fruit, application of ATP could significantly reduce fruit respiration rate; delay an increase of cell membrane permeability in pericarp; maintain higher contents of chlorophyll, carotenoid, anthocyanin, and flavonoid; and subsequently retard the change of apparent color on longans. In addition, lower polyphenol oxidase (PPO) activity and higher total phenolics content were also found in ATP-treated fruit, which contributed to lower browning index in longan pericarp. The application of ATP could effectively inhibit the decreases in contents of total soluble solids (TSS), total soluble sugars, and vitamin C with a limited increase of titratable acidity (TA) content in pulp, which maintain better quality and flavor in longan pulp. Furthermore, ATP treatment could keep a higher rate of commercially acceptable fruit, effectively prevent weight loss from longans, and retard the developments of aril breakdown and fruit disease in longan fruit. It could be concluded that 0.8 mM ATP treatment for 20 min could greatly delay longan fruit senescence, maintain higher fruit quality, and exhibit better storage behavior which might suggest a promising method for keeping quality and extending the shelf life of harvested "Fuyan" longan fruit.

Keywords: / Longan/ /Postharvest Physiology/ /Quality/ /Storage/

LOQUAT

Canete, M.L., et. al. 2015. Ripening degree at harvest factors affects bruising susceptibility and fruit sensorial traits of **loquat** *Eriobotrya japonica* Lindl. Scientia Hort.187. 102 - 107.

Abstract

Loquat is a subtropical fruit crop of growing interest in international markets. Loquat harvesting is commercially programmed based on fruit skin color. Unfortunately, loquat fruits are usually picked before reaching full ripening due to the enormous importance of fruit earliness in loquat price and commercialization. A second reason for premature harvest is the high susceptibility of mature loquat fruit to mechanical damage during harvest and postharvest handling. Due to the non-

climacteric nature of this crop, premature harvest results in fruits that are excessively acid and taste unpalatable to consumers. This conflict between consumer preferences and growers' interests has been studied in others fruits. The present work analyses 'Algerie' loquat fruits picked at four different stages of maturation in order to determine their susceptibility to mechanical damage, fruit quality and consumer acceptance with a view to proposing the best fruit maturation stage for harvesting. The results showed that the maturation stage at harvest strongly affects bruising incidence due to a decrease in fruit firmness during ripening. Loquat fruit quality and potential consumers' acceptance also proved to be highly dependent on maturity stage at harvest. Both instrumental and sensorial analyses of the parameters of fruit quality clearly discriminated between the different stages of maturity. The results of the sensorial tests revealed the preference for light orange fruits (stage 4) rather than fully ripe ones (stage 5) due to their greater firmness, fewer skin defects and better balance between sweetness and acidity. Consequently, we propose harvesting loquat fruits with a minimum value of soluble solids content (10 ° Brix) and a soluble solids content/titratable acidity ratio close to 1.0 (° Brix/g malic acid L⁻¹) to guarantee eating quality and consumer satisfaction.

Keywords: /Loquat/ /Mechanical Damage/ / Maturity/ /Fruit Quality/ /Sensory Evaluation/ /Consumer Preference/

Liu, Yuexue, et. al. 2015. Cloning and expression analysis of a CCoAOMT homolog in **loquat** fruit in response to low-temperature storage. *Postharvest Biol. & Technol.* 105: 45 - 50.

Abstract

This study aimed to isolate the caffeoyl-coenzyme A 3-O-methyltransferase gene (CCoAOMT) of loquat (*Eriobotrya japonica* Lindl.) and to investigate the changes in the expression of this gene in loquat fruits that were stored at low temperature. When stored at 4 °C, the fruits of both tested cultivars ('Jiefangzhong' and 'Zaozhong No. 6') showed no obvious changes in appearance, while their firmness and lignin content increased gradually. Using the RACE technique, EjCCoAOMT was isolated, and the protein alignment indicated that this protein includes the typical 8 motifs belonging to the CCoAOMT protein family and shows high similarity with the other CCoAOMT-like proteins. Its expression in green loquat fruit was lower than that in mature fruit. Low-temperature storage stimulated its expression at the beginning of the storage process, and then the transcription levels decreased throughout the rest of the storage period. These results suggested that the increases in lignin content and firmness in loquat fruit stored at a low temperature may be caused by the induced increase in EjCCoAOMT expression at the initial storage phase.

Keywords: /Loquat/ /Low Temperature Storage/

Mango

Ngamchuachit, P., et. al. 2015. Influence of cultivar and ripeness stage at the time of fresh cut processing on instrumental and sensory qualities of fresh cut **mangoes**. Postharvest Biol. & Technol. 106. 11 - 20.

Abstract

Mango cultivar and ripeness stage at the time of cutting are important factors that consequently affect the quality of the fresh-cut mango product. In this study, physico-chemical and sensory qualities were measured instrumentally, with sensory descriptive analysis, and by consumer acceptance tests. All tests were performed on fresh-cut 'Kent' and 'Tommy Atkins' mangos from different initial ripeness stages (45 N, 35 N, and 25 N). Instrumental quality parameters (color, firmness, soluble solids, titratable acidity) and sensory descriptive analysis were assessed periodically during 9 days of storage at 5 °C. During storage, the sensory profile of fresh-cut 'Kent' mango was predominant in fruity aroma, overall aroma intensity and orange flesh color, whereas fresh-cut 'Tommy Atkins' had less aroma and orange flesh color, but had greater edge sharpness, edge fibrousness, moist and glossy appearance and fibrous texture. Fresh-cut mango consumers found the 'Kent' cultivar more desirable than 'Tommy Atkins'. The initial ripeness stage of 35 N for 'Kent' mango and 25 N for 'Tommy Atkins' mango were optimal ripeness stages for fresh-cut mango in terms of handling, visual quality, and quality maintenance during storage, and were also well received by consumers. The a^*/b^* value and instrumental firmness of 'Kent' mango were correlated well with edge sharpness, sensory hue, and tartness. In addition, the L^* value and instrumental firmness of fresh-cut 'Tommy Atkins' mango were demonstrated to be useful predictors for the texture attributes, including melting, slipperiness, chewiness and firmness. Interestingly, SSC and SSC/TA were not good predictors of sensory sweetness.

Keywords: /Mango/ / Consumer Acceptance/ Ripening/ /Firmness/ /Sensory/ /Sweetness/

Sothornvit, R. and P. Klangmuang. 2015. Active edible coating to maintain the quality of fresh **mango**. Acta Hort. 1079: 473 - 480.

Abstract

Mango is a climacteric and generally highly perishable fruit. Anthracnose disease is the main limitation to export mango. Edible coating on mango may slow down the rate of deterioration and reduce the anthracnose problem. The objective of this study was to determine the effect of an active edible coating amended with plai (P) (*Zingiber cassumunar*) essential oil (EO) on the postharvest quality of fresh

mangoes. A hydroxypropyl methylcellulose (HPMC)-based composite solution with or without plai EO was selected as edible coating to be applied on mango. Plai EO was incorporated into the HPMC-based edible coating to enhance the antimicrobial activity against *Colletotrichum gloeosporioides*, which is the cause of anthracnose. Fresh 'Namdokmai Sithong' mangoes were dipped in the active HPMC-based edible coating solution for 2 min, dried in a hot air oven at 40°C for 30 min and then stored at 13°C. Uncoated-untreated and water dipped mangoes were used as control treatments. Thus, the treatments studied were uncoated, water dipped, HPMC coating and HPMC-P coating. The edible HPMC-based coatings (HPMC and HPMC-P coatings) reduced weight loss, delayed firmness loss and external color changes and decreased disease severity of fresh mango compared to untreated and water dipped treatments. The incorporation of plai EO into the coating did not further improve antimicrobial activity of HPMC alone. Storage life of active ediblecoated mangoes was extended to 18 days at 13°C.

Keywords: /Mango/ /Quality/ /Anthracnose/

Ulloa, Jose Armando, et. al. 2015. Effect of soaking in noni *Morinda citrifolia* juice on the microbiological and color behavior of Haden minimally processed **mango**. *J. Food Sci. Technol.* 52(5): 3079 - 3085.

Abstract

The purpose of this study was to evaluate the effect of soaking in noni juice on the microbiological and color behavior of minimally processed mango. Two batches of Haden mango cubes were treated by immersion in noni juice for 2.5 or 5.0 min. Each batch was packed in polypropylene boxes and stored at 6 °C for up to 15 days; in addition, a control group of mango cubes was prepared by immersion in sterile water for the same duration. According to the results, the soaking of mango cubes in noni juice had an antimicrobial effect on mesophilic aerobic bacteria, molds and yeasts during storage at 6 °C for 15 days, without significantly ($P < 0.05$) affecting the CIE L*, a*, b*, chroma and hue angle values, in comparison with the control after 12 days of storage. The noni juice soaking treatment was demonstrated to be a potentially valuable technology for decontamination of fresh-cut fruit surfaces.

Keywords: /Mango/ /Noni Juice/ /Fresh-Cut/

ORANGE

Aborisade, A.T. 2015. Heat treatments against the green mould on sweet orange *Citrus sinensis* L. Osbeck fruits and tropical ambient storage. *Acta Hort.* 1079. 319 - 324.

Abstract

Sweet orange fruits are easily injured during harvest and the juice released aids germination of the spores of the green mould resulting in rapid decay of fruits. Heat treatment has been found to control decay in many fruits and vegetables. The protocols adopted in commercial operations depend on the region, cultivar of commodity and the type of natural microflora on the produce. Orange fruits were wound inoculated with *Penicillium digitatum* (27×10^5 conidia/ml) in the flavedo. At 12 h post inoculation, fruits were subjected to steam (ST) and dry hot air (HA) treatments before storage at $28 \pm 2^\circ\text{C}$ and $86 \pm 2\%$ RH. Heat treatments controlled decay of fruits to various extents. Treatments with either ST at 50°C for 50 min or HA at 46°C for 90 min totally prevented or significantly reduced disease within 24 days of storage. Other steam treatments at 50°C for 30 min and 55°C for 50 min reduced disease within the same post-treatment storage period. However, there was complete decay on fruits exposed to ST at 55°C for 30 min by day 14 of storage. HA treatment at 75°C for 2, 6 and 22 min also significantly reduced disease severity within 14 days storage and then within the next 10 days compared with control which was completely decayed by day 24. Weight loss from fruits, immediately after treatment, with ST and HA was insignificant (0.06-1.20%) but was high (13.25- 17.67% by day 14) during storage, with control fruits losing weight the most. Rind hardening with storage was not correlated with heat treatment but with weight loss. Steam and hot air treatments have potential for extending the shelf-life of fruits during subsequent storage at ambient temperature.

Keywords: /Orange/ /Sweet Orange/ / Disease/ /Ambient Storage/

Aloui, Hajer, et. al. 2015. Physical properties and antifungal activity of bioactive films containing *Wickerhamomyces anomalus* killer yeast and their application for preservation of **oranges** and control of postharvest green mold caused by *Penicillium digitatum*. Int'l J. of Food Microbiol. 200: 22-30.

Abstract

This study assessed the ability of two bio-based films, obtained from sodium alginate (NaAlg) and locust bean gum (LBG), to protect the viability of *Wickerhamomyces anomalus* cells and control the growth of *Penicillium digitatum*. The effect of microbial cell incorporation on physical properties of the developed films was evaluated in terms of barrier, mechanical and optical properties. Furthermore, the application of these two matrices as bioactive coatings was investigated in order to evaluate their efficacy in preserving the postharvest quality of 'Valencia' oranges and inhibiting the growth of *P. digitatum* on artificially inoculated fruits. Results showed that NaAlg and LBG films were able to maintain more than 85% of the initial *W. anomalus* yeast population and that the developed films incorporating the killer yeast completely inhibited the growth of *P. digitatum* in synthetic medium. Likewise, NaAlg and LBG coatings enriched with *W. anomalus* yeast were effective at reducing weight loss and maintaining firmness of 'Valencia'

oranges during storage, and reduced green mold in inoculated fruits by more than 73% after 13 days.

Keywords: /Orange/ /Postharvest Quality/

Shamloo, M.M., et. al. 2015. Alternation of secondary metabolites and quality attributes in Valencia **orange** fruit *Citrus sinensis* as influenced by storage period and edible covers. *J Food Sci. Technol.* 52(4): 1936 – 1947.

Abstract

Flavonoids (FGs) are a large group of polyphenolic compounds with low molecular weight, found in free and glycosidic forms in plants. Citrus fruits can be used as a food supplement containing hesperidin and flavonoids to prevent infections and boost the immune system in human body. The aim of this study was the investigation of the effect of clove oil and storage period on the amount of hesperidin and naringin component in orange peel (cv. Valencia). Four treatments including clove oil (1 %), wax, mixture of wax-clove oil, control and storage period were applied. Treated fruits were stored at 7 °C and 85 % relative humidity for 3 months and naringin, hesperidin, antioxidant activity, total phenolic compounds, TSS, Vitamin C, fruits weight loss, pH, acidity and carbohydrates content were measured every 3 weeks. The amount of hesperidin and naringin was determined using high performance liquid chromatography at the detection wavelength of 285 nm. Antioxidant activity was measured using the 1, 1-diphenyl-2-picrylhydrazyl-hydrate (DPPH) free radical scavenging assay. Total phenolic compounds were measured using the Folin-Ciocalteu micro method. Results showed that naringin and hesperidin were decreased during storage. Different treatment only had significant effect on the amount of hesperidin while storage period affected both of naringin and hesperidin. Results of correlation study, indicated strong relation between antioxidant activity and amount of naringin and hesperidin during storage time. However, at the end of storage period, the amount of hesperidin and naringin were diminished independent of different covers. Probably anaerobic condition caused such reduction. Results showed that the amount of TSS, fruit hardness, weight loss, total sugar and fructose content were increased during storage period while total acidity, pH and glucose content showed descending trend during storage periods. In conclusion, hesperidin and naringin of peels can be used as suitable quality indexes indicating proper conditions for storage.

Keywords: /Orange/ /Storage/ / Antioxidant/ / Quality Attributes/

PAPAYA

Broetto, Sabrina Garcia, João Paulo Fabi, João Roberto Oliveira do Nascimento. 2015. Cloning and expression analysis of two putative **papaya** genes encoding polygalacturonase-inhibiting proteins. *Postharvest Biol. & Technol.* 105: 48 - 56.

Abstract

Polygalacturonase-inhibiting proteins (PGIPs) are naturally occurring plant inhibitors that are able to retard the activity of fungal polygalacturonases (PGs) on pectin, and the manipulation of PGIP levels or the transfer of specific PGIP genes could reduce plant tissue decay. Because there is no information about PGIPs from papaya, even though this fruit is highly susceptible to fungal infection, two papaya PGIP genes were cloned, and their expression patterns were followed in different organs and tissues at different developmental stages. The Cppgip4 and Cppgip6 sequences share many features with other PGIPs. These genes were ubiquitously expressed in different organs and tissues and were more abundant in fruit pulp and peel. Both transcripts peaked when the fruit were still growing in size and then decreased at a late stage of development. A further reduction was observed during ripening, as both genes decreased significantly within 9 days after harvest. The down-regulation of PGIP genes during ripening was correlated to the decreased inhibitory activity of papaya protein extract against fungal pectinase from *Aspergillus niger*, and although the enzymatic assay did not provide the specific activity of each gene product, the finding suggests that protection against fungal PGs was impaired during ripening.

Keywords: /Papaya/ /Fruit Ripening/

Kim, Jae-Hwan, et. al. 2015. Event-specific qualitative and quantitative detection of three genetically modified **papaya** events using a single standard reference molecule. *Food Control*. 55: 127 - 132.

Abstract

A novel standard reference plasmid (pGEM-PAPAYA3) was constructed as a positive control and reference standard for event-specific qualitative and quantitative detection of genetically modified (GM) papaya (55-1, 16-0-1, and Huanong No.1). The plasmid pGEM-PAPAYA3 contained the specific fragments of papaya endogenous reference gene chymopapain and the 3 GM papaya events. The qualitative PCR assay using pGEM-PAPAYA3 was established with a limit of detection correlating to approximately 5×10^5 copies of papaya haploid genomes. In the quantitative PCR assay, the square regression coefficients (R^2) ranged from 0.993 to 0.997. The standard deviation and relative standard deviation values for repeatability ranged from 0.04 to 0.25 and 0.05% to 0.86%, respectively. The method was used to test 11 papaya products purchased from Thailand, China, the Philippines and the USA, and the results revealed 2 varieties of GM papaya in 5 of the 11 samples tested. These results indicate the developed detection methods with the standard reference plasmid are applicable for identifying 3 GM papaya events.

Keywords: /Papaya/ /Genetically Modified/ /Standard Reference/

PEACH

Cindi, Meluci David, et. al. 2015. Chitosan boehmite-alumina nanocomposite films and thyme oil vapour control brown rot in **peaches** (*Prunus persica* L.) during postharvest storage. *Crop Protection* 72: 127 - 131.

Abstract

Brown rot (*Monilinia* spp.) affects the shelf life, fruit quality and marketability of peaches (*Prunus persica* L.). Increasing consumer concern regarding food safety makes it necessary to search for natural environmentally friendly alternative products for postharvest disease control. In this investigation, polyethylene terephthalate (PET) punnets containing thyme oil (TO sachets) and sealed with chitosan/ boehmite nanocomposite lidding films significantly reduced the incidence and severity of brown rot caused by *Monilinia laxa* in artificially inoculated peach fruits (cv. Kakawa) held at 25 °C for 5 days. Furthermore, PET punnets containing TO sachets and sealed with chitosan/boehmite nanocomposite lidding films significantly reduced the brown rot incidence to 10% in naturally infected fruits stored at 0.5 °C, 90% RH for 7 days and at the simulated market shelf conditions for 3 days at 15 °C, 75% RH. The chitosan/boehmite nanocomposite lidding films maintained the active components of thyme oil, thymol (56.43% RA), caryophyllen (9.47% RA) and b-linalool (37.6% RA) within the (head space volatiles) punnet. Panellists preferred fruits packed from commercial punnet containing thyme oil (sachets) and sealed with chitosan/boehmite nanocomposite lidding films due to overall appearance, taste, and natural peach flavour.

Keywords: /Peach/ / Stone Fruit/ /Sensory Properties/ / Biodegradable Films/ / Fruit Decay/

Denoya ,Gabriela I., Sergio R. Vaudagna, Gustavo Polenta. 2015. Effect of high pressure processing and vacuum packaging on the preservation of fresh-cut **peaches**. *LWT - Food Sci. & Technol.* 62 : 801 - 806.

Abstract

Nowadays consumers demand fresh-cut fruits free from additives and with appealing appearance. High pressure processing (HPP) could be a suitable alternative to preserve fresh-cut fruit, since it is less aggressive than thermal treatments. This work was accomplished to study the effect of HPP in combination with vacuum packaging (VP) on the preservation of fresh-cut peaches. Cubes of peaches were treated with a solution of ascorbic acid and citric acid to inhibit enzymatic browning and then subjected to: A) VP + HPP (500 MPa-5 min), B) only VP and C) Control. Immediately after processing, after 15 and 21 days, different evaluations were carried out over the samples: chromatic parameters (CIE L*C*h°), polyphenoloxidase (PPO) activity, Textural Profile Analysis, and ethanol content. During the period evaluated, L* and C* were significantly lower in vacuum-packed and pressurized samples than in the control. At day 21, the pressurized samples showed the best textural properties. Peaches subjected to HPP p VP also had significantly lower content of ethanol and PPO activity than the other treatments,

which evidences that fermentation and browning were successfully inhibited by this combination. It can be concluded that HPP þ VP could preserve fresh-cut peaches for at least 21 days at 10 °C, with only a slight translucency caused by VP.

Keywords: /Peach/ /Fresh-Cut/ /Browning/

PEAR

Allegra, A., et. al. 2015. The influence of harvest period and fruit ripeness at harvest on minimally processed cactus **pears** (*Opuntia ficus-indica* L. Mill.) stored under passive atmosphere. *Postharvest Biol. & Technol.* 104: 57 - 62.

Abstract

The aim of this study was to investigate the effect of (a) harvest season (summer and late crop), (b) fruit ripening stage at harvest and (c) time of storage, on the quality of minimal processed cactus pear (*Opuntia ficus-indica*). Fresh cut peeled cactus pears harvested at commercial harvest stage or when ripe on tree in August (summer crop) and October (late crop), were stored for 3, 5, 7 and 12 d at 5 °C and 95% RH in polyethylene terephthalate (PET) packages under passive atmosphere conditions. Visual quality and crunchiness score, flesh color, microbiological analysis, total soluble solids (TSS), total acidity (TA), total phenolics, ascorbic acid and b-carotene contents were measured. TSS content in fruit flesh did not change during storage, but late crop fruit harvested fully ripe had the highest content. The CO₂ concentration inside the package was higher for summer than late fruit and for fully ripe fruit than commercial harvest stage. Fresh cut summer cactus pears lost their marketability and crunchiness after 3 d, while those from the late crop retained good marketability after 5 or 7 d at 5 °C, depending on their ripeness stage at harvest. Fresh cut fruit of the summer crop had twice the ascorbic acid content than late cop fruit until 5 d after storage. Fully ripe fresh cut fruit of the summer crop had the lowest b-carotene content. The mesophilic aerobic microorganisms did not change significantly with treatments, until 12 d after storage, when fully ripe fresh cut fruit had the highest count. Mold content was higher in fully ripe than in fruit harvested at commercial ripeness. Ultimately, late fruit, manually peeled and stored at 5 °C under passive atmosphere, retained their original quality longer than fully ripe fruit of the same season or summer fruit harvested at either ripeness stage.

Keywords: /Pear/ /Minimally Processed/ /Fresh Cut/ / Shelf-life/

Almeida, D.P.F., R. Carvalho and E. Dupille. 2015. Efficacy of 1-methylcyclopropene (smartfresh tm) on quality retention of 'rocha' **pear** during long-term storage under controlled atmosphere. *Acta Hort.* 1079. 115-120.

Abstract

The ban on the use of diphenylamine (DPA), effective in the harvest season of 2013, is forcing a change in the technology for long-term storage of 'Rocha' pear (*Pyrus communis* L.). Efficacy of 1-methylcyclopropene (1-MCP, SmartFresh™), at 312 and 150 nl L⁻¹, was evaluated in 'Rocha' pear in comparison with the standard postharvest treatments used by the Portuguese pear industry: drenching with the fungicide imazalil alone and with imazalil combined with DPA. Fruit harvested at commercial maturity from four representative orchards in the Oeste Region, Portugal, were subjected to the postharvest treatments and stored at 0°C, 90-95% RH, under controlled atmosphere (CA, 3 kPa O₂ + 0.7 kPa CO₂), for up to 9.4 months. The CA regime was imposed immediately after the beginning of cold storage or after an 8-week delay. 1-MCP at 312 nl L⁻¹ reduced fruit softening, skin yellowing, and acidity loss, and increased soluble solids content in comparison with control fruit treated with fungicide alone or combined with DPA. Superficial scald appeared during the shelf-life after a storage period of 243 days (ca. 8 months). 1-MCP at 312 nl L⁻¹ was more effective than DPA in reducing superficial scald. Delayed CA increased scald incidence in relation to immediate CA. 1-MCP at 150 nl L⁻¹ was effective in reducing superficial scald with minimal effect on ripening-related changes. Internal browning disorders occurred after 243 days in CA storage. DPA reduced the incidence of internal browning after a storage period of 281 days, but not after subsequent shelf-life. 1-MCP at 312 nl L⁻¹ was as effective as DPA in reducing the incidence of internal browning under immediate and delayed CA conditions. On average, delayed CA storage appeared to be slightly better than immediate CA in reducing internal browning disorders during storage but the effect did not persist during shelf-life. In conclusion, 1-MCP at 312 nl L⁻¹ was an effective replacement for the conventional treatment with DPA in 'Rocha' pear stored under CA for up to 9 months. At 150 nl L⁻¹, 1-MCP had little effect on ripening-related changes and was less effective in protecting against the physiological disorders. Delayed CA did not seem beneficial for 'Rocha' pear.

Keywords: /Pear/ /Fruit Quality/ /Internal Browning/ /Physiological Disorders/

Folchi, A., P. Bertolini and D. Mazzoni. 2015. Preventing ripening blockage in 1-MCP treated 'abate fetel' **pears** by storage temperature management. Acta Hort. 1079: 215 - 222.

Abstract

Many cultivars of European pears, treated with 1-methylcyclopropene (1-MCP), undergo a blockage of the ripening process that does not resume during shelf life. We evaluated the possibility to use different storage temperatures to prevent ripening blockage by 1-MCP and at the same time inhibit superficial scald. Early and

optimal harvested 'Abate Fetel' pears were treated with 320 nl L-1 1-MCP for 24 h at 2°C. Subsequently the fruits were stored in air at -1 and 1°C for 17 and 34 weeks, respectively. All fruits treated with 1-MCP, depending on storage type and length, had lower ethylene production, compared with untreated controls. While treated fruits kept at 1°C were still firm at the end of storage and ripened normally to eating quality, softening and peel yellowing were prevented in fruit kept at -1°C. Superficial scald damaged the fruits kept at -1°C but not those stored at 1°C. 1-MCP treatment fully prevented scald. During storage the concentration of α -farnesene increased up to 17 weeks while conjugated trienols reached a peak after 34 weeks with large differences between -1 and 1°C. 1-MCP effectively reduced conjugated trienol accumulation at both storage temperatures. Results indicate the importance of raising the storage temperature from -1 to 1°C for reducing susceptibility to superficial scald, to avoid the ripening blockage by 1-MCP mainly in early picked fruit.

Keywords: /Pear/ / 1-MCP/ /Ethylene/ /Superficial Scald/ /Firmness/

Goliáš, J., J. Kožíšková and J. Létal. 2015. Changes in volatiles during cold storage and subsequent shelf-life of 'conference' **pears** treated with 1-mcp. Acta Hort. 1079: 465 - 472.

Abstract

European pears (*Pyrus communis* L. 'Conference') were untreated or treated with 5 μ L 1-methylcyclopropene (1-MCP) for 24 h at 20°C and then kept at 1°C for 80 days. The 1-MCP concentration was achieved by adding 1 g Smartfresh (Agrofresh Inc.) containing 0.14% 1-MCP as active ingredient into the 180-L free space. Pears were evaluated after 20, 30, 40, 50, 60, 70 and 80 days of storage at 1°C followed by shelf life storage at 20°C and normal oxygen atmosphere for 7 days. Evaluative criteria were firmness, soluble solids concentration (SSC), respiration rate, production of ethylene and production of volatile compounds. 1-MCP treated pears kept at 20°C (shelf life) had statistically significant slower softening than untreated fruits ($P \leq 0.01$). Treated fruits were 0.40 MPa firmer than control fruits after a 7-day shelf life period. The effect of cold and 1-MCP treatment resulted in significant inhibition of ethylene production, respiration rate and retention of flesh firmness after transfer to room temperature. A significant ($P \leq 0.01$) increase in ethylene production was observed in untreated fruits during the whole storage period. In terms of determining the effect of 1-MCP on the quality of pears, it is also important to examine the production of volatile aromatic compounds. 104 volatile compounds were sampled by head space SPME and identified by GC-MS, from which ethyl acetate, 2-methyl-1-butyl acetate, ethyl benzoate, and citronellol were significant.

Keywords: /Pear/ /1-methylcyclopropene/ /Firmness/ /Ethylene/ /Respiration Rate/

Jajo, A. , et. al. 2015. Effect of cool storage duration on ripening initiation of 'Angelys®' **pear** fruit. Acta

Abstract

Winter pears initiate ripening following exposure to room temperature (RT, 20°C), after a chilling period. The number of days required for pear fruit to fully ripen varies mainly depending on cultivar and duration of low temperature storage. However, the longer the time in cold storage, the faster the rate of post-storage ripening. This study aimed to correlate ripening of 'Angelys®' pear fruit with different chilling periods. The correlations of ripening were performed by using measurements of physiologically-related processes (soluble solid concentrations, firmness and titratable acidity) and molecular analyses. Fruit harvested at three different times (185, 192 and 199 days after bloom, DAFB) were separated into distinct lots with the same maturity (with similar chlorophyll content, measured non-destructively using IAD). Each lot was analysed after postharvest ripening for 6 days at RT, following cool storage (0°C) for 0, 1, 2 and 3 months. Results indicated that ripening is halted in the non-chilled pears and initiated in the majority of pears stored for 1, 2 and 3 months independent of the harvest time. Unexpectedly, among the 3 months chilled pears, harvested at 199 DAFB, some fruit were showing a strong delay of ripening (unripe group). The latter lot was compared with the nonchilled pears and those stored for 3 months but showing typical ripening traits (ripe group) by using an RNAseq approach. In the three comparisons, there were 2498 differentially expressed genes. Many of the genes differentially expressed in each comparison showed expression patterns related to cool storage. However, others showed patterns that were related to fruit ripening, such as those encoding for ethylene receptors and cell wall modifying enzymes. In addition, only in the ripe group an up-regulation of genes involved in chromatin remodelling was observed; such genes have been previously associated with the competence to ripen.

Keywords: /Pear/ /Cold Storage/ /Ripening/

Neuwald, D.A., J. Streif and D. Kitemann. 2015. Effects of 1-MCP treatment in combination with ethylene on storage behaviour and fruit ripening of 'conference' pears. *Acta Hort.* 1079: 459- 464.

Abstract

Postharvest softening of apple and pear can be effectively controlled by the application of 1-methylcyclopropene (1-MCP). An advantage of 1-MCP is its long lasting inhibition of ripening which can prevent major quality losses during shelflife. Most consumers require ripe pears, however, with a soft and juicy melting fruit texture. After 1-MCP application, however, the ability of pear fruit to become soft ripe can be reduced and fruit show variation in appearance with non-homogenous colour changes ranging from green to yellow. The aim of this work was to evaluate

the effect of 1-MCP treatments alone or in combination with ethylene ('imprinting') on storage and ripening behaviour and fruit quality of 'Conference' pears. One day after harvest, pears were treated with 1-MCP 'SmartFresh™' (300 $\mu\text{l L}^{-1}$ = commercial use rate or 600 $\mu\text{l L}^{-1}$) alone or in combination with ethylene (300, 450, 600, 900 $\mu\text{l L}^{-1}$). Fruits were analyzed after 6 months of storage in CA at 0°C, plus 5 and 10 days shelf-life at 20°C. The 1-MCP treatment alone, as well as in combination, with different ethylene concentrations led to a better maintenance of firmness, a slower skin yellowing, a delayed loss of acidity and an inhibition of respiration and ethylene production compared with untreated fruit. Between the different ethylene treatments there were only slight differences concerning the effect on firmness. The combination with the highest ethylene concentration (600 $\mu\text{l L}^{-1}$ 1-MCP + $\mu\text{l L}^{-1}$ C₂H₄) significantly stimulated softening. Concerning colour, titratable acidity, soluble solids and ethylene production, no differences between the 1-MCP + ethylene combinations were observed. Only a slight stimulating effect on respiration by additional ethylene application was noticed. However, a sensory analysis after ten days of shelf life resulted in better scores for 600 $\mu\text{l L}^{-1}$ 1-MCP + 450 $\mu\text{l L}^{-1}$ ethylene and 600 $\mu\text{l L}^{-1}$ 1-MCP + 600 $\mu\text{l L}^{-1}$ ethylene treated fruit than fruit treated with 600 $\mu\text{l L}^{-1}$ 1-MCP alone; the latter was described as hard and poor in flavor.

Keywords: /Pear/ /1-methylcyclopropene/ /Ethylene/ /Ripening/ /Fruit Quality/

Lizhen Zeng, et. al. 2015. Improvement in the effectiveness of *Cryptococcus laurentii* to control postharvest blue mold of **pear** by its culture in β -glucan amended nutrient broth. *Postharvest Biol. & Technol.* 104: 26 - 32.

Abstract

The addition of β -glucan at 5 g L^{-1} to nutrient dextrose broth during the culture of *Cryptococcus laurentii* improved its activity subsequently to control postharvest blue mold, caused by *Penicillium expansum*, on pear fruit. It enhanced the colonization of the fruit by *C. laurentii*, increased β -(1,3)-glucanase activity in a cell-free filtrate of the culture medium, and, in *C. laurentii*, it increased activities of superoxide dismutase (SOD) and catalase (CAT) and decreased the malondialdehyde (MDA) content. The increase in active oxygen metabolism indicates that it may be related to the increase in biocontrol efficacy of this yeast. The use of β -glucan in the culture of this yeast was an effective method to enhance the antagonistic activity of *C. laurentii*.

Keywords: /Pear/ /Postharvest/ /Blue Mold/

Rizzolo, A., M., et. al. 2015. Quality of 'conference' **pears** as affected by initial low oxygen stress, dynamically controlled atmosphere and 1-mcp treatment. *Acta Hort.* 1079: 343 - 350.

Abstract

'Conference' pears in Italy are often subjected to superficial scald in cold storage, impairing their marketing. Among the postharvest methods employed to control scald, some include treatment at harvest with 1-methylcyclopropene (1-MCP), dynamically controlled atmosphere (DCA) and initial low O₂ stress (ILOS). This research aimed at studying the influence of these treatments on the quality of 'Conference' pears. Treated (300 nL/L 1-MCP, Smartfresh) and untreated pears (control), after 4 weeks at -0.5°C, were stored in controlled atmosphere (CA, 2 kPa O₂ + 0.7 kPa CO₂), with or without ILOS (0.3-0.5 kPa O₂) and in DCA (0.3-0.5 kPa O₂ + 0.45 kPa CO₂). ILOS was applied twice for 2 weeks with a 3 weeks interval, while monitored with fluorescence sensors (HarvestWatch™). After 4 months of storage, fruit were put at 20°C up to 7 days and evaluated for skin color, pulp mechanical properties (firmness, stiffness, energy-to-rupture), ethylene production (EP), sensory characteristics and storage disorders. Fruit softening and EP were strongly reduced by 1-MCP. Skin yellowing was slowed down by 1-MCP, especially in DCA and ILOS+CA pears which maintained the greenest color throughout the shelf life period. Control fruit stored in DCA and in ILOS+CA at d1 of shelf life had a skin color similar to that of treated pears, showing a quick yellowing with the progress of shelf life period. Treated pears were perceived as firmer and less juicy than control ones regardless of the storage atmosphere. DCA treated pears were more grainy and astringent, and less sweet and aromatic than control DCA fruit. Treated ILOS+CA fruit were perceived as grainy and astringent as control ILOS+CA pears, but less sweet and aromatic. Two types of storage disorders were detected: blackening which was distinguished in two forms (early blackening and black spot) differing for the color and the severity of the disorder. Black spot was developed only in treated DCA fruit (4%); early blackening and black speck were developed in all atmospheres, the former more pronounced in control fruit, with DCA treated pears showing the lowest percentage of early blackening.

Keywords: /Pear/ /Postharvest/ / 1-MCP/ /Controlled Atmosphere/ /Storage Disorders/ /Fruit Quality/

Sharma, Sonu, T.V. Ramana Rao. 2015. Xanthan gum based edible coating enriched with cinnamic acid prevents browning and extends the shelf-life of fresh-cut **pears**. Food Science and Technology 62: 791-800.

Abstract

The objective of this investigation was to elucidate the influences of xanthan gum-based edible coating (2.5 g/L) applied alone or enriched with cinnamic acid (1 g/L) on the quality attributes of fresh-cut Asian pear (*Pyrus pyrifolia* L. cv. 'Nashpati') and European pear (*Pyrus communis* L. cv. 'Babughosha') stored at 4 °C. The incorporation of cinnamic acid as antioxidant agent into xanthan gum based edible coating caused significant ($p < 0.05$) retardation of the oxidative browning, decline of ascorbic acid level, degradation of total phenolics content and reduction in antioxidant capacity as compared to fresh-cut pears coated only with xanthan gum and uncoated ones. The control slices of 'Nashpati' displayed greater rise in

browning index (BI) and polyphenol oxidase activity (PPO) and consistent decline in lightness (L^*) values than those of 'Babughosha' during 8 days of storage. Moreover, the lower proliferation of microorganism over the fresh-cut pear may be attributed to the combined influence of good processing conditions along with xanthan gum edible coating enriched with cinnamic acid. Thus the tested xanthan gum based edible coating plus cinnamic acid may contribute to reduce the surface browning and enhance the shelf-life of fresh-cut 'Nashpati' and 'Babughosha' for 4 days and 8 days, respectively at 4 °C.

Keywords: Pear/ /Browning/ /Quality/ /Minimally Processed/

Zhang, Wen, Di Cui, Yibin Ying. 2015. The impulse response method for **pear** quality evaluation using a laser Doppler vibrometer. J. Food Eng. 159: 9 - 15.

Abstract

The impulse response method using a laser Doppler vibrometer (LDV) was performed to non-destructively measure pear quality. To get a wide range of texture and different freshness in pears, the experiment was conducted every other day during 7 days storage. Each pear was excited by a half-sine impulse signal, and an LDV was used to measure the response signal from the top of the pear. A fast Fourier transform algorithm was used to transform time domain signals to frequency domain signals. A total of 15 and 8 features were extracted from the time and frequency domain signals, respectively. Pear texture was measured by the puncture test. Maximum force (MF), flesh firmness (FF) and stiffness (Stif) were extracted from the force-deformation curve as texture indices. Different modeling methods, including the stepwise multiple linear regression (SMLR), back propagation neural network (BPNN), and principal component analysis-back propagation neural network (PCA-BPNN) methods, were used for quantitative analysis of pear texture. Best prediction results were obtained by the PCA-BPNN method, especially for predicting FF with correlation coefficient (r_p) of 0.840 and root mean square error of prediction (RMSEP) of 0.959 N. The Fisher's discriminant analysis (FDA), BPNN, and PCA-BPNN methods were applied to qualitative analysis of pear freshness. Pears were categorized into 4 groups with different freshness according to the 4 test days. The best results were also obtained by the PCA-BPNN method, resulting in accuracy of 89.0% and 83.3% for calibration and validation, respectively. Experimental results showed that the impulse response method using an LDV is capable for evaluating pear texture and freshness. The proposed approach provides a way for rapid detection of pear quality to meet the requirement of on-line detection.

Keywords: /Pear/ /Nondestructive/ /Quality/

PERSIMMON

Novillo, P., et. al. 2015. Astringency removal of 'rojo brillante' **persimmon** by combining CO_2 and ethanol application. Acta Hort. 1079: 509 - 604.

Abstract

'Rojo Brillante' belongs to the group of persimmon cultivars which are astringent at harvest. Therefore, fruit are routinely subjected to postharvest deastringency treatment based on fruit exposure to high concentration of CO₂. The temperature of the process and the maturity stage of the fruit are key factors for the effectiveness of deastringency treatment. In the Mediterranean area, the application treatment of 95-100% CO₂ for 24 h at 20°C has been established as the optimal conditions to ensure astringency removal of 'Rojo Brillante' persimmon throughout the season. However, this treatment is usually applied at room temperature in industrial scale which at the end of the season is as low as 12°C. It has been reported that the deastringency treatment at low temperature may be incomplete when it is applied to fruit at an advanced maturity stage. The aim of this work was to evaluate the effectiveness of an alternative deastringency treatment combining high-CO₂ concentrations and ethanol application to persimmon fruit at an advanced maturity stage. Fruit were subjected to the standard treatment (98% CO₂) and to the alternative treatment (98% CO₂ + 0.5% ethanol) at two different temperatures (20 and 12°C) and three durations: 12, 18 or 24 h. Soluble tannin content, ethanol and acetaldehyde concentration and sensory evaluations were determined at harvest, immediately after treatments (d0) and after 1 (d1) and 2 (d2) days. Our results showed that the CO₂-ethanol treatment for 24 h was the only treatment that allowed total astringency removal at 12°C. When treatments were performed at 20°C, the CO₂-ethanol treatment enhanced the deastringency process leading to a faster astringency removal when compared with the application of high-CO₂ only.

Keywords: /Persimmon/ /Astringency/ /Temperature/ /Maturity/

Sanchís, Elena, Milagros Mateos, María B. Pérez-Gago. 2015. Effect of maturity stage at processing and antioxidant treatments on the physico-chemical, sensory and nutritional quality of fresh-cut 'rojo brillante' **persimmon**. Postharvest Biol. & Technol. 105:34 - 44.

Abstract

The aim of this work was to study the effect of the maturity stage (MS), storage at 15 °C before processing and antioxidant application on the quality of fresh-cut 'Rojo Brillante' persimmons. The MS at harvest had an effect on both fruit firmness and the efficacy of the antioxidants to control enzymatic browning. Nutritional quality was affected by MS and storage time before processing, but not by antioxidant application. For commercial purposes, the persimmons harvested at the beginning of the season could be processed as a fresh-cut commodity, even after 3 days of storage at 15 °C if treated with 0.01 kg L⁻¹ ascorbic acid (AA) or 0.01 kg L⁻¹ citric acid (CA). However, processing fruits from late season immediately after harvest and being treated with AA are recommended. The limit of marketability of fresh-cut 'Rojo Brillante' persimmons was reached after 6 and 8 days with AA and CA, respectively.

Keywords: /Persimmon/ / Minimally Processed/ /Maturity/

PLUM

Davarynejad, Gholam Hossein, et. al. 2015. Effects of salicylic acid and putrescine on storability, quality attributes and antioxidant activity of **plum** cv. 'Santa Rosa'. J Food Sci. Technol. 52(4): 2053 - 2062.

Abstract

Plum fruit has a short shelf life with a rapid deterioration in quality after harvest. The primary goal of this study is to investigate and compare the effect of putrescine and salicylic acid on quality properties and antioxidant activity of plum during storage. The plum fruits (cv. 'Santa Rosa') were harvested at the mature ripe stage, and dipped in different concentrations of putrescine (1, 2, 3 and 4 mmol/L) and salicylic acid (1, 2, 3 and 4 mmol/L), as well as distilled water (control) for 5 min. The fruits were then packed in boxes with polyethylene covers and stored at 4 °C with 95 % relative humidity for 25 days. A factorial trial based on completely randomized block design with 4 replications was carried out. The weight loss, fruit firmness, total soluble solids, titratable acidity, pH, maturity index, ascorbic acid, total phenolics and antioxidant activity at 0, 5, 10, 15, 20 and 25 days after harvest were recorded. During the storage period, the weight loss, total soluble solids, pH and maturity index increased significantly while the fruit firmness, titratable acidity, ascorbic acid, total phenolics and antioxidant activity decreased significantly ($P < 0.05$) for all treatments. Statistically significant differences were observed between different treatments (putrescine, salicylic acid and control) in all measured parameters. The data showed that the weight loss and softening of the plum fruits were decreased significantly by the use of putrescine and salicylic acid. Also, exogenous treatments of putrescine and salicylic acid are found to be effective in maintaining titratable acidity, ascorbic acid, total phenolics and antioxidant activity in plum fruits during storage at 4 °C. It was concluded that postharvest treatment of plum fruit with putrescine and salicylic acid were effective on delaying the ripening processes and can be used commercially to extend the shelf life of plum fruit with acceptable fruit quality.

Keywords: /Plum/ /Postharvest/ / Shelf life/

Erogul, Deniz, Fatih Sen. 2015. Effects of gibberellic acid treatments on fruit thinning and fruit quality in japanese **plum** (prunus salicina lindl.). Scientia Hort. 186: 137 - 142.

Abstract

The crop load of Japanese plums must be adjusted to ensure that the size of the harvested produce agrees with market requirements. The present study investigated the effects of gibberellic acid (GA3) treatment at different concentrations and during different cultivation periods after full bloom on the next year's fruit thinning and the current year's fruit quality. GA3 was applied to plum

trees at concentrations of 50 and 75 mg/L at 12 and 14 weeks after anthesis (WAA). GA3 treatment at a concentration of 75 mg/L 14 WAA decreased harvest yield by 27.93%, whereas yields were similar to that of the control treatment under the remaining experimental conditions. The main impact was on fruit size: trees treated with GA3 14 WAA had significantly larger fruit than did trees under the other treatments. In consideration of the reduction to total yield, 50 mg/L is recommended for thinning purposes in Japanese plum. Fruit color, total soluble content concentration, and fruit firmness were increased after GA3 application. The antioxidant activity of the untreated trees was higher than that of the GA3 treated trees, whereas phenol content was determined to be similar.

Keywords: /Plum/ /Fruit Quality/

Larsen, H., et. al. 2015. **Plum** fruit packed in flow packs with absorbent pads and stored at different temperatures. Acta Hort. 1079: 695 - 700.

Abstract

The shelf life of plum fruit (*Prunus domestica*) is limited due to among other factors fungal fruit decay. Absorbent pads ("fruit pads") are commercially used today in order to absorb juice from the berries and condense water and hence reduce fungal growth. The aim of this experiment was to evaluate the effect of different types of absorbent pads on weight loss, decay and quality for plum fruit under realistic storage conditions. Plum fruit ('Reeves' and 'Jubileum') were delivered at a commercial packing house, packed in trays on a flow packaging machine with three different types of absorbent pads placed at the bottom of the trays (standard fruit pad and two humidity control pads with different active compounds; denoted active pad 1 and 2). Trays without pads were controls. After packaging, plums were stored at 3 or 6°C for 7 days and thereafter 2 days at 20°C. Fruit quality, weight loss and amount of fungal decay were recorded at the end of the storage period. The different pads had no significant effects on ripeness state measured by DA-meter and fruit firmness measured at end of storage. The pads had significantly different effect on weight loss, and for 'Jubileum' the weight loss was 1.5% for the active pad 1, 2.5% for the active pad 2 and below 1% for the standard pad and the control. Significant effects were found for cultivar and absorbent pads on the total amount of decayed fruit. 'Jubileum' was more vulnerable to decay than 'Reeves', and the active pad 2 had the lowest number of decayed 'Jubileum' fruit stored at 3°C. More work and a cost-benefit analysis should be performed before absorbent pads are recommended for plum fruit.

Keywords: /Plum/ /Weight Loss/ /Fungal Decay/ /Quality/

POMEGRANATE

Caleb, O.J., et. al. 2015. Effect of pre-treatment and modified atmosphere packaging on quality attributes and volatile composition of **pomegranate** arils ('bhagwa'). Acta Hort. 1079: 165 - 172.

Abstract

A major problem associated with minimally processed pomegranate arils (*Punica granatum* L.) is the development of off-odours and microbial growth when stored under modified atmosphere packaging (MAP) at high CO₂ and low O₂. This study investigated the effects of passive-MAP combined with anti-browning pretreatment (4-hexylresorcinol (0.001 M) + potassium sorbate (0.05 M) + ascorbic acid (0.5 M)) on the microbial quality and change in volatile composition of pomegranate ('Bhagwa') arils stored at 5°C for 15 days. Changes in headspace gas composition, physicochemical attributes, volatile composition and microbial quality were evaluated at 3-day intervals for 15 days. Volatile compounds were extracted via headspace solid phase micro-extraction (HS-SPME) and analyzed by gas chromatography-mass spectrometry (GC-MS). Headspace gas composition was significantly influenced by pre-treatment, packaging and storage duration ($p < 0.05$), across all treatment. A decrease in total soluble solids (TSS), titratable acidity (TA) (0.3-0.4 g citric acid (CA) 100 ml⁻¹) and pH (2.6-3.4) was observed across all treatments. Anthocyanin concentration varied with storage duration and treatment, however, an increase was observed with reference to initial concentration (12.8±0.5 mg cyanidin-3-glucoside (C3gE) 100 ml⁻¹). Yeast and mould counts ranged from 1.5-4.9 log CFU g⁻¹ after 12 days of storage. Pre-treatment and passive-MAP helped maintain produce quality attributes and delayed microbial growth compared to clamshell trays. Furthermore, compositional changes in volatile compounds were identified from GC-MS analysis. A total of 13 primary and 28 secondary volatiles were detected and identified in the headspace of pomegranate juices of 'Bhagwa'.

Keywords: /Pomegranate/ /Packaging/ /Modified Atmosphere Packaging/ /Postharvest/ /Quality/

Gamrasni, D., et. al. 2015. 1-MCP improves the quality of stored 'wonderful' **pomegranates**. Acta Hort. 1079: 229 - 234.

Abstract

A major limitation in pomegranate storage is the deterioration of internal quality and taste. As pomegranate is a non-climacteric fruit, not producing large amounts of ethylene during ripening, it is not expected to respond to 1-methylcyclopropene (1-MCP), an ethylene action inhibitor. However, there are reports that non-climacteric fruits may respond to this treatment and one of its effects may be the deceleration of respiration. Our hypothesis was that 1-MCP treatment of pomegranate could delay senescence and deterioration of fruit quality

in storage by minimizing the effect of ethylene on metabolic processes, such as respiration. Both laboratory scale and commercial experiments were conducted to examine 1-MCP effects on quality attributes of stored 'Wonderful' pomegranates. The treatment was applied at 900 ppb for 24 h at 20°C prior to storage at 7°C in either air or a controlled atmosphere (2% O₂ + 5% CO₂). Respiration in regular air (RA) was reduced in response to 1-MCP, but was similar to that of the control after controlled atmosphere (CA) storage. In addition, lower ethanol and acetaldehyde contents were measured in treated fruit. Exposure of fruit from both treatments to ethylene enhanced their respiration rates. Improved internal quality detected as a result of 1-MCP treatment, was expressed as an inhibition of browning of the internal white septa and preservation of aril color and taste during storage and subsequent shelf life. Although the effect of 1-MCP on external quality was not significant, the overall commercial quality of the pomegranates was improved due to some inhibition of husk scald, especially in air storage. Overall, 1-MCP treatment was shown to improve the quality of stored 'Wonderful' pomegranates, especially their internal quality and taste. We assume that this may be the result of delayed metabolic processes, expressed as reduced respiration and ethanol and acetaldehyde production.

Keywords: /Pomegranates/ /1-methylcyclopropene/ /Storage/ /Fruit Quality/

Kapetanakou, A.E. I., G. Stragkas, P.N. Skandamis. 2015. Developing an antimicrobial packaging of ready-to-eat **pomegranate** arils based on vapors of brandy or distillery ethanol. Food Res. Int'l. 69: 141 - 150.

Abstract

Despite the increasing pomegranate consumption, the ready-to-eat (RTE) arils are highly perishable and this negatively impacts their commercialization. Nowadays, mild pre-packaging decontamination interventions (washing with sanitizing agents or exposure to ultraviolet light) in sequence or not with modified atmospheres packaging technologies are applied. Even though, the latter combination of methods provides them a shelf-life of 10-14 days at cold storage, several negative effects have been also reported (i.e., degradation of anthocyanins). Thus, the aim of the study was to evaluate the effect of alternative, mild antimicrobials such as the vapors of distillery ethanol and brandy on microbial, physical, textural, sensorial, and multispectral imaging attributes of RTE arils during storage at different temperatures in perforated bags. Lactic acid bacteria (LAB) and yeasts/moulds were the dominant spoilage microbiota of RTE arils, regardless of storage temperature and antimicrobial. Vapors produced by both volatile antimicrobials significantly inhibited ($p < 0.05$) the growth of LAB and yeasts/moulds, at all storage temperatures. For instance, at 4 °C, when population of TVC on controls was $6.9 \log \text{CFU g}^{-1}$ (day 23), the respective counts on arils treated with distillery ethanol or brandy followed the order: $4.9 \log \text{CFU g}^{-1}$ (1 mL of ethanol) $3.9 \log \text{CFU g}^{-1}$ (1 mL of brandy) $2.2 \log \text{CFU g}^{-1}$ (2 mL of ethanol) N

1.2 log CFU g⁻¹ (2mL of brandy). Moreover, arils exposed to distillery ethanol and brandy vapors showed lower weight loss (%) compared to controls, while the firmness was reduced, regardless of treatment and storage temperature. Color measurements and evaluation of multiple sensory attributes revealed that arils exposed to brandy vapors showed more intense red color and look fresher compared to controls for longer storage time. The latter observation was also validated by multispectral image analysis, since the results suggested that arils packaged with distillery ethanol or brandy maintained their anthocyanin and carotenoids content at higher levels than controls, at 4 °C. Thus, such preservation methods may open new perspectives on mild antimicrobial packaging in order to extend shelf-life of perishable minimally processed fruits, like pomegranate RTE arils.

Keywords: /Pomegranate/ /Ready- to -Eat/ /Antimicrobial Packaging/

Stone Fruit

Nogales-Delgado, Sergio, María del Carmen Fuentes-Pérez, Diego Bohoyo-Gil. 2015. Cultivar characterization of **stone fruits** for their minimal processing. J Food Sci. Technol. 52(4):2193-2201

Abstract

Due to their physicochemical properties, minimal processing of fruits is challenging because of their quick quality loss. Therefore, several preservative steps are needed, such as washing treatments, modified atmosphere packaging, cultivar selection, etc. The latter is an important pre-harvest condition due to the fact that many functional compounds and enzymes are dependent on the cultivar. The aim of this study was to compare the minimal processing adaptation of different stone fruits (nectarine, peach, and plum), focusing on visual and functional quality. The fruit underwent minimal processing in a clean room (temperature and relative humidity were kept at 8 °C and 70 %, respectively) and was washed during 2 min into 2 % w/v ascorbic acid, 1 % w/v citric acid, and 1 % w/v calcium lactate solution. To sum up, nectarine and peach offered a better adaptation, and medium-season cultivars had higher quality maintenance. Nevertheless, late cultivars should not be ruled out before hand on account of their remarkable functional content.

Keywords: /Stone Fruit/ /Fresh Cut/ /Antioxidant/ /Browning/

STRAWBERRY

Chaiwong, S. and C.F.H. Bishop. 2015. Use of an insulated bag from the supermarket to maintain 'elsanta' **strawberry** temperature to households. Acta Hort. 1079: 187 - 192.

Abstract

The issue of temperature control or maintenance for perishable fresh produce is an important area and particularly so for highly perishable products such as strawberries. Much research and investigation has been on cool chain stops at the retail outlet and there are very limited studies of the “last mile” between the retail outlet and the consumer domestic refrigerator. This study looks at the typical temperature of ‘Elsanta’ strawberries at the time of purchase in representative UK supermarkets and then the temperature rise of both the pulp and the air within the punnet under different temperature scenarios. Results from this study showed that the range of mean pulp temperature at purchase from six supermarkets was 6.3 to 13.0°C during a 10-week retail display period. Three temperature scenarios were simulated from 5 to 10°C, 5 to 15°C, and 10 to 30°C. A single punnet of ‘Elsanta’ strawberries was put in a supermarket plastic bag (High Density Polyethylene) or within the light weight insulated bags (LIB-White or LIB-Reflective). The physical and mechanical characteristics of three materials were measured for thickness, tensile strength, percent elongation, and water vapour transmission rate. The insulated bags kept pre-chilled strawberries and delayed the increase of air and pulp temperature by about 20 and 10% respectively over 3 h, when compared with control (plastic bag). This study showed that the insulated bag has a potential to assist cool temperature management and reduce strawberry deterioration from supermarket to household.

Keywords: /Strawberry/ /Cold chain/

Gu, Xianbin, et. al. 2015. Transcription factors and anthocyanin genes related to low temperature tolerance in rd29A:RdreB1B1 transgenic **strawberry**. *Plant Physiol. & Biochem.* 89: 31 - 43.

Abstract

Dehydration-responsive element-binding (DREB) transcription factors play critical roles in plant stress responses and signal transduction. To further understand how DREB regulates genes expression to promote cold-hardiness, Illumina/Solexa sequencing technology was used to compare the transcriptomes of non-transgenic and rd29A:RdreB1B1 transgenic strawberry plants exposed to low temperatures. Approximately 3.5 million sequence tags were obtained from non-transgenic (NT) and transgenic (T) strawberry untreated (C) or low-temperature treated (LT) leaf samples. Over 1000 genes were differentially expressed between the NT-C and T-C plants, and also the NT-C and NT-LT, as well as the T-C and T-LT plants. Analysis of the genes up-regulated following low-temperature treatment revealed that the majority are linked to metabolism, biosynthesis, transcription and signal transduction. Uniquely up-regulated transcription factors as well as anthocyanin biosynthetic pathway genes are discussed. Accumulation of anthocyanin in the stolon and the base of the petiole differed between nontreated NT and T plants, and this correlated with gene expression patterns. The differentially expressed genes that encode transcription factors and anthocyanin enzymes may contribute to the cold hardiness of RdreB1B1 transgenic strawberry. The transcriptome data provide a valuable resource for

further studies of strawberry growth and development and DREB-mediated gene regulation under low-temperature stress.

Keywords: /Strawberry/

Ulukanli, Zeynep & Ayse Tulin Oz. 2015. The effect of oleum myrtle on the fruit quality of **strawberries** during MAP storage. J Food Sci. Technol. 52(5): 2860 - 2868.

Abstract

Strawberries are known to be significant source of the nutraceuticals; however, rapid perishable property of this fruit is very important issue. Up to now, extension of this fruit is still the focus of scientific and industrial interest in the worldwide. Therefore, of the known nutraceuticals, myrtle essential oil in this study is intended to use for extending the storage of strawberries. Strawberries were individually immersed in the treatment solutions of 0.1 % myrtle oil, 0.5 % myrtle oil and then placed in Modified Atmosphere Packaging (MAP) for 8 days at 5 °C. The control fruits without myrtle oil treatment were also placed inMAP and stored under the same condition. Treatment of myrtle oil decreased the weight and the fruit firmness loss. Furthermore, titratable acidity (TA), pH and colour value did not display significant changes during storage. Fluctuations were observed in the vitamin C, total soluble solids (TSS), TSS/TA content and microbial growth. The O₂ concentration inMAP decreased from 21% to around 15 %, whereas, CO₂ concentration varied from 6.0 to 6.9 % in the treatments by the 8th day of storage time. The delay of flesh firmness, weight loss, vitamin C loss and increasing CO₂ concentration inMAP, best sensory quality as well as limiting the growth of microbial parameters in concern was attained through the use of 0.5 % myrtle oil, suggesting that 0.5 % myrtle oil showed more pronounced activity than 0.1 % myrtle oil and control inmaintaining the fruit quality and shelf life of fruits during MAP storage.

Keywords: /Strawberry/ /Fruit Quality/ /Shelf life/

SWEET CHERRY

Børve, J. and A. Stensvand. 2015. Factors affecting postharvest fungal fruit decay in **sweet cherry** in a cool, wet climate. Acta Hort. 1079: 307 - 312.

Abstract

The growing season in Norway is characterized by a relatively cool and wet climate, and all commercial sweet cherry production takes place under plastic roofs or in plastic tunnels for protection against rain and thus reduction of fruit cracking and fungal fruit decay. Fungal pathogens found to cause postharvest decay in Norway include *Monilinia* sp., *Botrytis cinerea*, *Mucor piriformis*, *Colletotrichum acutatum*, *Penicillium* sp. and *Cladosporium* sp. The following experiment with postharvest fruit decay took place over two seasons: Samples of 5×100 fruit of

'Lapins' and 'Van' from orchards delivering fruit to three packing houses, were stored for 10 days in Life Span® bags at 2°C followed by 2-3 days at 20°C. Averaged over all fruit assessed, 55% developed fungal decay after storage in the first season and 4% in the following season. However, the amount of decay differed greatly between packing houses and orchards. In the season with high incidence, fruit decay varied from 12 to 100% and 1.6 to 95% on 'Van' and 'Lapins', respectively. Respective data for the successive season were 0 to 38% on 'Van' and 0 to 41% on 'Lapins'. *Mucor* rot was the dominant cause of fruit decay in both years. Factors affecting postharvest decay are discussed.

Keywords: /Sweet Cherry/ /Fruit Rot/

Guillén, F., et. al. 2015. Postharvest treatments with oxalic acid on quality of the early-season **sweet cherry** cultivar 'early lory'. Acta Hort. 1079: 173 - 178.

Abstract

'Early Lory' is an early season sweet cherry cultivar (*Prunus avium* L.) originating from France. This cultivar is medium in size (7-8 g), kidney-shaped, and dark-red with a long stalk. The fruit is very sweet and juicy. The commercial harvest dates are between 22-29 of May and it has medium durability during storage and transportation. Oxalic acid (OA) is a final metabolite in plants and exhibits many physiological functions, the main one being related to the induction of systemic resistance against plant diseases. The objective of this work was to study the effect of OA, applied postharvest at 0, 1, 10 and 100 mM, on quality attributes during 20 days of storage at 2°C. Overall, results demonstrated that OA was very effective in delaying the postharvest ripening process through maintenance of fruit firmness and titratable acidity with no significant effect on total soluble solids and colour changes. The most effective OA concentration for reducing acidity losses was 100 mM while the concentration of 10 mM gave better results in terms of reduced softening. The application of OA at any concentration induced a reduction in respiration rate, which could be responsible for the beneficial effects found in 'Early Lory' sweet cherry and a net extension of shelf life, 10 days for control cherries up to 20 days for OA-treated fruit.

Keywords: /Sweet Cherry/ /Storage/ /Ripening/ /Oxalic Acid/

Toivonen, P.M.A. 2015. Integrated analysis for improving export of **sweet cherries** and how a small industry can compete by focusing on premium quality. Acta Hort. 1079: 71 - 82.

Abstract

The British Columbia sweet cherry industry, which neighbors a huge US industry, relies on export markets that pay premium prices. Premium export quality relies on having both high quality large fruit and green stems. Harvesting sweet cherries at later maturities results in superior eating quality and the focus has been to harvest a more mature fruit. While the stem is not edible, it is important to visual impact and is an indicator of freshness. The first research on sweet cherries for export focused on retaining a bright green stem up to six weeks storage and details of that work will be discussed. Development of late season cultivars was necessary to extend the season past the US crop. 'Sweetheart' has become the most reliable cultivar for containerized ocean shipment. Characteristics important to containerized shipment of sweet cherries were identified and data on shipping potential and respiratory heat will be presented. Logistics from harvest to packing and the impact of deviations in logistics on sweet cherry quality at market was evaluated to develop optimal handling specifications. It is critical to protect harvested fruit with reflective covers to prevent stem browning and improve fruit quality during shipping. Post-pack cooling is also mandatory to reliable quality retention for cherries harvested at later maturities. One factor that does not appear to have large effect on shipping quality is plastic packaging or box liner type. Success of containerized shipping of premium quality sweet cherries is dependent on numerous factors, all of which must be optimized.

Keywords: /Sweet Cherries/ /Shelf Life/ /Storage/ /Firmness/

Valero, D. 2015. Recent developments to maintain overall **sweet cherry** quality during postharvest storage. Acta Hort. 1079: 83 - 94.

Abstract

Sweet cherry (*Prunus avium* L.) is a deciduous tree originated around the Black and Caspian Seas. Most of sweet cherry production is used for fresh consumption although industrialised produce such as jam, jelly, stewed fruit, marmalade, syrup and several types of soft drinks are increasingly available. Spain is the third European producer with 25,000 ha dedicated to sweet cherry with a yield of 67,600 metric tons of fruit per year. In Spain, early-season production areas begin harvest at the end of April and continue through June, midseason production areas harvest from May through June and late-season production areas harvest from May to July. The concept of "quality" depends on the product itself and the consumer's preferences, and for sweet cherry it is widely accepted that the main characteristics related to fruit quality are fruit weight, colour, firmness, sweetness, sourness, flavour and aroma. For this reason producers use a number of parameters to establish the optimum time for harvesting, the most reliable being skin colour. Red colour development in sweet cherry is used as indicator of quality and ripening, and is due to accumulation and profile of anthocyanins. Sweet cherry horticultural production chain consists of several parts: production, picking, cooling, selection,

grading, packaging, transport, distribution and consumption. From the consumer point of view, storage quality is probably the most important factor affecting eating quality, especially for overseas marketing. Sweet cherry fruit is a very perishable commodity, since both the edible part and the stem lose water rapidly as well as decay incidence, which constitutes the main problem for successful transport and marketing. The changes in these quality parameters during postharvest storage lead to reduced shelf life. This keynote aims to give an updated knowledge about some recent developments with the objective of a better control of postharvest deterioration of sweet cherries. The strategies include pre- and postharvest applications and some innovative treatments including oxalic acid, salicylic acid, acetylsalicylic acid, methyl jasmonate and methyl salicylate. Since sweet cherry fruit are also appreciated by their content in bioactive compounds with additional health benefits, special interest will be given to the effect of these treatments on anthocyanins and polyphenols, due to their antioxidant properties.

Keywords: /Sweet Cherry/ /Preharvest Treatment/ /Postharvest Quality/

TABLE GRAPES

Freitas, Paula M., et. al. 2015. Postharvest treatment of **table grapes** with ultraviolet-C and chitosan coating preserves quality and increases stilbene content. *Postharvest Biol. & Technol.* 105: 51 - 57.

Abstract

Red table grapes were treated after harvest with ultraviolet-C light (UV-C) and chitosan coating, both alone and in combination. Effect of treatments on quality, fungal decay, and resveratrol content of grapes was studied. In preliminary trials, combination of UV-C with chitosan coating yielded better results compared with the same treatments applied alone. Therefore, further optimization was performed with combinations of the two treatments. Chitosan coating preserved brightness and visual quality of fruit while preventing decay by *Botrytis cinerea*. Furthermore, this coating treatment had no effect on respiration rate or resveratrol content of grapes. UV-C treatment combined with storage at 20°C for 24 h before refrigerated storage led to increased resveratrol content and had no negative effects on the sensory quality of treated grapes when combined with chitosan coating. In contrast with endogenous resveratrol, the application of resveratrol solutions was effective for the prevention of growth of *B. cinerea*. Use of UV-C combined with chitosan coating followed by incubation for 24 h at 20 °C before refrigerated storage increased the resveratrol content, maintained sensory quality, and reduced fungal decay of red table grapes when compared to control grapes.

Keywords: /Table Grapes/ /Botrytis Cinerea/ /Sensory Quality/

Lichter, A., T. et. al. 2015. Effects of gibberellin on cracking and postharvest quality of the seeded **table grape** 'zainy. Acta Hort. 1079:265 - 272.

Abstract

Seeded grapes can be a good model to study the effect of gibberellic acid (GA) on the peel because berry size is not affected by their external application. 'Zainy' grape is a local late-season seeded cultivar which has very high yields, berries of approximately 10 g and loose clusters. The main problem is that they undergo cracking during ripening and are additionally susceptible to browning during storage. To test the effect of GA on cracking it was applied at early or late fruit set corresponding to berry diameter of 6 and 10 mm or both. The experiments were carried in three different vineyards over three years. Results suggest that GA did not affect berry size, brix or acidity but had minor effects on berry firmness. GA reduced the level of peel cracking in some of the experiments and late application was more effective than early application, suggesting that the process is not at the level of cell division. Deep cracking which transverses the flesh was reduced in two experiments but GA did not have a significant effect on macro-cracking. Less decay was recorded upon cold storage of GA-treated clusters from these experiments. Shelf life of the clusters in refrigerated display cabinet at 10°C reduced decay, while GA-treated clusters had slightly higher weight loss during storage. Autofluorescence of berries or rachis corresponding to chlorophyll or flavonoid levels was affected by both temperature and GA. The results of this study may have practical implications as part of integrated approach to alleviate the problem of cracking.

Keywords: /Table Grape/ /Postharvest/

Wu, Ziming, et. al. 2015. Heat acclimation reduces postharvest loss of **table grapes** during cold storage - analysis of possible mechanisms involved through a proteomic approach. Postharvest Biol. & Technol. 105: 26 - 33.

Abstract

In this study, a combined biochemical and proteomic approach was used to investigate changes of fruit quality and protein expression profiles of grape berries upon hot water treatment (HWT) during the subsequent 45 days of cold storage. HWT obviously inhibited postharvest loss and chilling damage by reducing weight loss and membrane damage and slowing fruit softening. Proteomic analysis allowed the identification of 64 proteins regulated by heat treatment. Most of the up-regulated proteins in heat-treated grape berries were related to defense response and redox metabolism, suggesting a physiological adaptation to environmental stress. In addition, the increased expression of proteins associated with carbohydrate and energy metabolism immediately after HWT provided a molecular explanation for the rapid decline of soluble sugar content observed in heat-treated

grape berries, which might be necessary for activation of the energy-demanding defense response to storage environmental stress, thereby reduced postharvest loss during storage at low temperature.

VEGETABLES

BAMBOO SHOOTS

Yang, Huqing, et. al. 2015. Effects of combined aqueous chlorine dioxide and chitosan Coatings on microbial growth and quality maintenance Of fresh-cut **bamboo shoots** (*phyllostachys praecox* f. *Prevernalis.*) during storage. *Food Bioprocess Technol.* 8: 1011 - 1019.

Abstract

This study was conducted to investigate the effects of aqueous chlorine dioxide (ClO₂) combined with chitosan coating on microbial growth and quality maintenance of freshcut bamboo shoots during cold storage. Fresh-cut shoots respiration rate, weight loss, firmness, lignin, colour, microbial and activities of phenylalanine ammonia lyase (PAL), cinnamyl alcohol dehydrogenase (CAD), peroxidase (POD) and polyphenol oxidase (PPO) were measured. The results indicated that treatment with 28 mg L⁻¹ ClO₂ plus chitosan coating inhibited increase in respiration rate and firmness, delayed browning and lignification and reduced microorganism counts of total aerobic bacteria and yeasts and moulds compared to control treatment. The efficiency was better than that of ClO₂ or chitosan treatment alone. Furthermore, combination of ClO₂ and chitosan inhibited the activities of PAL, CAD, POD and PPO throughout the storage period. Our study suggests that ClO₂ plus chitosan coating treatment may be a promising method of maintaining fresh-cut bamboo shoot quality and extending their postharvest life.

Keywords: /Bamboo Shoots/ / Fresh-cut/ / Chitosan/ / Browning/

BROCCOLI

de Beer, T. and E.M. Crouch. 2015. Maintaining **broccoli** shelf-life during mixed load marketing with a novel in-box 1-methylcyclopropene and modified atmosphere packaging system. *Acta Hort.* 1079: 179 - 186.

Abstract

Suboptimal temperature and ethylene exposure during mixed load transport and storage can limit the shelf-life and quality of highly perishable and ethylene sensitive vegetable products such as broccoli. A novel, small scale, in-box application system for 1-methylcyclopropene (1-MCP) (SmartFresh™ In-Box) in combination with modified atmosphere packaging was assessed for its potential in maintaining broccoli green colour and limiting water loss, two of the most important quality criteria for broccoli. Broccoli (*Brassica oleracea* 'Parthenon') was packaged in Ripelock (AgroFresh, Inc., Philadelphia, PA, USA) modified atmosphere bags either

with or with-out an 1-MCP releasing in-box sachet and treated with 5 µl L-1 ethylene for 16 h to simulate mixed loads or left untreated. Packaged broccoli was stored at 0, 7.5 or 12°C for 42, 22 and 18 d, respectively. Quality as a measure of percentage yellowing and water loss was assessed at various intervals during storage and after 3 d shelf-life at 10°C for each storage evaluation time. 1-MCP significantly reduced the rate of yellowing for broccoli stored at 7.5 and 12°C, seen during storage and retail display assessments. 1-MCP application buffered against suboptimal temperature induced yellowing for products stored at 7.5°C plus 3 d shelf-life at 10°C. No treatment differences were found between products stored at 0°C, with all broccoli heads maintaining a retail acceptable level of less than 20% yellowing for up to 42 d. At 7.5°C, the maximum storage duration that allowed for quality retail (less than 20% yellowing) was 11 d and was achieved with the in-box 1-MCP + MAP system. The 1-MCP system was able to extend storability by a week compared with untreated or ethylene exposed products. At 12°C, a maximum storage duration of 8 d was achieved with the 1-MCP in-box application. The MAP was successful at limiting water loss during storage, with no differences recorded between the various treatments and storage temperatures.

Keywords: /Broccoli/ /Shelf Life/ /Modified Atmosphere Packaging/ /Ethylene/ / 1-methylcyclopropene/

Kabakeris, T., et. al. 2015. The role of chlorophyll derivatives in postharvest quality determination of **broccoli**. Acta Hort. 1079:201 - 206.

Abstract

Broccoli is a highly perishable crop which shows natural variation in shelf life. In order to predict storability, early indicators of postharvest changes are required. Changes in chlorophyll (Chl) and early Chl derivatives have been studied in the florets of broccoli curds (*Brassica oleracea* L. var. *italica* Plenck 'Ironman') during 4 days of storage at 16°C. The Chl derivatives chlorophyllide a (Chlide), pheophytin a (Pheoin) and pheophorbide a (Pheoide) have been determined by means of liquid chromatography combined with fluorescence detection. Broccoli harvested throughout the year at 4 planting sites in Germany showed different hue angle values ranging from 96 to 114°, resulting in different storability. Levels of Chl derivatives between harvest batches showed significant differences on storage day 2. However, those differences were not related to subsequent shelf life.

Keywords: /Broccoli/ /Shelf Life/ /Storability/

GREEN BEANS

Donsì, Francesco, et. al. 2015. **Green beans** preservation by combination of a modified chitosan based-coating containing nanoemulsion of mandarin

essential oil with high pressure or pulsed light processing. *Postharvest Biol. & Technol.* 106: 21 - 32.

Abstract

The combination of an antimicrobial edible coating with other non-thermal treatments, comprising high hydrostatic pressure (HHP) or pulsed light (PL), was assessed against *Listeria innocua*, inoculated on green bean samples, evaluating also the impact on product color and firmness during 14 days refrigerated storage at 4 °C. The coating formulation consisted of modified chitosan containing a nanoemulsion of mandarin essential oil. Non-thermal treatments conditions were determined in preliminary inactivation tests against *L. innocua* inoculated on coated green beans, which showed that 400 MPa and 5 min for HHP, and 1.2 × 10⁵ J/m² per bean side for PL, were able to cause a reduction in *L. innocua* population of about 4 and 2 Log cycles, respectively. The combination of the coating application with HHP resulted as the most promising approach, causing a significant reduction of *L. innocua* over the entire storage period, owing to the development of a significant synergism of antimicrobial effects; however, it also had a strong impact on green beans firmness. In contrast, the combination of the coating application with PL exhibited a slight antagonistic effect, and had a slight detrimental impact on color properties.

Keywords: /Green Beans/ / Antimicrobial Coating/

Lettuce

Jacobs, B.A.J.G., et. al. 2015. Predicting stored period and shelf life potential of lamb's **lettuce** using vis/nir reflectance spectroscopy. *Acta Hort.* 1079: 207 - 214.

Abstract

Lamb's lettuce (*Valerianella locusta* L.) delivered to the vegetable auctions is not always fresh. The product can be stored for a certain time depending on the time of year. Stored and freshly harvested material is visually not distinguishable, but the shelf life potential of the first is limited. This leads to losses in distribution and a lower quality for consumers. The aim of this work was to develop a fast non-destructive methodology that uses visible/near infrared (Vis/NIR) reflectance spectroscopy that can determine whether lamb's lettuce has been in storage and give an idea about the remaining shelf life potential. The Vis/NIR reflectance spectra were linked to the time in storage and to the quality of the samples at the end of a shelf life holding period by partial least squares regression (PLS). The prediction of the remaining shelf life potential was not successful based on colorimetric quality attributes. There was a better performance when the quality scores given by a panel of experts was used, but for the moment this prediction model lacks accuracy.

The detection and quantification of a prior storage period was validated with an external test set and the root mean square error of prediction (RMSEP) was 2.5 days. Vis/NIR reflectance spectroscopy was a valid, fast and non-destructive method for determining and quantifying a storage period of lamb's lettuce.

Keywords: /Lettuce/ /Storage/ /Postharvest/ /Quality/

Olanya, Ocen M., Brendan A. Niemira, John G. Phillips. 2015. Effects of gamma irradiation on the survival of *Pseudomonas fluorescens* inoculated on romaine **lettuce** and baby spinach. *Food Sci. & Technol.* 62: 55 - 61.

Abstract

Irradiation of fresh fruits and vegetables has been utilized as a post-harvest intervention measure to inactivate microbial pathogen on produce. The objectives of this research were to determine the survival (D10 values) of *Pseudomonas fluorescens* (Pf) strains 2-79, Q8R1, Q287, surface inoculated on baby spinach and romaine lettuce; and Pf strains suspended in buffer peptone water (BPW). Gamma irradiation doses of 0 (control), 0.25, 0.50, 0.75 and 1.0 kGy were applied on *P. fluorescens* inoculated on produce and stored for 24 h at 4 °C. On spinach and romaine lettuce, the D10 values of *P. fluorescens* ranged from 0.04 ± 0.01 to 0.05 ± 0.02 and from 0.05 ± 0.03 to 0.06 ± 0.03 kGy, respectively. Pf had high sensitivity to irradiation and its populations varied on spinach and on romaine lettuce. These results indicate that low irradiation values are required to inactivate Pf on produce resulting with low bacterial survival.

Keywords: /Lettuce/ /Baby |spinach/ /Gamma Irradiation/

Woltering, E.J. and Y.W. Seifu. 2015. Low intensity monochromatic red, blue or green light increases the carbohydrate levels and substantially extends the shelf life of fresh- cut **lettuce**. *Acta Hort.* 1079: 257 - 264.

Abstract

During dark storage of fresh-cut product prepared from butterhead and iceberg lettuce the levels of carbohydrates (glucose, fructose, sucrose, starch) decrease. Carbohydrate levels were low in butterhead lettuce at the start [~ 20 mg/g dry matter (DW)] and levels decreased by over 50% during storage at 12°C; carbohydrate levels in iceberg lettuce were much higher at the start (~ 350 mg/g DW) and decreased by over 70% during storage. When the fresh-cut lettuces were stored under a low intensity monochromatic light (red, blue, red + blue, green), either continuous or in a 12-h photoperiod, the shelf life was markedly prolonged over the dark control. The prolonged shelf life coincided with vastly increased levels

of carbohydrates in the lit samples. In butterhead lettuce, the carbohydrate levels increased during storage up to 10 times compared to the initial level; in iceberg lettuce the light greatly prevented carbohydrate depletion. The shelf life showed a positive correlation with the amounts of carbohydrates in the fresh-cuts measured at day 7 or 14 of the storage. This strongly indicates that the carbohydrate level is a key factor in extending shelf life of fresh cut lettuce stored under light. The applied light intensity ($5 \mu\text{mol m}^{-2} \text{s}^{-1}$ PAR) is considered well below the light compensation point which indicates that photosynthetic sugar production may not be the primary process involved in sugar accumulation. The possible involvement of gluconeogenesis in sugar accumulation under low light is discussed.

Keywords: /Lettuce/ /Quality/ /Shelf Life/ /Fresh-Cut/

MUSHROOM

Capotorto, I., M.L. Amodio and G. Colelli. 2015. Influence of modified atmosphere packaging on shelf-life of whole And sliced 'cardoncello' mushroom (*pleurotus eryngii*). Acta Hort. 1079: 553 - 560.

Abstract

The aim of this study was to optimize modified atmosphere packaging (MAP) for whole and sliced 'Cardoncello' mushrooms, a typical mushroom of south Italy. Whole mushrooms were packed in active MAP (initial gas concentrations 5 kPa O₂ + 10 kPa CO₂ in nitrogen) using polypropylene (PP) or polylactic acid (PLA) films, with or without microperforation (MP), and stored for 27 days at 0°C. Sliced mushrooms were packed in the same atmosphere in PP films with two levels of microperforations (MP1 and MP2) and stored for 14 days at 0°C. For both experiments, an air-control treatment (CTRL) was also considered. Mushroom respiration rate, headspace gas composition, weight loss, firmness, colour, pH, total soluble solids, acidity, total phenols, antioxidant activity, microbial and sensory quality were measured. For whole mushrooms, results indicated that the storage in microperforated packages better preserved the aroma compared with CTRL whereas samples stored in non-perforated films showed quick development of hypoxic conditions. Samples stored in PP-MP showed a lower oxygen reduction and a higher CO₂ accumulation compared with PLA. Moreover, samples stored in PLA showed a higher weight loss compared with PP. Samples stored in PP-MP showed a lower growth of mesophilic bacteria, yeast and moulds compared with samples stored in PLA-MP. For sliced mushrooms, there were no differences in gas composition between PP-MP1 and PP-MP2 films. Cutting significantly affected aroma; mushrooms stored in PP-MP1 maintained the aroma better than samples in PP-MP2 or samples in CTRL. Storage in MAP delayed the growth of mesophilic bacteria as well as yeast and moulds compared with CTRL, with PP-MF1 being more effective than PP-MP2. In conclusion, the use of MAP delayed quality loss, extending the shelf-life of whole and sliced mushrooms at 0°C. In addition, best results were obtained with microperforated polypropylene, for both whole and sliced 'Cardoncello' mushrooms.

Keywords: /Mushroom/ /Fresh-Cut/ /Weight Loss/ /Fresh-Cut/

Geyer, M., et. al. 2015. Packaging of **mushrooms** in a humidity-regulating plastic tray for preventing water condensation Acta Hort. 1079: 153 - 158.

Abstract

Mushrooms are highly transpiring and respiring commodities. The plastic films commonly used for fresh produce have lower water vapour permeability relative to the transpiration rate of mushrooms. Therefore, excessive moisture accumulation occurs inside the package causing condensation. Fluctuations in temperature along the supply chain aggravate the problem further. The objective of the present study was to actively control the headspace relative humidity using hygroscopic salt (NaCl) incorporated directly into the punnet matrix. Humidity regulating trays prepared with an active layer containing 18% (w/w) salt were used to pack mushrooms and the amount of water absorbed/condensed was compared with trays without salt. The headspace relative humidity in the salt containing trays was 92.7% as compared to 100% in control-PP tray. The salt containing tray absorbed 1.1 g of water vapour during first day of packaging and reached its maximum capacity after 8 days (2.2 g). This absorption capacity was far too low for the packaging of 250 g mushrooms which demanded a capacity about 5 to 10 g resulting in excessive condensation inside the humidity regulating tray. In conclusion, the humidity regulating trays have not enough capacity to absorb sufficient amount of water vapour from the package headspace containing mushrooms.

Keywords: /Mushroom/ /FreshProduce/ /Respiration/ /Packaging/

Hu, Yong-Hua, et. al. 2015. Postharvest application of 4-methoxy cinnamic acid for extending the shelf life of **mushroom** (*Agaricus bisporus*) Postharvest Biol. & Technol. 104: 33 - 41.

Abstract

Mushroom (*Agaricus bisporus*) rapidly loses its white skin color and turns brown after harvest rapidly. 100 mmol L⁻¹ 4-methoxy cinnamic acid (MCA) was used to extend the shelf life of *A. bisporus* in this study. Freshly harvested fruit bodies were stored at (20 ± 1) °C and 85% ± 5% relative humidity. The physiological indexes, reactive oxygen metabolism and ultrastructure of *A. bisporus* were investigated. The results indicated that the weight loss, percentage of open-cap, the degree of browning, relative leakage rate, malondialdehyde (MDA) content and superoxide anion generation rate were reduced in treated group. The respiratory

climacteric was delay in treated group. Moreover, they kept high catalase (CAT) and ascorbate peroxidase (APX) activities and endogenous antioxidants (AsA and GSH) content. The mushroom treated with MCA maintained a relatively complete ultrastructure; PPO and POD in tissues contact with phenolic substrates were delayed. These findings suggest that MCA could have potential in maintaining the quality of mushroom.

Keywords: /Mushroom/ / Browning/ / Postharvest Quality/

ONION

Sharma, Kavita, et. al. 2015. Quantitative analysis of flavonoids, sugars, phenylalanine and tryptophan in **onion** scales during storage under ambient conditions. Food Sci. Technol. 52(4):2157 - 2165.

Abstract

A comprehensive quantitative analysis of flavonoids, sugars, phenylalanine, and tryptophan have been carried out in different onion scales during storage at ambient temperature (20–23 °C) and relative humidity (60–80 %). Depending on the length of storage, dry matter content and composition shows variation inside the onion bulbs. Inner sprouts were observed on longitudinally cut bulbs after 2 months and visible sprouts appeared after 5 months of storage. The bulbs lost 20 to 30 % of their weight at the end of the storage. Higher dry matter content was observed in the inner scales. Significantly high content of quercetin in inner scales and high level of quercetin-3,4'-O-diglucoside and quercetin-4'-O-monoglucoside in outer scales was observed during a 7 months storage. During storage period, high content of fructose and glucose was observed in the middle scales while sucrose was high in the inner scales. There was no particular trend observed within analyzed amino acids. However, the content of phenylalanine was higher than tryptophan.

Keywords: /Onion/ /Storage/

TOMATO

Ceglie, F.G., et. al. 2015. Quality and postharvest performance of organically-grown **tomato** (*lycopersicon esculentum* L. 'marmande') under unheated tunnel in Mediterranean climate. Acta Hort. 1079: 487 - 494.

Abstract

The organic production method includes a defined list of technical tools that are allowed in the EU Regulation and which can lead to different product quality. Different approaches to the fertility management of tomato organic production were compared in relation to the quality at harvest and during storage. Three organic farming systems were implemented in an experimental greenhouse: i) a simplified organic production system based on organic commercial fertilizers (SUBST); ii)

organic production system based on animal manure amendment and cover crops (AGROMAN), and iii) organic production system based on green manuring of cover crops and on-farm compost amendment (AGROCOM). At harvest, breaker and pink tomatoes were sampled from each system. Breaker tomatoes were subsequently stored in a cold room at 15°C and ripened up to pink stage within 10 days. The effect of the fertilization systems was studied comparing breaker tomatoes after 10 days of storage and pink tomato ripened on plant and after storage. Yield, morphological indexes, dry matter, firmness, and composition were evaluated. The three systems produced comparable total (58.87 ± 5.4 t ha⁻¹), and marketable (48.19 ± 5.1 t ha⁻¹) yields. AGROMAN fruits were larger in comparison to the other systems.

AGROCOM system led to lower firmness, acidity and carotenoids than SUBST system and also showed the lowest dry matter. At harvest, SUBST tomatoes at the breaker stage showed higher vitamin C than AGROCOM, while this difference was not statistically significant after ripening. Pink tomatoes ripened on plant showed higher soluble solids content than pink tomatoes ripened in storage; moreover, for AGROCOM and SUBST the carotenoids content was higher when ripened on the plant. In conclusion, in complex systems (AGROMAN and AGROCOM), it is possible to synchronise the mineralisation rates of organic amendments and green manure with the needs of the plants, and to obtain similar tomatoes yields and quality of simpler and less sustainable systems (SUBST).

Keywords: /Tomato/ /Maturity/ /Organically Grown/

Charles, M.T., et. al. 2015. Assessment of changes in organic acid and sugar profiles of **tomato** fruits induced by uv-c hormesis. Acta Hort. 1079: 159 - 164.

Abstract

The beneficial effects of UV-C hormesis encompass increased resistance to pathogens, delay in ripening and senescence, enhancement of specific phytochemicals potentially advantageous to human health, improvement of microbiological safety of minimally-processed commodities. However, consumer acceptability is highly dependent on the extent to which the treatment affects critical quality attributes, such as taste. To our knowledge, there is only one report regarding the evaluation of the acceptability of UV-C treated tomato (*Solanum lycopersicum*) fruits using a sensory panel, where small differences in taste perception were observed. We report profiles of simple sugars and organic acids in tomato fruits 15 days after UV-C treatment. The pre-storage UV-C treatment was applied at 3.7 kJ m⁻², and the storage temperature was 14°C. The fruits from four different cultivars ('Balzamo', 'Clermont', 'Lorenzo' and 'Makari') were harvested at two ripening stages. In the UV-C-treated fruits, acid titers tended to be higher and sugar titers tended to be lower. Treatment with UV-C had no significant effect on citric acid content but did significantly affect all other parameters. In 'Balzamo', significant increases in ascorbic acid and sucrose levels were observed at both ripening stages, and a higher fructose level was observed with treatment at the breaker stage, suggesting an enhancement in quality for this cultivar. It is likely that

in most cultivars, UV-C caused a metabolic shift that slowed down the expected degradation of organic acids. This shift might be related to senescence delay. The data are discussed in terms of the possible metabolic cost of defense and the importance of varietal differences.

Keywords: /Tomato/ /Fruit Quality/

de Beer, T. and E.M. Crouch. 2015. Maintaining high market value of surplus **tomato** harvests during short-term storage by limiting colour development with 1-MCP. Acta Hort. 1079: 444 - 452.

Abstract

Farm gate value of tomatoes is directly related to fruit colour, with greener (turning to champagne) fruit fetching higher returns than red fruit. During peak production periods fruit often need to be stored for short periods as a result of surplus harvests prior to market closure over weekends or public holidays. During such storage periods market value of the harvest can be reduced due to red colour development above what the market accepts as optimal. 1-methylcyclopropene (1-MCP) has been shown to limit red colour development of tomatoes. This research investigated the feasibility of treating unsorted 'Star 9011' tomato (Stark Ayers) with 1-MCP directly after harvest as a short term storage protocol in limiting red colour development of tomatoes versus standard procedures. Losses due to absolute ripening retardation were also measured and factored into the feasibility of the treatment protocol, allowing its net benefit to be determined. Unsorted tomatoes were colour scored and treated with $0.5 \mu\text{L L}^{-1}$ 1-MCP for 16 h at 8 or 15°C directly after harvest and left at these temperatures for simulated farm storage of 2-3 d. Products were then colour scored again before shelf-life simulation at either 8°C (market ready fruit) or at ambient (green fruit) for red colour induction prior to marketing. Colour development was assessed on alternate days for two weeks. An untreated control was included for all treatments. At both temperature regimes (8 and 15°C), the 1-MCP treated tomatoes had 20% less fruit that were too red for optimal market value sale. The percentage of product loss due to green fruit that failed to ripen due to 1-MCP application on green fruit was higher for 1-MCP treatments than the controls. Overall, 1-MCP resulted in reduction of losses by 10 and 19% compared with controls at 8 and 15°C, respectively.

Keywords: /Tomato/ /1-methylcyclopropene/ /Ripening/ /Ethylene/ / SmartFresh/

Karapanos, I.C., et. al. 2015. The ripening and quality characteristics of cherry **tomato** fruit in relation to the time of harvest. Acta Hort. 1079: 495 - 500.

Abstract

To evaluate the effect of early harvesting on the fruit quality of two commercial cherry tomato hybrids ('Conchita F1' and 'Cherelino F1'), fruit were harvested: (1) at the red-ripe stage (RR), (2) at the breaker stage (BR) and held at 25°C in the dark, or (3) at the mature-green stage (MG), treated with ethylene (150 mg L⁻¹ for 48 h, at 25°C in the dark) and held at 25°C under light (2,500 lx) or darkness. During ripening and/or at full ripeness, fruit quality was evaluated with respect to colour, respiration, ethylene production, firmness and composition (sugars and starch). Fruit of 'Conchita' harvested at the MG stage and held in the light developed a uniform red colour within 7 days of ethylene treatment, whereas 'Cherelino' fruit harvested at the same stage took 5 days longer to go through ripening and failed to redden uniformly. Light proved essential for colour development, since in both genotypes MG and BR fruit held in the dark failed to redden uniformly even 20 days after harvest. In contrast, fruit ripened naturally on the plant exhibited a uniform colour and were firmer than those ripened on the shelf. CO₂ and ethylene production of detached MG and BR fruit of both genotypes was high during the initial stages of ripening, but declined with increasing maturation without evidence of a respiratory climacteric. 'Conchita' fruit, which have a longer postharvest life than 'Cherelino', consistently produced less ethylene during maturation. Starch breakdown during ripening was not affected by postharvest treatments and was invariably low at maturity. However, fruit that ripened on the plant contained more fructose and glucose than those harvested at stages BR and MG and ripened on the shelf. Consequently, we recommend that cherry tomato hybrids should be ripened on the plant prior to harvest.

Keywords: /Tomato/ /Postharvest Life/ /Harvesting/ /Ripening/ /Ethylene Treatment/

Meng , Xia, et. al. 2015. Physiological changes in fruit ripening caused by overexpression of **tomato** SIAN2, an R2R3-MYB factor. *Plant Physiol. & Biochem.* 89: 24 - 30.

Abstract

The R2R3-MYB protein SIAN2 has long been thought to be a positive regulator of anthocyanin accumulation. To investigate the role of SIAN2, we have previously overexpressed the gene in tomato. In this work, we analysed physiological characters of the transgenic plants during the fruit ripening. We show that fruits of transformants overexpressing SIAN2 displayed an orange colour, fast softening and elevated ethylene production. Overexpression of SIAN2 resulted in reduction of carotenoid levels via alteration of flux through the carotenoid pathway, elevated ethylene synthesis mainly via upregulation of ethylene biosynthesis genes, and early softening of fruits. We also found that the transcript level of SIRIN, an important ripening-related gene, was up-regulated in transgenic fruits. These results suggest that SIAN2 acts as an important regulator of fruit ripening.

Keywords: /Tomato/ /Fruit Ripening/ /Ethylene/

Subramanian Parthiban, et. al. 2015. Expression of an exogenous 1-aminocyclopropane-1-carboxylate deaminase gene in psychrotolerant bacteria modulates ethylene metabolism and cold induced genes in **tomato** under chilling stress. *Plant Physiol. & Biochem.* 89: 18 - 23.

Abstract

The role of stress induced ethylene under low temperature stress has been controversial and hitherto remains unclear. In the present study, 1-aminocyclopropane-1-carboxylate deaminase (ACCD) gene, *acdS* expressing mutant strains were generated from ACCD negative psychrotolerant bacterial strains *Flavobacterium* sp. OR306 and *Pseudomonas frederiksbergensis* OS211, isolated from agricultural soil during late winter. After transformation with plasmid pRKACC which contained the *acdS* gene, both the strains were able to exhibit ACCD activity in vitro. The effect of this ACCD under chilling stress with regards to ethylene was studied in tomato plants inoculated with both *acdS* expressing and wild type bacteria. On exposing the plants to one week of chilling treatment at 12/10 °C, it was found that stress ethylene, ACC accumulation and ACO activity which are markers of ethylene stress, were significantly reduced in plants inoculated with the *acdS* gene transformed mutants. In case of plants inoculated with strain OS211-*acdS*, ethylene emission, ACC accumulation and ACO activity was significantly reduced by 52%, 75.9% and 23.2% respectively compared to uninoculated control plants. Moreover, expression of cold induced *LeCBF1* and *LeCBF3* genes showed that these genes were significantly induced by the *acdS* transformed mutants in addition to reduced expression of ethylene-responsive transcription factor 13 (ETF-13) and ACO genes. Induced expression of *LeCBF1* and *LeCBF3* in plants inoculated with *acdS* expressing mutants compared to wild type strains show that physiologically evolved stress ethylene and its transcription factors play a role in regulation of cold induced genes as reported earlier in the literature.

Keywords: /Tomato/ /1-aminocyclopropane-1-carboxylate // Ethylene/

HERBS AND SPICES

SPICES

Eresam, E., et. al. 2015. Concise and informative title: evaluation of selected spices in extending shelf life of paneer. Food Sci. Technol. 52(4): 2043 - 2052.

Abstract

Black pepper, cardamom, cinnamon and clove were tested for their relative efficacy in improving shelf life of paneer. All the spices were incorporated in paneer @ 0 (control), 0.2, 0.4, 0.6, 0.8 and 1.0 % by wt. of expected yield of paneer. Addition of black pepper, cardamom or clove at the rate of 0.6 % by weight or cinnamon at the rate of 0.4 % by weight was found to be acceptable. Therefore, paneer was prepared by incorporating black pepper, cardamom and clove i.e. Bp, Ca and Cl@0.6%and cinnamon (Ci)@0.4%by wt. of expected yield of paneer. All the paneer samples viz. Bp, Ca, Cl and Ci were subjected to sensory evaluation when fresh and after interval of 7 days during storage at 7±1 °C up to 28 days. Results indicated that control remained acceptable up to 7 days, Bp up to 14 days of storage and Cl up to 21st day of storage. The overall acceptability score of Ca

remained well above the acceptable level even on 28th day of the storage. Results of changes in chemical characteristics indicate that amongst all the spices studied, cardamom had maximum ability to control the rate of increase in acidity, free fatty acids content and soluble nitrogen content in paneer during storage. The order of the relative effectiveness in enhancing shelf life of paneer was cardamom > cinnamon > clove > black pepper. The effect of cardamom on microbial counts of paneer viz. standard plate counts (SPC), yeast and mould count and coliform count were evaluated. Among the spices studied, cardamom was found to be the best spice to improve shelf life of paneer up to 28 days of storage at 7 ± 1 °C.

Keywords: /Spices/ /Herbs/ /Shelf Life/

TUBERS AND ROOTCROPS

CASSAVA

Uchechukwu-Agua, Amarachi D., Oluwafemi J. Caleb, Umezuruike Linus Opara. 2015. Postharvest handling and storage of fresh **cassava** root and products: a review. Food Bioprocess Technol. 8: 729 – 748.

Abstract

The increase in global demand for healthy food products and initiatives to ensure food security in developing countries has focused on the cultivation of drought-resistant and biofortified cassava varieties. Cassava is a staple root crop grown in subtropical and tropical climates. Cassava flour is gluten free, which can be used as composite flour in essential foods such as bread. Thus, the role of postharvest handling of freshly harvested cassava root is essential, owing to the rapid physiological deterioration of the root soon after harvest. This situation confers a limited shelf life and, thus, creates poor utilization of the cassava root. However, processing cassava root into other food forms such as fufu, garri, starch and highquality flour enhances stability and long-term storage. This article critically reviewed the postharvest handling, processing and storage of fresh cassava root. Highlighting on the role of storage and minimal processing on sustainable cassava production, various spoilage mechanisms of cassava root were identified. In developing countries, cassava root is a valuable food and energy source, and understanding the role of optimum postharvest handling, processing and storage techniques would alleviate some concerns of food insecurity.

Keywords: /Cassava/ /Postharvest/ /Storage/

SWEET POTATO

Adam , Rahma Isaack, Kirimi Sindi , Lone Badstue. 2015. Farmers' knowledge, perceptions and management of diseases affecting **sweet potatoes** in the lake victoria zone region, Tanzania. Crop Protection 72: 97 - 107.

Abstract

The purpose of this study was to assess farmers' knowledge, perception and management of sweet potato (SP) diseases, and to determine factors associated with farmers' satisfaction with sweet potato planting material in Mwanza and Mara sites within the Lake Victoria Zone region of Tanzania. We used multiple methods and data sources, principally a survey of 621 households spread across nine districts, and in-depth interviews with farmers in three villages located in three different districts. Our study revealed four main findings. Firstly, we found that although farmers were able to identify unhealthy SP plants, they were unable to tell the specific type of disease affecting the plants both from direct and photographic observations. Secondly, there exists considerable heterogeneity in the way farmers manage unhealthy plants in the field; some farmers were observed to follow management methods prescribed by plant pathologists, while others used traditional methods of managing a diseased plant. Thirdly, the following three factors were found to be the determinants of farmers' knowledge and management of SP diseases and plant root damage: (i) farmers' training in SP production and management; (ii) the number of plots which the woman of the household has control over; and (iii) household membership to a crop production association. Lastly, the location of farms is a strong determinant of farmers' satisfaction with SP vines; residing in areas in which sweet potato vines are widely available and in a village that is accessible by a primary road or tarmac road increases a farmer's satisfaction with sweet potato vines that are available in the farmers' farm during planting time.

Keywords: /Sweet Potato/ /Pest Management/